



Cornell  
SC Johnson College of Business

INSEAD

The Business School  
for the World®



# The Global Innovation Index 2017

Innovation Feeding the World

TENTH EDITION



Confederation of Indian Industry

strategy&



Serviço Brasileiro de Apoio às  
Micro e Pequenas Empresas



Confederação Nacional da Indústria  
CNI A FORÇA DO BRASIL, INDÚSTRIA





Cornell  
SC Johnson College of Business

INSEAD  
The Business School  
for the World®



---

# The Global Innovation Index 2017

## Innovation Feeding the World

TENTH EDITION

---

**Soumitra Dutta, Bruno Lanvin, and Sacha Wunsch-Vincent**  
Editors



Confederation of Indian Industry

strategy&



SEBRAE

Serviço Brasileiro de Apoio às  
Micro e Pequenas Empresas

CNI

Confederação Nacional da Indústria  
CNI - A FORÇA DO BRASIL INDUSTRIA

---

*The Global Innovation Index 2017: Innovation Feeding the World* is the result of a collaboration between Cornell University, INSEAD, and the World Intellectual Property Organization (WIPO) as co-publishers, and their Knowledge Partners.

The report and any opinions expressed in this publication are the sole responsibility of the authors. They do not purport to reflect the opinions or views of WIPO Member States or the WIPO Secretariat.

The terms 'country', 'economy', and 'nation' as used in this report do not in all cases refer to a territorial entity that is a state as understood by international law and practice. The terms cover well-defined, geographically self-contained economic areas that may not be states but for which statistical data are maintained on a separate and independent basis. Any boundaries and names shown and the designations used on any visual maps do not imply official endorsement or acceptance by any of the co-publishers. Chapters 2–11 contributions may deviate from UN terminology for countries and regions.

© Cornell University, INSEAD, and the World Intellectual Property Organization, 2017

This work is licensed under the Creative Commons Attribution Non-commercial No-Derivatives 3.0 IGO License. The user is allowed to reproduce, distribute, and publicly perform this publication without explicit permission, provided that the content is accompanied by an acknowledgement that Cornell University, INSEAD, and WIPO are the source. No part of this publication can be used for commercial purposes or adapted/translated/modified without the prior permission of WIPO. Please write to [treaties@mail@wipo.int](mailto:treaties@mail@wipo.int) to obtain permission.

To view a copy of the license, please visit <http://creativecommons.org/licenses/by-nc-nd/3.0/igo/>.

When content, such as an image, graphic, data, trademark, or logo, is attributed to a third party, the user is solely responsible for clearing the rights with the right holders.

Suggested citation: Cornell University, INSEAD, and WIPO (2017): *The Global Innovation Index 2017: Innovation Feeding the World*, Ithaca, Fontainebleau, and Geneva.

ISSN 2263-3693

ISBN 979-10-95870-04-3

Printed and bound in Geneva, Switzerland, by the World Intellectual Property Organization (WIPO), and in New Delhi, India, by the Confederation of Indian Industry (CII).





# Contents

|  |              |
|--|--------------|
| <b>Preface: Releasing the Global Innovation Index 2017: Innovation Feeding the World</b>   | <b>v</b>     |
| By Soumitra Dutta, Cornell SC Johnson College of Business, Cornell University; Francis Gurry, World Intellectual Property Organization; and Bruno Lanvin, INSEAD                                       |              |
| <b>Foreword: Innovation as the Key Driver of Sustainable Agriculture and Future Food Security in the Developing World</b>  | <b>vii</b>   |
| By Chandrajit Banerjee, Director General, Confederation of Indian Industry   |              |
| <b>Foreword: Innovating to Feed the World</b>  | <b>ix</b>    |
| By Tim Ryan, US Chairman and Senior Partner, PwC   |              |
| <b>Foreword: Innovation in Food Production: Learning from the Past with an Open Mind for the Future</b>  | <b>xi</b>    |
| By Robson Braga de Andrade, President of CNI, Director of SESI, and President of SENAI's National Council; and Guilherme Afif Domingos, President-Director of Sebrae                                   |              |
| <b>Contributors to the Report</b>  | <b>xiii</b>  |
| <b>Advisory Board to the Global Innovation Index</b>   | <b>xv</b>    |
| <b>RANKINGS</b>  |              |
| <b>Global Innovation Index 2017 Rankings</b>   | <b>xviii</b> |
| <b>KEY FINDINGS</b>  |              |
| <b>Key Findings of the GII 2017</b>  | <b>xxiii</b> |
| <b>CHAPTERS</b>  |              |
| <b>Chapter 1: The Global Innovation Index 2017: Innovation Feeding the World</b>   | <b>3</b>     |
| By Soumitra Dutta, Rafael Escalona Reynoso, and Jordan Litner, Cornell SC Johnson College of Business, Cornell University; Bruno Lanvin, INSEAD; and Sacha Wunsch-Vincent and Francesca Guadagno, WIPO |              |
| <b>Annex 1: The Global Innovation Index (GI) Conceptual Framework</b>  | <b>47</b>    |
| <b>Annex 2: Adjustments to the Global Innovation Index Framework and Year-on-Year Comparability of Results</b>   | <b>55</b>    |
| <b>Annex 3: Joint Research Centre Statistical Audit of the 2016 Global Innovation Index</b>  | <b>59</b>    |
| By Michaela Saisana, Marcos Domínguez-Torreiro, and Daniel Vertesy, European Commission, Joint Research Centre (JRC), Ispra, Italy   |              |
| <b>Annex 4: Measuring Innovation in Agriculture and Food Systems</b>   | <b>73</b>    |

(Continued)

|  |            |
|--|------------|
| <b>Chapter 2: The Potential of a Global Diagnostic Tool for Agricultural Innovation Systems</b>  | <b>81</b>  |
| By Christian Grovermann, Samy Gaiji, Karin Nichterlein, Abdoulaye Saley Moussa, Sónia Dias, Andrea Sonnino, and Delgermaa Chuluunbaatar, FAO   |            |
| <b>Chapter 3: The Role of Private-Sector R&amp;D in Agricultural Innovation: Improving Yields, Equipment Productivity, and Sustainability</b>  | <b>89</b>  |
| By Barry Jaruzelski and Volker Staack, PwC's Strategy&; and Tom Johnson, PwC   |            |
| <b>Chapter 4: Innovation in Agriculture and Food Systems in the Digital Age</b>  | <b>97</b>  |
| By Harold van Es and Joshua Woodard, Cornell University  |            |
| <b>Chapter 5: Digital Technologies Transforming Indian Agriculture</b>   | <b>105</b> |
| By Ankur Seth, formerly with the Confederation of Indian Industry; and Kavery Ganguly, Confederation of Indian Industry  |            |
| <b>Chapter 6: Innovations in Food Distribution: Food Value Chain Transformations in Developing Countries and their Implications for Nutrition</b>  | <b>113</b> |
| By Miguel I. Gómez and Katie D. Ricketts, Charles H. Dyson School of Applied Economics and Management, Cornell SC Johnson College of Business, Cornell University  |            |
| <b>Chapter 7: Policies and Institutions Fostering Innovation and Agriculture Technologies in Brazil</b>  | <b>121</b> |
| By Robson Braga de Andrade, National Industry Confederation (CNI); and Guilherme Afif Domingos, Brazilian Micro and Small Business Support Service (Sebrae)  |            |
| <b>Chapter 8: Mobilizing Science, Technology, and Innovation to Transform Japanese Agriculture</b>   | <b>129</b> |
| By Yuko Harayama, Council for Science, Technology and Innovation, Cabinet Office of Japan  |            |
| <b>Chapter 9: Technological Future of the Agriculture and Food Sector in Russia</b>  | <b>135</b> |
| By Leonid Gokhberg and Ilya Kuzminov, National Research University Higher School of Economics, Russia  |            |
| <b>Chapter 10: Innovation in the Agri-Food Sector in Latin America and the Caribbean</b>   | <b>143</b> |
| By José Luis Solleiro and Rosario Castañón, National University of Mexico; Karla Rodríguez, CamBioTec, A.C.; and Olivia Mejía, National University of Mexico   |            |
| <b>Chapter 11: Enhancing Innovation in the Ugandan Agri-Food Sector: Progress, Constraints, and Possibilities</b>  | <b>151</b> |
| By Travis Lybbert, Agricultural & Resource Economics, University of California Davis; Kritika Saxena, Graduate Institute, Geneva; Julius Ecuru, Uganda National Council for Science and Technology, Uganda; Dick Kawooya, University of South Carolina; and Sacha Wunsch-Vincent, WIPO |            |

## SPECIAL SECTION: CLUSTERS

|   |            |
|---|------------|
| <b>Identifying and Ranking the World's Largest Clusters of Inventive Activity</b> | <b>161</b> |
| By Kyle Bergquist, Carsten Fink, and Julio Raffo, WIPO                            |            |

## APPENDICES

|  |            |
|--|------------|
| <b>Appendix I: Country/Economy Profiles</b>  | <b>179</b> |
| <b>Appendix II: Data Tables</b>              | <b>313</b> |
| <b>Appendix III: Sources and Definitions</b> | <b>401</b> |
| <b>Appendix IV: Technical Notes</b>          | <b>417</b> |
| <b>Appendix V: About the Authors</b>         | <b>423</b> |

## Releasing the Global Innovation Index 2017: Innovation Feeding the World



©WIPO, 2017. Photo by Emmanuel Berrod.

We are pleased to present the Global Innovation Index (GII) 2017 on the theme ‘Innovation Feeding the World’.

This year is a particularly noteworthy one for the GII, as it marks the release of the 10th edition of the report. The first edition was produced in 2007 by Soumitra Dutta at INSEAD with the goal of producing a comprehensive broad-based model of innovation that captured its complex nature in both developed and emerging economies. Over the last decade, the GII has gained international recognition, establishing itself as both a leading reference on innovation and a ‘tool for action’ for decision makers.

Numerous countries have incorporated the GII into their innovation agendas and metrics. Remarkably, in view of the GII, a large number of countries have increased their collection of innovation metrics that conform to international standards; these countries also use the metrics more. These changes are taking place with the cooperation of WIPO and other responsible international organizations—most notably the UNESCO Institute for Statistics—which assist the country in question to resolve issues and increase its data coverage.

Innovation is not limited to the most advanced economies. Innovation is also not limited to the high-technology sectors. Innovation has today become a global phenomenon, affecting all sectors of the economy, including food and agriculture—which are among the most ancient and basic sectors of activity. Feeding the world, while contributing to protecting the environment and providing quality and balanced nutrition to growing populations with different lifestyles and consumption patterns, remains a complex challenge. Innovation has a key role to play in addressing this challenge.

The 2017 edition of the GII is dedicated to the theme of innovation in agriculture and food systems. Agricultural and food-processing sectors continue to face an enormous rise in global demand and increased competition for limited natural resources. Innovation can be key to maintaining the productivity growth required to meet this rising demand in a sustainable fashion, and it can help enhance the networks that integrate food systems. This

year’s report analyses these demands and the opportunities they present from different angles, including those of data-driven strategies, the impact of biotechnological and digital technologies, effective policies, and strengthened networks, while at the same time suggesting new approaches for both developed and developing countries.

Finally, the GII 2017 includes another innovation this year. The GII has long recognized that innovative activity tends to be concentrated in geographic clusters. However, no metrics have existed to measure innovation performance at the cluster level on an internationally comparable basis. This year’s GII seeks to take a first step in remedying this measurement gap. It presents a novel approach towards identifying and ranking the world’s largest clusters of inventive activity, drawing on international patent filings. We hope that the cluster perspective offers a useful complement to the long-standing country-based rankings that will continue to form the core of the GII.

We thank our Knowledge Partners, the Confederation of Indian Industry (CII), PricewaterhouseCoopers (PwC) and Strategy&, and the National Confederation of Industry Brazil (CNI) and Brazilian Service of Support to Micro and Small Enterprises (Sebrae) for their support of this year’s report.

Likewise, we thank our prominent Advisory Board, which has been enriched by a new member this year: Chuan Poh Lim, Chairman, Agency for Science, Technology and Research (A\*STAR) of Singapore.

We hope that the collective efforts of innovation actors and decision makers who use the GII will continue to pave the way for better innovation policies around the world.

### **SOUMITRA DUTTA**

Dean, Cornell SC Johnson College of Business, Cornell University

### **FRANCIS GURRY**

Director General, World Intellectual Property Organization (WIPO)

### **BRUNO LANVIN**

Executive Director for Global Indices, INSEAD



## Innovation as the Key Driver of Sustainable Agriculture and Future Food Security in the Developing World



The primary obligation of a nation is to protect its citizens from hunger and malnutrition by enabling sustainable and equitable food production and distribution channels. The developing world, characterized by gross economic and social inequalities coupled with inequitable access to safe, nutritional food and quality healthcare, requires innovation to meet the ever-rising demand for food and to sustain its agricultural growth.

Despite the fact that India is one of the world's largest producers of food grain, the largest producer of milk, and its second largest producer of sugar, low-quality inputs such as low-grade seed, saline soil, inadequate irrigation, traditional farming methods (combined with small, scattered landholdings), restrictive access to formal credit, dependence on private moneylenders, and weak market linkages have long plagued its agriculture sector.

To counter these challenges, a gradual infusion of tech-based tools such as digital remote sensing, geographic and price information systems, crop and soil health monitoring, and farm management platforms has taken place. These tools promise to rationalize processes and enhance efficiency, productivity, distribution, and access along the entire continuum of the food system from farm to fork and beyond.

Public policy plays a pivotal role in making an environment conducive to this transition. The adoption of innovation-led farm technologies has spurred public and private investments in R&D, helped technology transfer and uptake, as well as inter-sectoral cooperation. Over the last two decades, this has enabled sustainable agriculture to gradually gain momentum.

The Confederation of Indian Industry (CII) has been a strong proponent of this paradigm shift. The theme of this year's Global Innovation Index (GII), 'Innovation Feeding the World', thus resonates well with the agenda and focus of CII in this sector, and like previous years may prove beneficial for stimulating effective policy dialogue within the government.

For last two years, in collaboration with the GII, CII has been engaged with the Indian government to boost India's ranking. I am delighted to report that this effort has improved India's 2016 GII results. Another outcome of this sustained effort was the launch of the GII 2016 in India at a special event, jointly organized by the Department of Industrial Policy and Promotion (DIPP), the National Institution for Transforming India (NITI Aayog), and CII, in the presence of the Director-General of the World Intellectual Property Organization (WIPO). During the event, India's Minister of State for Commerce and Industry instituted a high-level Task Force on Innovation to suggest ways India can improve its innovation eco-system.

As a follow up to this launch, the first international consultative exercise was organized in January 2017 in New Delhi to address existing data gaps in the GII. International agencies such as UNESCO, among others, participated in the exercise where the first India Innovation Index Portal was launched. These developments have created the desired momentum for states to work on building their innovation ecosystems and improving their innovation indicators.

In line with this year's theme, Chapter 5 covers the current ecosystem of digital technologies in Indian agriculture—the rise of agro-tech start-up ventures and the advocacy initiatives that are the backbone needed to modernize Indian agriculture.

CII has been a longstanding partner of GII. I would like to take this opportunity to congratulate the GII team once again for coming out with this important edition, and for taking up a theme that resonates very well in today's challenging times.

**CHANDRAJIT BANERJEE**  
Director General  
Confederation of Indian Industry





## Innovating to Feed the World



We live in a world of finite resources but infinite passion and creativity. At PwC, we are committed to building trust in society and solving important problems. But as problems become more global and complex, the solutions require a greater focus on innovation. The Global Innovation Index (GII) does just that by creating metrics to evaluate innovation and by identifying new ways to address the challenges that affect business and society.

At Strategy&, PwC's strategy consulting business, we are proud to be part of the 2017 GII. This year's theme of innovation in food systems highlights one of the most complex challenges humanity faces: managing the global food supply. We know that without significantly expanding agricultural production over the next three decades, the world's population will increasingly face hunger, malnutrition, and famine.

Resource scarcity is one of the key megatrends shaping our world today and in the years to come, so meeting the needs of the world's people in a sustainable way will require renewed focus on innovation in a variety of fields and from a variety of stakeholders. In this case, addressing global food insecurity involves technological innovation, including leading-edge advances in data analytics; global distribution and supply chain management; risk assessment; economic flexibility; a deeper understanding of climate and weather conditions; and sustainability practices. It's clear that no company, government, or any other institution can solve the food crisis on its own. To find a lasting solution, we have to work together.

In our research for the GII, we have identified promising agricultural innovations being developed by the private sector. Many of these are a result of more corporate R&D investment in software and services, and new technologies that are improving efficiency and productivity. However, the public sector—which has traditionally represented the majority of agricultural R&D expenditures—continues to play an important role in spurring agricultural innovation. There's a real opportunity for governments and businesses to collaborate to

support corporate ventures and to ensure that investments have a greater impact.

In PwC's most recent CEO survey, we asked CEOs how the corporate community can help spread the benefits of globalization more widely. The majority of them said the best way is to collaborate, particularly with government. As a GII Knowledge Partner, we hope to do our part in helping to close the gap between innovation and finding tangible solutions to important problems that affect communities around the world.

**TIM RYAN**  
US Chairman and Senior Partner  
PwC



## Innovation in Food Production: Learning from the Past with an Open Mind for the Future



The National Confederation of Industry (CNI), the Social Service of Industry (SESI), the National Service of Industrial Training (SENAI), and the Brazilian Micro and Small Business Support Service (Sebrae) are more and more concerned with innovation. We are convinced that the only way to achieve sustainable development is through innovation. Since 2008, CNI business leaders have maintained the Entrepreneurial Mobilization for Innovation (MEI), putting innovation at the centre of corporate strategy and enhancing the effectiveness of innovation policies in Brazil.

‘Innovation Feeding the World’, this year’s theme for the Global Innovation Index, is a central issue for environmental sustainability and for the world’s social and economic well-being. Innovations are spread across different economic sectors, sustaining one another with new ideas and state-of-the-art technologies. Innovation in agribusiness and food production now requires the knowledge and technologies produced by other sectors.

Brazil’s role in grain production is not just a result of abundant natural resources and good climate conditions. Historically, the country has developed a consistent and comprehensive system of research and development to support innovation and new agriculture technologies. This system benefits from the leadership of Embrapa (Brazilian Agriculture Research Corporation), one of the country’s most important public research enterprises, which has provided Brazilian farmers with crucial tools needed for a modern and dynamic agroindustry.

Inspired by Embrapa, in 2013 the government launched the Brazilian Agency for Industrial Research and Innovation (Embrapii), which manages non-refundable grants invested in projects carried out by companies and research institutions and is acknowledged for its excellence, technological focus, and ability to meet companies’ needs.

The technology challenges for agro-industry are now more complex than ever. In the past, soil fertilization, mechanization, plant breeding, genetic engineering,

and improvements in cultivation techniques were the main drivers for the increase in agriculture productivity; today other challenges demand a new set of technologies and policies.

Agriculture and food production greatly impact the environment. With the growing demand for agriculture products, sustainable productivity growth in agriculture is a vital issue. This includes not only increasing crop productivity but also reducing inefficiencies in transportation and food industrialization. Another significant issue relates to how best to adapt to climate change and the expected increased frequency of extreme weather events. New technologies could contribute a great deal in this domain too.

Fortunately, a vast array of new technologies promises to increase efficiency in food production. New equipment and devices are at the centre of such technologies. Precision agriculture raises the possibility of using knowledge and information technologies to adapt cultivation techniques to each specific location, with its own soil and climate characteristics. Crop sensors could use agriculture inputs much more precisely by using the exact amount needed by a specific site. Drones and robots have already automated several tasks in agriculture production.

All these innovations are blurring the boundaries between industry, services, and agriculture. More and more, industrial and service technologies are offering new possibilities in agriculture. These new possibilities are also becoming more accessible to small innovative businesses in all sectors. To seize the resulting opportunities, a new framework of policies and institutions is needed to take advantage of lessons learned from successful past experiences and envision new possibilities for agriculture and food production. The theme of the Global Innovation Index this year could not be timelier.

**ROBSON BRAGA DE ANDRADE**  
President, CNI; Director, SESI;  
and President, SENAI’s National Council

**GUILHERME AFIF DOMINGOS**  
President-Director, Sebrae



## Contributors to the Report

*The Global Innovation Index 2017: Innovation Feeding the World* was developed under the general direction of **Francis GURRY** (Director General, World Intellectual Property Organization), and the editors of the report, **Soumitra DUTTA**, **Bruno LANVIN**, and **Sacha WUNSCH-VINCENT**.

The report was prepared and coordinated by a core team comprising:

### CORE TEAM

**Soumitra DUTTA**, Dean, Cornell SC Johnson College of Business, Cornell University

**Rafael ESCALONA REYNOSO**, GII Lead Researcher, Cornell SC Johnson College of Business, Cornell University

**Jordan LITNER**, GII Project Manager, Cornell SC Johnson College of Business, Cornell University

**Bruno LANVIN**, Executive Director for Global Indices, INSEAD

**Francesca GUADAGNO**, Economist and Project Manager, Innovation Economics Section, WIPO

**Sacha WUNSCH-VINCENT**, Senior Economist, Economics and Statistics Division, WIPO

The following people, institutions, and sources have supported the production of the GII:

### CO-PUBLISHERS

#### Cornell University

**Sarah MAGNUS-SHARPE**, Director, PR & Media Relations, Cornell SC Johnson College of Business, Cornell University

#### INSEAD

**Christine HIRZEL**, Global Head, Boards & External Relations

**Sophie BADRE**, Director, Media Relations Europe & Asia

**Virginie BONGEOT-MINET**, Centre Coordinator

**Chris HOWELLS**, Managing Editor, INSEAD Knowledge

**Aileen HUANG**, Associate Director, Media Relations, Asia

#### World Intellectual Property Organization (WIPO)

**Carsten FINK**, Chief Economist, Economics and Statistics Division

#### Economics and Statistics Division

#### Communications Division and External Relations Division

**WIPO Bureaus**, External Offices, and WIPO Coordination Office in New York

#### Printing Plant

### KNOWLEDGE PARTNERS

#### Confederation of Indian Industry

**Anjan DAS**, Executive Director

**Jibak DASGUPTA**, Director

#### CNI/Sebrae

**Gianna SAGAZIO**, Innovation Director, Innovation Directory, National Confederation of Industry (CNI)

**Suely LIMA**, Innovation Manager, Innovation Directory, National Confederation of Industry (CNI)

**Julieta Costa CUNHA**, Project Manager, Innovation Directory, National Confederation of Industry (CNI)

**Idenilza MIRANDA**, Industrial Development Specialist, Innovation Directory, National Confederation of Industry (CNI)

**Fernanda DE NEGRI**, Consultant, Innovation Directory, National Confederation of Industry (CNI)

**Guilherme Afif DOMINGOS**, Chief Executive Officer, Brazilian Micro and Small Business Support Service (Sebrae)

**Heloisa MENEZES**, Technical Director, Brazilian Micro and Small Business Support Service (Sebrae)

**Vinicius LAGES**, Chief Management and Financial Officer, Brazilian Micro and Small Business Support Service (Sebrae)

**Kelly SANCHES**, Industry Unit Manager, Technical Directory, Brazilian Micro and Small Business Support Service (Sebrae)

**Analuza LOPES**, Industry Unit Substitute, Manager, Technical Directory, Brazilian Micro and Small Business Support Service (Sebrae)

**Hugo Lumazzini PAIVA**, Project Manager, Industry Unit, Technical Directory, Brazilian Micro and Small Business Support Service (Sebrae)

**Augusto TOGNI**, Agribusiness Unit Manager, Technical Directory, Brazilian Micro and Small Business Support Service (Sebrae)

**Andrea RESTREPO**, Analyst, Agribusiness Unit, Technical Directory, Brazilian Micro and Small Business Support Service (Sebrae)

**Celio CABRAL**, Innovation Unit Manager, Technical Directory, Brazilian Micro and Small Business Support Service (Sebrae)

**Athos RIBEIRO**, Analyst, Innovation Unit, Technical Directory, Brazilian Micro and Small Business Support Service (Sebrae)

(Continued on next page)

**PricewaterhouseCoopers/Strategy&****Alessandro BORGOGNA**, Partner, PwC Middle East**Barry JARUZELSKI**, Principal, PwC US**Thomas JOHNSON**, Principal, PwC US**Marcus MORAWIETZ**, Partner, PwC Germany**Tim RYAN**, US Chairman and Senior Partner, PwC US**Ivan DE SOUZA**, Partner, PwC Brazil**Volker STAACK**, Principal, PwC US**Steven VELDHOEN**, Partner, PwC Japan**Kiran CHAUHAN**, Senior Manager, PwC Canada**Laura W. GELLER**, Senior Manager, PwC US**Spencer HERBST**, Manager, PwC US**DIRECT COLLABORATORS****Antanina GARANASVILI**, PhD Candidate in Economics, University of Padova and Queen Mary, University of London**Michaela SAISANA**, Head of the Competence Centre on Composite Indicators & Scoreboards (COIN), European Commission, Joint Research Centre (JRC); and **Sven LANGEDIJK**, Head of Unit, Modelling, Indicators and Impact Evaluation, European Commission, Joint Research Centre (JRC)**Hope STEELE**, Editor, Steele Editorial Services**Neil WEINBERG**, Managing Member, Neil Weinberg Design Group LLC**DATA COLLABORATORS**

We are also grateful to the following persons/institutions for their collaboration with specific data requests:

**David BESCOND**, Statistician; **Steven KAPSOS**, Head of Unit; **Yves PERARDEL**, Senior Econometrician; and **Marie-Claire SODERGREN**, Senior Economist, all at the Data Production and Analysis Unit (DPAU), Department of Statistics, International Labour Office (ILO)**Mohsen BONAKDARPOUR**, Managing Director, IHS Markit; **Karen CAMPBELL**, Senior Consultant, IHS Markit**Barbara D'ANDREA**, Senior Statistician, International Trade Statistics Section, and **Adelina MENDOZA**, Senior Statistical Officer, Market Access Intelligence Section, both from the Economic Research and Statistics Division, World Trade Organization (WTO)**Klaas DE VRIES**, Associate Economist and **Bart VAN ARK**, Executive Vice President, Chief Economist & Chief Strategy Officer, The Conference Board**Piet DONSELAAR**, Senior Policy Advisor, Ministry of Economic Affairs, Innovation & knowledge Department, Directorate-General for Enterprise and Innovation, the Netherlands**Fred GAULT**, Professorial Fellow; UNU-MERIT, Professor Extraordinaire, Tshwane University of Technology (TUT) in South Africa, Member of TUT Institute for Economic Research on Innovation**Thierry GEIGER**, Head of Analytics and Quantitative Research, and **Ciara BROWNE**, Head of Partnerships, both from Global Competitiveness and Risks, World Economic Forum**Dong GUO**, Statistician; **Rita LANG**, Senior Statistical Assistant; **Jürgen MUTH**, Senior Statistical Assistant; and **Valentin TODOROV**, Senior Information Management Officer, all from the Statistics Division, Department of Policy, Research and Statistics, United Nations Industrial Development Organization (UNIDO)**Héctor HERNANDEZ**, Project Leader – Scoreboard, Territorial Development Unit; **Alexander TÜBKE**, Team Leader – Industrial Research & Innovation and Technology Analysis, Territorial Development Unit, both from the European Commission, Joint Research Centre, Directorate for Growth and Innovation**Richard LAMBERT**, Manager, Global Government IP Sales, Clarivate Analytics**Ben SOWTER**, Head of Division, QS Intelligence Unit, QS Quacquarelli Symonds Ltd**Petra STEINER**, Key Account Manager, Bureau van Dijk Electronic Publishing GmbH**Susan TELTSCHER**, Head a.i.; **Esperanza MAGPANTAY**, Senior Statistician; and **Nathalie DELMAS**, Assistant, all at the ICT Data and Statistics Division (IDS), Telecommunication Development Bureau (BDT), International Telecommunication Union (ITU)**Padmasai VARANASI**, Junior Economist-Statistician, Research and Public Policy, World Federation of Exchanges**Said Ould A. VOFFAL**, Programme Specialist, **Elise LEGAULT**, Programme Specialist, **Chiao-Ling CHIEN**, Assistant Programme Specialist, and **Imededdine JERBI**, Statistician, Education Indicators and Data Analysis Section; **Lydia DELOUMEAUX**, Assistant Programme Specialist, and **Lisa BARBOSA**, Statistical Assistant, Culture Unit; **Talal EL HOURANI**, Statistician, Education Survey Section; **Martin SCHAAPER**, Head of Section, Science, Culture and Communication; **Luciana MARINS** and **Rohan PATHIRAGE**, Assistant Programme Specialists, and **Zahia SALMI** and **Ghania DJAFRI**, Statistical Assistants, Science, Technology and Innovation Unit, all from the United Nations Educational, Scientific and Cultural Organization (UNESCO) Institute for Statistics (UIS)**Clement WOLF**, Public Policy Manager and **Ethan GAUVIN**, Public Policy Analyst, both at Google**Leila ZIA**, Senior Research Scientist, Research Team and **Dan ANDREESCU**, Senior Software Engineer, Analytics Team, both at Wikimedia Foundation**Matthew ZOOK**, Professor at the University of Kentucky and President, ZookNIC Inc.**Energy Data Centre**, headed by **Duncan MILLARD**, International Energy Agency (IEA)**United Nations Commodity Trade Statistics Database**, Department of Economic and Social Affairs/ Statistics Division, <http://comtrade.un.org/db/>**PwC Global entertainment and media outlook 2016–2010**, [www.pwc.com/outlook](http://www.pwc.com/outlook)



## Advisory Board to the Global Innovation Index

In 2011, an Advisory Board was set up to provide advice on the research underlying the Global Innovation Index (GII), generate synergies at its stages of development, and assist with the dissemination of its messages and results. The Advisory Board is a select group of leading international practitioners and experts with unique knowledge and skills in the realm of innovation. Its members, while coming from diverse geographical and institutional backgrounds (international organizations, the public sector, non-governmental organizations, business, and academia), participate in their personal capacity. We are grateful for the time and support provided by the Advisory Board members.

In 2017, we welcome a new member to the Advisory Board: Chuan Poh Lim, Chairman, Agency for Science, Technology and Research (A\*STAR).

### ADVISORY BOARD MEMBERS

#### Robert D. ATKINSON

President, The Information Technology and Innovation Foundation (ITIF), United States of America

#### Irina BOKOVA

Director General of the United Nations Educational, Scientific and Cultural Organization (UNESCO)

#### Dongmin CHEN

Professor/Dean, School of Innovation and Entrepreneurship, and Director, Office of Business Development for Science and Technology, Peking University, China

#### Fabiola GIANOTTI

Director-General of the European Organization for Nuclear Research (CERN)

#### Leonid GOKHBERG

First Vice-Rector, Higher School of Economics (HSE), and Director, HSE Institute for Statistical Studies and Economics of Knowledge, Russian Federation

#### Yuko HARAYAMA

Executive Member, Council for Science, Technology and Innovation, Cabinet Office, Government of Japan

#### Hugo HOLLANDERS

Senior Researcher, UNU-MERIT (Maastricht University)

#### Beethika KHAN

Program Director, National Science Foundation (NSF), United States of America

#### Chuan Poh LIM

Chairman, Agency for Science, Technology and Research (A\*STAR)

#### Raghunath Anant MASHELKAR

Chairman, National Innovation Foundation and President, Global Research Alliance

#### Mary O'KANE

Professor, NSW Chief Scientist and Engineer, Australia

#### Sibusiso SIBISI

President and Chief Executive Officer, Council for Scientific and Industrial Research (CSIR), South Africa

#### Pedro WONGTSCHOWSKI

Member of the Board of Directors of Ultrapar Participações S.A. and of Embraer S.A.; Chairman of the Board of Directors of the Brazilian Enterprise for Research and Innovation (EMBRAPIL) and of the Brazilian Association of Innovative Companies (ANPEI)

#### Houlin ZHAO

Secretary-General, International Telecommunication Union (ITU)



# Rankings

## Global Innovation Index 2017 rankings

| Country/Economy          | Score (0–100) | Rank | Income | Rank | Region | Rank | Efficiency Ratio | Rank | Median: 0.62 |
|--------------------------|---------------|------|--------|------|--------|------|------------------|------|--------------|
| Switzerland              | 67.69         | 1    | HI     | 1    | EUR    | 1    | 0.95             | 2    |              |
| Sweden                   | 63.82         | 2    | HI     | 2    | EUR    | 2    | 0.83             | 12   |              |
| Netherlands              | 63.36         | 3    | HI     | 3    | EUR    | 3    | 0.93             | 4    |              |
| United States of America | 61.40         | 4    | HI     | 4    | NAC    | 1    | 0.78             | 21   |              |
| United Kingdom           | 60.89         | 5    | HI     | 5    | EUR    | 4    | 0.78             | 20   |              |
| Denmark                  | 58.70         | 6    | HI     | 6    | EUR    | 5    | 0.71             | 34   |              |
| Singapore                | 58.69         | 7    | HI     | 7    | SEAO   | 1    | 0.62             | 63   |              |
| Finland                  | 58.49         | 8    | HI     | 8    | EUR    | 6    | 0.70             | 37   |              |
| Germany                  | 58.39         | 9    | HI     | 9    | EUR    | 7    | 0.84             | 7    |              |
| Ireland                  | 58.13         | 10   | HI     | 10   | EUR    | 8    | 0.85             | 6    |              |
| Korea, Rep.              | 57.70         | 11   | HI     | 11   | SEAO   | 2    | 0.82             | 14   |              |
| Luxembourg               | 56.40         | 12   | HI     | 12   | EUR    | 9    | 0.97             | 1    |              |
| Iceland                  | 55.76         | 13   | HI     | 13   | EUR    | 10   | 0.86             | 5    |              |
| Japan                    | 54.72         | 14   | HI     | 14   | SEAO   | 3    | 0.67             | 49   |              |
| France                   | 54.18         | 15   | HI     | 15   | EUR    | 11   | 0.71             | 35   |              |
| Hong Kong (China)        | 53.88         | 16   | HI     | 16   | SEAO   | 4    | 0.61             | 73   |              |
| Israel                   | 53.88         | 17   | HI     | 17   | NAWA   | 1    | 0.77             | 23   |              |
| Canada                   | 53.65         | 18   | HI     | 18   | NAC    | 2    | 0.64             | 59   |              |
| Norway                   | 53.14         | 19   | HI     | 19   | EUR    | 12   | 0.66             | 51   |              |
| Austria                  | 53.10         | 20   | HI     | 20   | EUR    | 13   | 0.69             | 41   |              |
| New Zealand              | 52.87         | 21   | HI     | 21   | SEAO   | 5    | 0.65             | 56   |              |
| China                    | 52.54         | 22   | UM     | 1    | SEAO   | 6    | 0.94             | 3    |              |
| Australia                | 51.83         | 23   | HI     | 22   | SEAO   | 7    | 0.60             | 76   |              |
| Czech Republic           | 50.98         | 24   | HI     | 23   | EUR    | 14   | 0.83             | 13   |              |
| Estonia                  | 50.93         | 25   | HI     | 24   | EUR    | 15   | 0.79             | 19   |              |
| Malta                    | 50.60         | 26   | HI     | 25   | EUR    | 16   | 0.84             | 8    |              |
| Belgium                  | 49.85         | 27   | HI     | 26   | EUR    | 17   | 0.67             | 47   |              |
| Spain                    | 48.81         | 28   | HI     | 27   | EUR    | 18   | 0.70             | 36   |              |
| Italy                    | 46.96         | 29   | HI     | 28   | EUR    | 19   | 0.73             | 31   |              |
| Cyprus                   | 46.84         | 30   | HI     | 29   | NAWA   | 2    | 0.74             | 28   |              |
| Portugal                 | 46.05         | 31   | HI     | 30   | EUR    | 20   | 0.71             | 33   |              |
| Slovenia                 | 45.80         | 32   | HI     | 31   | EUR    | 21   | 0.68             | 44   |              |
| Latvia                   | 44.61         | 33   | HI     | 32   | EUR    | 22   | 0.74             | 26   |              |
| Slovakia                 | 43.43         | 34   | HI     | 33   | EUR    | 23   | 0.75             | 25   |              |
| United Arab Emirates     | 43.24         | 35   | HI     | 34   | NAWA   | 3    | 0.49             | 104  |              |
| Bulgaria                 | 42.84         | 36   | UM     | 2    | EUR    | 24   | 0.80             | 15   |              |
| Malaysia                 | 42.72         | 37   | UM     | 3    | SEAO   | 8    | 0.68             | 46   |              |
| Poland                   | 41.99         | 38   | HI     | 35   | EUR    | 25   | 0.67             | 48   |              |
| Hungary                  | 41.74         | 39   | HI     | 36   | EUR    | 26   | 0.73             | 30   |              |
| Lithuania                | 41.17         | 40   | HI     | 37   | EUR    | 27   | 0.59             | 84   |              |
| Croatia                  | 39.80         | 41   | HI     | 38   | EUR    | 28   | 0.66             | 52   |              |
| Romania                  | 39.16         | 42   | UM     | 4    | EUR    | 29   | 0.69             | 39   |              |
| Turkey                   | 38.90         | 43   | UM     | 5    | NAWA   | 4    | 0.84             | 9    |              |
| Greece                   | 38.85         | 44   | HI     | 39   | EUR    | 30   | 0.56             | 87   |              |
| Russian Federation       | 38.76         | 45   | UM     | 6    | EUR    | 31   | 0.61             | 75   |              |
| Chile                    | 38.70         | 46   | HI     | 40   | LCN    | 1    | 0.60             | 77   |              |
| Viet Nam                 | 38.34         | 47   | LM     | 1    | SEAO   | 9    | 0.84             | 10   |              |
| Montenegro               | 38.07         | 48   | UM     | 7    | EUR    | 32   | 0.63             | 62   |              |
| Qatar                    | 37.90         | 49   | HI     | 41   | NAWA   | 5    | 0.61             | 68   |              |
| Ukraine                  | 37.62         | 50   | LM     | 2    | EUR    | 33   | 0.83             | 11   |              |
| Thailand                 | 37.57         | 51   | UM     | 8    | SEAO   | 10   | 0.75             | 24   |              |
| Mongolia                 | 37.13         | 52   | LM     | 3    | SEAO   | 11   | 0.74             | 27   |              |
| Costa Rica               | 37.09         | 53   | UM     | 9    | LCN    | 2    | 0.69             | 43   |              |
| Moldova, Rep.            | 36.84         | 54   | LM     | 4    | EUR    | 34   | 0.78             | 22   |              |
| Saudi Arabia             | 36.17         | 55   | HI     | 42   | NAWA   | 6    | 0.53             | 96   |              |
| Kuwait                   | 36.10         | 56   | HI     | 43   | NAWA   | 7    | 0.79             | 18   |              |
| South Africa             | 35.80         | 57   | UM     | 10   | SSF    | 1    | 0.53             | 97   |              |
| Mexico                   | 35.79         | 58   | UM     | 11   | LCN    | 3    | 0.61             | 74   |              |
| Armenia                  | 35.65         | 59   | LM     | 5    | NAWA   | 8    | 0.80             | 17   |              |
| India                    | 35.47         | 60   | LM     | 6    | CSA    | 1    | 0.66             | 53   |              |
| TFYR of Macedonia        | 35.43         | 61   | UM     | 12   | EUR    | 35   | 0.59             | 80   |              |
| Serbia                   | 35.34         | 62   | UM     | 13   | EUR    | 36   | 0.61             | 67   |              |
| Panama                   | 34.98         | 63   | UM     | 14   | LCN    | 4    | 0.69             | 38   |              |
| Mauritius                | 34.82         | 64   | UM     | 15   | SSF    | 2    | 0.48             | 109  |              |

## Global Innovation Index 2017 rankings (continued)

| Country/Economy            | Score (0–100) | Rank | Income | Rank | Region | Rank | Efficiency Ratio | Rank | Median: 0.62 |
|----------------------------|---------------|------|--------|------|--------|------|------------------|------|--------------|
| Colombia                   | 34.78         | 65   | UM     | 16   | LCN    | 5    | 0.52             | 100  |              |
| Bahrain                    | 34.67         | 66   | HI     | 44   | NAWA   | 9    | 0.56             | 88   |              |
| Uruguay                    | 34.53         | 67   | HI     | 45   | LCN    | 6    | 0.59             | 82   |              |
| Georgia                    | 34.39         | 68   | UM     | 17   | NAWA   | 10   | 0.63             | 60   |              |
| Brazil                     | 33.10         | 69   | UM     | 18   | LCN    | 7    | 0.52             | 99   |              |
| Peru                       | 32.90         | 70   | UM     | 19   | LCN    | 8    | 0.49             | 106  |              |
| Brunei Darussalam          | 32.89         | 71   | HI     | 46   | SEAO   | 12   | 0.34             | 124  |              |
| Morocco                    | 32.72         | 72   | LM     | 7    | NAWA   | 11   | 0.61             | 71   |              |
| Philippines                | 32.48         | 73   | LM     | 8    | SEAO   | 13   | 0.65             | 55   |              |
| Tunisia                    | 32.30         | 74   | LM     | 9    | NAWA   | 12   | 0.62             | 65   |              |
| Iran, Islamic Rep.         | 32.09         | 75   | UM     | 20   | CSA    | 2    | 0.80             | 16   |              |
| Argentina                  | 32.00         | 76   | UM     | 21   | LCN    | 9    | 0.55             | 94   |              |
| Oman                       | 31.83         | 77   | HI     | 47   | NAWA   | 13   | 0.46             | 115  |              |
| Kazakhstan                 | 31.50         | 78   | UM     | 22   | CSA    | 3    | 0.46             | 116  |              |
| Dominican Republic         | 31.17         | 79   | UM     | 23   | LCN    | 10   | 0.65             | 54   |              |
| Kenya                      | 30.95         | 80   | LM     | 10   | SSF    | 3    | 0.66             | 50   |              |
| Lebanon                    | 30.64         | 81   | UM     | 24   | NAWA   | 14   | 0.61             | 69   |              |
| Azerbaijan                 | 30.58         | 82   | UM     | 25   | NAWA   | 15   | 0.50             | 103  |              |
| Jordan                     | 30.52         | 83   | UM     | 26   | NAWA   | 16   | 0.65             | 57   |              |
| Jamaica                    | 30.36         | 84   | UM     | 27   | LCN    | 11   | 0.57             | 86   |              |
| Paraguay                   | 30.30         | 85   | UM     | 28   | LCN    | 12   | 0.61             | 72   |              |
| Bosnia and Herzegovina     | 30.23         | 86   | UM     | 29   | EUR    | 37   | 0.47             | 112  |              |
| Indonesia                  | 30.10         | 87   | LM     | 11   | SEAO   | 14   | 0.69             | 42   |              |
| Belarus                    | 29.98         | 88   | UM     | 30   | EUR    | 38   | 0.39             | 120  |              |
| Botswana                   | 29.97         | 89   | UM     | 31   | SSF    | 4    | 0.38             | 121  |              |
| Sri Lanka                  | 29.85         | 90   | LM     | 12   | CSA    | 4    | 0.65             | 58   |              |
| Trinidad and Tobago        | 29.75         | 91   | HI     | 48   | LCN    | 13   | 0.56             | 90   |              |
| Ecuador                    | 29.14         | 92   | UM     | 32   | LCN    | 14   | 0.62             | 66   |              |
| Albania                    | 28.86         | 93   | UM     | 33   | EUR    | 39   | 0.37             | 122  |              |
| Tajikistan                 | 28.16         | 94   | LM     | 13   | CSA    | 5    | 0.59             | 83   |              |
| Kyrgyzstan                 | 28.01         | 95   | LM     | 14   | CSA    | 6    | 0.47             | 114  |              |
| Tanzania, United Rep.      | 27.97         | 96   | LI     | 1    | SSF    | 5    | 0.73             | 29   |              |
| Namibia                    | 27.94         | 97   | UM     | 34   | SSF    | 6    | 0.48             | 108  |              |
| Guatemala                  | 27.90         | 98   | LM     | 15   | LCN    | 15   | 0.56             | 91   |              |
| Rwanda                     | 27.36         | 99   | LI     | 2    | SSF    | 7    | 0.33             | 125  |              |
| Senegal                    | 27.11         | 100  | LI     | 3    | SSF    | 8    | 0.54             | 95   |              |
| Cambodia                   | 27.05         | 101  | LM     | 16   | SEAO   | 15   | 0.63             | 61   |              |
| Uganda                     | 26.97         | 102  | LI     | 4    | SSF    | 9    | 0.47             | 113  |              |
| El Salvador                | 26.68         | 103  | LM     | 17   | LCN    | 16   | 0.48             | 107  |              |
| Honduras                   | 26.36         | 104  | LM     | 18   | LCN    | 17   | 0.52             | 101  |              |
| Egypt                      | 26.00         | 105  | LM     | 19   | NAWA   | 17   | 0.59             | 81   |              |
| Bolivia, Plurinational St. | 25.64         | 106  | LM     | 20   | LCN    | 18   | 0.57             | 85   |              |
| Mozambique                 | 24.55         | 107  | LI     | 5    | SSF    | 10   | 0.61             | 70   |              |
| Algeria                    | 24.34         | 108  | UM     | 35   | NAWA   | 18   | 0.47             | 111  |              |
| Nepal                      | 24.20         | 109  | LI     | 6    | CSA    | 7    | 0.49             | 105  |              |
| Ethiopia                   | 24.16         | 110  | LI     | 7    | SSF    | 11   | 0.72             | 32   |              |
| Madagascar                 | 24.15         | 111  | LI     | 8    | SSF    | 12   | 0.68             | 45   |              |
| Côte d'Ivoire              | 23.96         | 112  | LM     | 21   | SSF    | 13   | 0.69             | 40   |              |
| Pakistan                   | 23.80         | 113  | LM     | 22   | CSA    | 8    | 0.62             | 64   |              |
| Bangladesh                 | 23.72         | 114  | LM     | 23   | CSA    | 9    | 0.55             | 93   |              |
| Malawi                     | 23.45         | 115  | LI     | 9    | SSF    | 14   | 0.53             | 98   |              |
| Benin                      | 23.04         | 116  | LI     | 10   | SSF    | 15   | 0.47             | 110  |              |
| Cameroon                   | 22.58         | 117  | LM     | 24   | SSF    | 16   | 0.56             | 92   |              |
| Mali                       | 22.48         | 118  | LI     | 11   | SSF    | 17   | 0.60             | 78   |              |
| Nigeria                    | 21.92         | 119  | LM     | 25   | SSF    | 18   | 0.52             | 102  |              |
| Burkina Faso               | 21.86         | 120  | LI     | 12   | SSF    | 19   | 0.24             | 127  |              |
| Zimbabwe                   | 21.80         | 121  | LI     | 13   | SSF    | 20   | 0.56             | 89   |              |
| Burundi                    | 21.31         | 122  | LI     | 14   | SSF    | 21   | 0.41             | 117  |              |
| Niger                      | 21.18         | 123  | LI     | 15   | SSF    | 22   | 0.36             | 123  |              |
| Zambia                     | 20.83         | 124  | LM     | 26   | SSF    | 23   | 0.59             | 79   |              |
| Togo                       | 18.41         | 125  | LI     | 16   | SSF    | 24   | 0.28             | 126  |              |
| Guinea                     | 17.41         | 126  | LI     | 17   | SSF    | 25   | 0.40             | 118  |              |
| Yemen                      | 15.64         | 127  | LM     | 27   | NAWA   | 19   | 0.40             | 119  |              |

Note: World Bank Income Group Classification (July 2016): LI = low income; LM = lower-middle income; UM = upper-middle income; and HI = high income. Regions are based on the United Nations Classification: EUR = Europe; NAC = Northern America; LCN = Latin America and the Caribbean; CSA = Central and Southern Asia; SEAO = South East Asia, East Asia, and Oceania; NAWA = Northern Africa and Western Asia; SSF = Sub-Saharan Africa.





# Key Findings



## Key Findings of the GII 2017

From the Global Innovation Index 2017, devoted to measuring the innovation performance of 127 economies and the theme ‘Innovation Feeding the World’, six messages emerge. Many of these messages are concerned with innovation as a driver of growth generally. One is concerned specifically with the role of innovation as a way to address the growing need for advances in agriculture and food value chains.

---

### **Finding 1: Crafting the foundations for innovation-driven growth while the global economy is at an important turning point**

In a turn of events, growth is reaching a novel and more sustained momentum as the GII goes to print this year. Laying the foundation for innovation-driven economic development is ever more paramount. Related policies that will sustain innovation investments can help transform the cyclical economic upswing into longer-term growth. Such proactive innovation policies are also a powerful antidote to uncertainty because they boost the confidence and thus also the investments of economic actors into the future.

In spite of this new growth momentum, investment and productivity growth are still at historic lows. China aside, investment growth in middle-income countries has now fallen to levels similar to that of rich countries (Figure A). Furthermore,

the productivity crisis is more topical today than ever. The downturn has amplified the phenomenon of lacklustre productivity gains in rich countries, in conjunction with weakened technological innovation and diffusion. Emerging economies are affected as well, with their catch-up to advanced-country productivity slowing.

Research and development (R&D) investments need to be intensified. Although permanently subdued R&D growth was avoided thanks to countercyclical innovation policies and private innovation expenditures, R&D growth is still lower today than it was in 2011–13, and much lower than in 2005–08 (Figure A). Tighter government R&D budgets in selected high-income countries and slower spending growth in emerging countries explain part of this slowdown. Disconcertingly, and in addition to flattening public R&D, business research expenditures seem to be losing momentum.

---

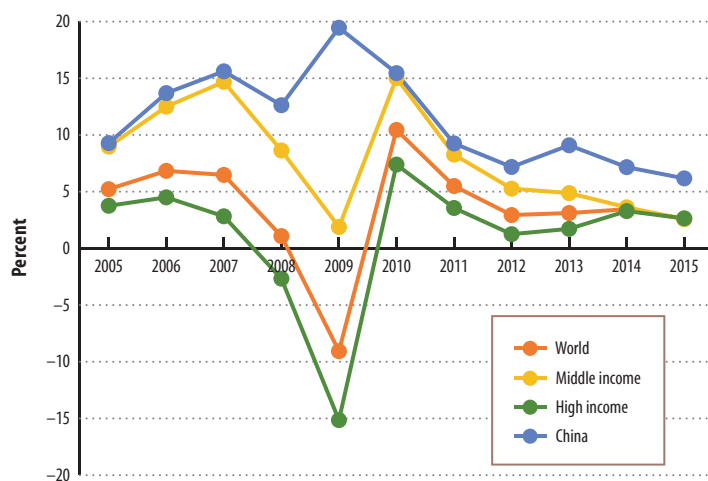
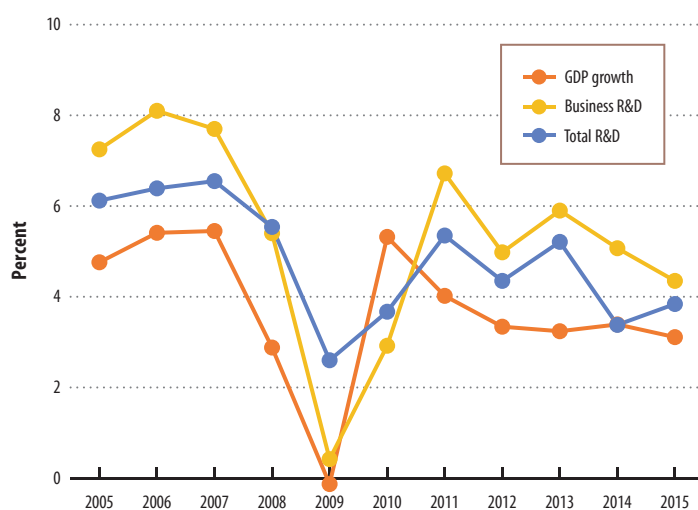
### **Finding 2: Smart, digital agricultural innovation and a better uptake of innovation in developing countries can help overcome serious food challenges**

Today a fresh innovation drive is required to confront slow growth in agricultural productivity and the bottlenecks in today’s agricultural innovation systems. First and foremost, lagging agricultural productivity

growth in low- and middle-income economies and lagging agricultural R&D spending across all economies both need to be reversed. Second, innovations need to disperse more effectively throughout the agricultural and food sector, especially in developing countries.

Helping to meet this need for innovation in agricultural systems, a wave of new agricultural technologies and innovations is taking place that could help overcome lagging productivity. The pace of agricultural innovation has increased over the last few years, with innovations from other sectors spilling over to agricultural and food systems. Advances in areas such as genetics and nano- and biotechnologies have proven their ability to be a source of higher yields and better nutrient content, even though their full environmental and health impacts have yet to be fully understood. Big data are reshaping the world of agriculture: digital agriculture has started to spread worldwide, helped by the development of innovations in information technology (IT)—for example, sensors, drones and robotics, and virtual and augmented reality—as well as data generation and analytics enabled by remote sensing, and geographic information systems.

Unfortunately, the new wave of technological advances is rolling out rather slowly in many parts of the world, including in rich countries. And developing countries,

**Figure A: Global investment and business R&D falling short****Investment growth, 2005–15****R&D expenditures growth, 2005–15**

Source: See Figure 1 from Chapter 1.

chain. These are mostly obstacles concerned with liquidity constraints, agricultural inputs of imperfect quality, insufficient information and awareness, and a lack of post-harvest and distribution infrastructure.

Public authorities have critical roles to play in helping stimulate innovation in food and agricultural value chains. For a start, the agriculture and food sector should be part and parcel of any national innovation strategy. To this day, this is very rarely the case.

To overcome market failures, policy makers have a responsibility to provide funding mechanisms to stimulate innovation in agriculture and food production. Instruments such as agricultural funds and focused research institutes need to work more efficiently. Developing countries also need to engage more in domestic R&D, for example, while setting priorities in research fields appropriate to their specific resources and contexts. Local (sub-national) initiatives are also important: grassroots innovations are happening in farming that can often be scaled up. In such contexts, robust links between public research institutions, firms, and the grassroots level are key.

Efforts to enhance the efficiency of the food and agriculture innovation system should focus on reducing lags between R&D efforts and the widespread adoption of agricultural innovations. Accelerating technology transfers by establishing clear rules of engagement in university-industry interactions, including the commercialization of intellectual property derived from these, is a valuable option. Supporting the demand for innovation from farmers and commercial farming operations is equally important. Five recommendations are:

particularly in Sub-Saharan Africa, have yet to benefit from earlier waves of agricultural innovations.

New technologies aside, the brunt of agricultural innovation is found in improved processes and services that

occur along the agricultural value chain, be it in high-income or low-income economies, not only in novel technologies. In the case of developing countries, there are many significant bottlenecks along the value

- First, provide adequate information to farmers, ensure that key workers along the value chain have sufficient relevant skills, and encourage the adoption of new products and processes.
- Second, empower farmers by providing access to digital technologies and the new service platforms that have immense potential to positively impact agriculture.
- Third, recognize and help boost entrepreneurship and venture capital approaches within the agricultural sector.
- Fourth, both the private sector and government can help infuse excellence and innovative attitudes that are evident in other vital sectors—such as the information and communication technologies, or ICT, sector—into the agricultural sector.
- Finally, improve national legal and regulatory frameworks in agriculture, and more generally streamline regulations and reduce bureaucracy around farmers, in particular when striking a balance between traditional and advanced farming technologies.

**Finding 3: More innovation convergence is needed globally, with developing countries perfecting their innovation systems**

Innovation is becoming more global but divides remain; innovation leaders are uncontested at the top but new players are emerging.

Switzerland leads the rankings for the seventh consecutive year. In the top 25, some economies—such as the Netherlands, Denmark, Germany, Japan, France, Israel, and China—move up. Yet rich countries

**Table A: Innovation achievers: Income group and years as an innovation achiever**

| Economy               | Income group        | Years as an innovation achiever (total)      |
|-----------------------|---------------------|--|
| Viet Nam              | Lower-middle income | 2017, 2016, 2015, 2014, 2013, 2012, 2011 (7) |
| Kenya                 | Lower-middle income | 2017, 2016, 2015, 2014, 2013, 2012, 2011 (7) |
| Moldova, Rep.         | Lower-middle income | 2017, 2016, 2015, 2014, 2013, 2012, 2011 (7) |
| India                 | Lower-middle income | 2017, 2016, 2015, 2014, 2013, 2012, 2011 (7) |
| Armenia               | Lower-middle income | 2017, 2016, 2015, 2014, 2013, 2012 (6)       |
| Ukraine               | Lower-middle income | 2017, 2016, 2015, 2014, 2012 (5)             |
| Rwanda                | Low income          | 2017, 2016, 2015, 2014, 2012 (5)             |
| Uganda                | Low income          | 2017, 2016, 2015, 2014, 2013 (5)             |
| Mozambique            | Low income          | 2017, 2016, 2015, 2014, 2012 (5)             |
| Malawi                | Low income          | 2017, 2016, 2015, 2014, 2012 (5)             |
| Senegal               | Low income          | 2017, 2015, 2014, 2013, 2012 (5)             |
| Tajikistan            | Lower-middle income | 2017, 2016, 2013 (3)                         |
| Malta                 | High income         | 2017, 2016, 2015 (3)                         |
| Madagascar            | Low income          | 2017, 2016 (2)                               |
| Bulgaria              | Upper-middle income | 2017, 2015 (2)                               |
| Burundi               | Low income          | 2017 (1)                                     |
| Tanzania, United Rep. | Low income          | 2017 (1)                                     |

Source: See Table 5 from Chapter 1.

take most of the top 25 spots, with middle-income countries growing more distant to the top 25 this year, rather than closing the gap.

The exception is still China. It moves up by three spots in this edition, becoming the 22nd most innovative economy in the world after having entered the top 25 in 2016 as the first middle-income economy. With the exceptions of Bulgaria and Malaysia, the gap between the 11–25 ranked economies and middle-income economies remains large, especially in Institutions, Human capital and research, Infrastructure, and Creative outputs. Outside these countries, only a few upper-middle-income economies—such as Turkey, the Russian Federation, and Viet Nam—are among the top 50 this year. Similarly, the innovation quality ranking is led by the United States of America (USA), Japan, the United Kingdom, and other high-income

countries, with China being the only middle-income country closing the gap.

In terms of regions, the same patterns of innovation divides persist: Northern America; Europe; and South East Asia, East Asia, and Oceania lead, followed at a great distance by Northern Africa and Western Asia; Latin America and the Caribbean; Central and Southern Asia; and, finally, Sub-Saharan Africa.

Yet there are many positive developments too. For a start, in 2017 we continue to see a number of countries that perform significantly better on innovation than their current level of development would predict; it is hoped that this will trigger a virtuous cycle of development in the years to come. A total of 17 economies compose the cluster of ‘innovation achievers’ this year. This group has grown this year relative to 2016.

Most of these economies—nine in total—come from the Sub-Saharan Africa region, followed by three economies in the Eastern region of Europe. Table A shows the list of innovation achievers; particularly notable is the consistent progress in Sub-Saharan Africa, with some new economies, such as Tanzania and Burundi, joining this group. Importantly, Kenya, Rwanda, Senegal, Uganda, Mozambique, and Malawi stand out for being innovation achievers at least five times in the previous six years. Particular results-oriented activities in Viet Nam and India leading to achievements on particular innovation components are also especially notable.

Continuing with the trend identified in earlier editions of the GII, the average performance of the group of low-income economies is getting closer to the average performance of the middle-income cluster. Both in GII scores and also in their catch-up on particular innovation variables, the innovation achievers mentioned in Table A help close the gap.

---

**Finding 4: Opportunities have emerged to leverage the rise of new East Asia Innovation Tigers, fostering deeper regional innovation networks and benefitting from the rise of India**

In terms of innovation and economic development more broadly, Asia is definitely a more and more important engine of innovation in the 21st century, complementing existing innovation efforts in high-income economies, mostly in Northern America and Europe.

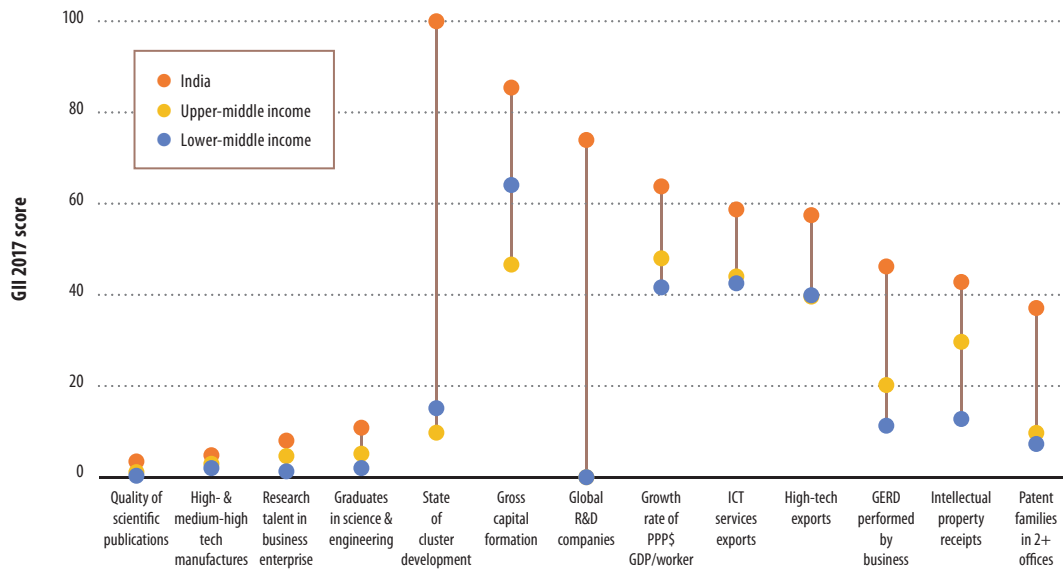
The different elements of a potentially strong networked innovation powerhouse are coming together in Asia. For a start, and despite enduring economic setbacks, Japan has continued to be a driving force of global innovation since the late 1970s. Later,

in the 1980s, the so-called Asian Tigers emerged, with Hong Kong (China), Singapore, the Republic of Korea, and to some extent Malaysia developing their innovation agendas quite rapidly. In conjunction with Japan, these economies are the top Asian countries in innovation in the region. In the 1990s, the rise of other South East Asian countries such as Thailand was also forecast by economic and innovation experts—complementing the large established players. The economic spurt of these countries was temporarily stopped short by the Asian financial crisis, but has since continued unabated. In addition, thanks to its steadily persevering innovation agenda, China also vigorously entered the picture while making strides in terms of innovation activities and results.

Moving forward, a novel dynamic of innovation development is in place today, potentially producing a new line-up of up-and-coming Asian countries. New Asian Tigers—such as Indonesia, the Philippines, and Viet Nam—are emerging too, and they increasingly join not only Asian high-tech value chains but also other activities such as ICT offshoring. These and other countries in Asia are also active in improving their innovation performance. Although Singapore is still uncontested as number 1 among the smaller or emerging Asian economies, countries such as Viet Nam, the Philippines, and Thailand are rapidly catching up. Among them, Viet Nam tops education expenditure in the region and does very well in ICT use, gross capital formation, and FDI net inflows. Malaysia has the best cluster development and ICT use, the Philippines leads ICT services exports, Thailand tops the quality of publications and trademarks, and Cambodia only recently engaged on innovation activities but its FDI inflows are already high.

A potentially stronger pan-Asian innovation network is seeing the light of day as China, Japan, and the Republic of Korea increasingly conduct some of their manufacturing activities—including those in technology-intensive sectors—in neighbouring Asian countries, leading to regional production and innovation networks. However, these intra-regional production activities still mostly concern low-skill and low-wage assembly operations with Chinese, Japanese, or Korean firms choosing to manufacture in, for example, Viet Nam, to benefit from excellent framework conditions and lower wages. Few collaborative R&D projects exist between the Asian leading nations, their top innovation clusters, or these smaller newcomers today, at either the firm or the country level. The newly emerging Asian economies, such as Malaysia, the Philippines, and Viet Nam, still experience low R&D and low resident patenting levels. As a result, the potential of intra-regional innovation networks in Asia is far from fully utilized.

There is development in Central and Southern Asia too, with interesting developments in countries such as the Islamic Republic of Iran, Kazakhstan, and Bangladesh. But, first and foremost, India's current and imminent development, and its contribution to the region and the global innovation landscape, is vital these days. As demonstrated in the GII for some years, India has consistently outperformed on innovation relative to its GDP per capita. Recently it made important strides in innovation input and output performance. India is now in the top half of the GII rankings. The continual improvement of India in terms of investment, tertiary education, the quality of its publications and universities, its ICT services exports,

**Figure B: India ahead of average lower-middle- and upper-middle-income economies**

Source: See Figure 6 in Chapter 1.

and its innovation clusters deserves mention (Figure B). It is to be hoped that India will continue on this trajectory, with innovation investments leading to more and more dynamic R&D-intensive firms that are active in patenting, high-technology production, and exports. If India then increasingly connects its innovation system to the innovative countries in the East mentioned above, as well as to standing innovation powerhouses in the West, it will make a true difference in Asia's regional role in innovation, and to global innovation more generally.

This is a promising prospect. The emergence of innovative new Asian Tigers, an innovative India, and better innovation networks in the region are likely to be among the most encouraging developments for worldwide innovation in the next few decades.

#### **Finding 5: Preserving the innovation momentum in Sub-Saharan Africa and tapping the innovation potential in Latin America are priorities**

A recurrent finding of the last editions of the GII has been that the innovation momentum in Sub-Saharan Africa must be preserved, while countries in Latin America and the Caribbean are working to meet their innovation potential.

For several editions, the GII has noted that—relative to its level of economic development—the Sub-Saharan Africa region performs comparatively well on innovation. Since 2012, Sub-Saharan Africa has had more countries among the group of innovation achievers than any other region. Kenya, Rwanda, Senegal, Uganda, Mozambique, and Malawi stand out for being innovation achievers at least five times in the past six years. Kenya is the chief innovation achiever in the region,

outperforming every year since 2011—including in the 2017 edition.

Noted improvements in Institutions and Business sophistication have allowed the region as a whole to catch up with Central and Southern Asia in these factors. Boosted by economies such as South Africa, Mauritius, Botswana, Namibia, Rwanda, and Burkina Faso, Sub-Saharan Africa this year has its highest scores in Institutions and Market sophistication. Larger economies such as South Africa, Kenya, Botswana, and Namibia help foster the expansion in Infrastructure; others such as Mauritius, Rwanda, Senegal, and Zimbabwe are helping to do so in Human capital.

This year, however, the drivers of growth that have been active in the region have seen a slowdown. Clearly, in absolute terms the gap between these Sub-Saharan Africa economies and some South East Asian innovation

**Table B: Top cluster of countries or cross-border regions, within the top 25**

| Rank | Cluster name               | Territory(ies)          |
|------|----------------------------|-------------------------|
| 1    | Tokyo–Yokohama             | Japan                   |
| 2    | Shenzhen–Hong Kong (China) | China/Hong Kong (China) |
| 3    | San Jose–San Francisco, CA | United States           |
| 4    | Seoul                      | Korea, Rep.             |
| 10   | Paris                      | France                  |
| 12   | Frankfurt–Mannheim         | Germany                 |
| 18   | Eindhoven                  | Netherlands/Belgium     |
| 21   | London                     | United Kingdom          |
| 22   | Tel Aviv                   | Israel                  |
| 24   | Stockholm                  | Sweden                  |

Source: Derived from Table 1 in Annex 2 in the Special Section on Clusters.

leaders is also still large, in particular when one considers that integration of global value chains and innovation exports, participation in high-tech production and exports, and patenting by Sub-Saharan economies are still low.

Turning to Latin America and the Caribbean, more must be done to reach the region's full innovation potential. Chile, Mexico, and Brazil and some other countries in the region are undoubtedly important innovation actors. Mexico is also an active contributor to global value chains, including in high-tech sectors. It is notable, however, that there is more potential for broad regional improvement on innovation, both in terms of overall innovation performance and also in terms of key innovation variables such as scientific publications, R&D, and patenting. For example, in recent years and also in 2017, no economies from this region are identified as innovation achievers—none outperform in innovation relative to their level of development. The region as such has faced important economic challenges in the last year, with Brazil only slowly emerging from an economic recession according to current forecasts, although the

country is still facing a high degree of uncertainty.

To further support this economic upswing and help the region progress in terms of innovation, sustained efforts in improved innovation investments and more coordinated innovation systems are required. Also needed is broader regional R&D and innovation cooperation, which is still largely absent when compared with other regions identified by the GII as being successful in innovation.

**Finding 6: The largest sub-national clusters of inventive activity, as measured by patenting, include Tokyo–Yokohama, Shenzhen–Hong Kong (China), and San Jose–San Francisco, CA**

This year the GII makes a first attempt at assessing sub-national innovation clusters. The importance of innovation hubs at the sub-national and international levels has been at the forefront of GII discussions for the last 10 years for two main reasons. First, successful innovation clusters are essential for national innovation performance. Second, one of the most frequent questions from countries has been whether the GII model can be applied at the sub-national

level to assess innovation clusters more broadly.

However, measuring the territorial dimension of innovation remains challenging. Only a few GII indicators are readily available at the regional or city level for a large set of countries. Besides, clusters often do not stop at national borders. By definition, the search for official and timely innovation data is challenging. In an effort to contribute preliminary solutions, a novel approach is presented in the GII 2017 that identifies the largest inventive clusters as measured by Patent Cooperation Treaty (PCT) patenting. Drawing on advanced mapping techniques and WIPO patenting data, Table B shows some of the leading innovation clusters that result from this analysis. Tokyo–Yokohama, Shenzhen–Hong Kong (China), and San Jose–San Francisco (the Silicon Valley area in California) lead in terms of being the largest inventive clusters, based on this methodology.

In the coming years, attempts to foster data on local innovation clusters should receive increased attention, and may possibly become a more important component of the GII.



# Chapters



# The Global Innovation Index 2017: Innovation Feeding the World

Soumitra Dutta, Rafael Escalona Reynoso, and Jordan Litner, Cornell SC Johnson College of Business, Cornell University

Bruno Lanvin, INSEAD

Sacha Wunsch-Vincent and Francesca Guadagno, WIPO

Since the release of the Global Innovation Index (GII) last year, the world has seen reason to expect recovery and indeed renewed economic growth. Although uncertainty remains high, the holding pattern of the global economy might well give way to a more sustained upswing. It is still questionable, however, whether the foundations for continued growth are in place; the probability of a ‘low-growth’ scenario is still high. In this context, firms, institutions, and policy makers can help sustain the recovery and shape the future by creating novel sources of innovation-driven growth.

## Nourishing the welcome economic upswing while tackling low investment and productivity

The global economy has been in a holding pattern for several years; it has never fully recovered from the 2007–08 crisis and has never returned to a momentum of sustained growth. In recent years, initial optimism and hopes of recovery were rather quickly replaced with downward revisions to economic growth. The growth rates experienced before the economic crisis remain elusive.

As the new edition of the Global Innovation Index 2017 goes to print, however, a new, if modest, growth momentum is in place. The world’s leading economic institutions predict a pick-up of global economic activity in 2017 and 2018, following

**Key findings in brief**

The six key findings of the GI 2017 are:

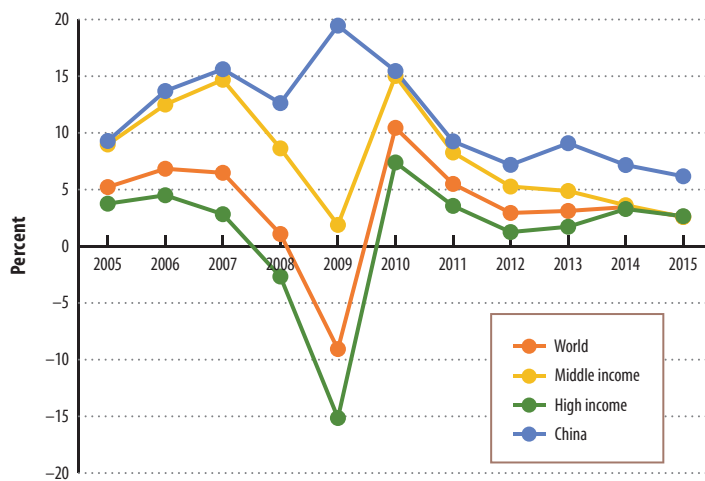
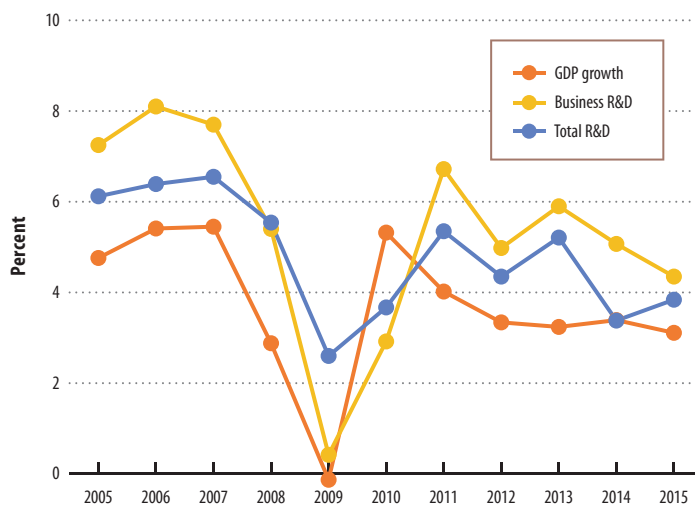
1. Creating new sources of innovation-driven growth is now vital to transforming the current economic upswing into the possibility of longer-term growth.
2. Smart and digital agricultural innovation and better diffusion to developing countries are required to help overcome serious food challenges.
3. More innovation convergence is needed globally, as low- and middle-income countries put more emphasis on their innovation systems.
4. The prospect of regional Asian innovation networks will also benefit from the rise of new Asian Innovation Tigers and India’s high potential.
5. Preserving the momentum of innovation in Sub-Saharan Africa and tapping the innovation potential in Latin America and the Caribbean must be priorities.
6. Regional clusters of inventive activity are essential to national innovation performance; improved innovation metrics on this topic are required.

a strong fourth quarter in 2016.<sup>1</sup> Compared with previous years, these growth forecasts for the world economy have not been revised downwards but upwards in recent months.<sup>2</sup> Business and consumer confidence are high.<sup>3</sup>

Projections also indicate that growth across low-, middle- and high-income economies will be broad-based and positive. Growth in emerging economies continues to be the main driver of the economic upswing. Economic growth is predicted to be relatively strong in middle- and certain low-income economies such as China, India, Indonesia, and Thailand; a few

African economies (Kenya, Senegal, and Uganda); and also in a handful of large advanced economies—the Republic of Korea (Korea), the United States of America (USA), and Canada. Brazil and the Russian Federation (Russia) are expected to experience growth again, with the former emerging from a deep recession.<sup>4</sup>

As a region, Latin America and the Caribbean face more positive prospects, following the stabilization of commodity prices benefitting low- and middle-income economies worldwide. Africa will experience a modest pick-up, boosted also by new infrastructure projects.<sup>5</sup>

**Figure 1: Global investment and business R&D falling short****Figure 1a: Investment growth, 2005–15****Figure 1b: R&D expenditures growth, 2005–15**

Source: 1a. World Bank World Development Indicators database, March 2017; 1b. Authors' estimate based on the UNESCO Institute for Statistics (UIS) database and the IMF World Economic Outlook database, March 2017.

Note: 'Investment' refers to real gross fixed capital formation.

That said, growth rates experienced before the economic crisis remain distant for close to all countries. Some large emerging economies, such as China, are seeing their high growth rates reduced, and other advanced economies, such as Japan, see persistently low growth rates.

Furthermore, a number of factors might derail the scenario of a durable upswing.

Many monetary, fiscal, and other factors are at stake, as well as unprecedented levels of geopolitical and economic uncertainty. The leading economic institutions are wary of a

more perpetual low-growth scenario, in which growth cannot be sustained and increased over time. This report is concerned with two related bottlenecks in particular.

First, investment and productivity increases are still at historic lows. And these low levels are at the origin of the lower growth than was enjoyed in pre-crisis years.<sup>6</sup> Despite more positive recent developments, investment—especially in emerging and developing countries—has not yet recovered.<sup>7</sup> In fact, investment growth in middle-income countries has fallen to levels similar to that of rich countries. China aside, the growth of investment in middle-income countries is even lower than it is in high-income ones (see Figure 1a). Furthermore, the productivity crisis is more topical today than ever.<sup>8</sup> Potential measurement issues aside, global labour productivity in 2016 is as low as it was in 2015.<sup>9</sup> The downturn, in conjunction with forces that weakened technological innovation and diffusion, has amplified the phenomenon of lower productivity in rich countries.<sup>10</sup> In the meantime, emerging economies are affected as well, with catch-up to advanced-country productivity levels slowing.

Second, concerns around faltering global economic integration are mounting. Trade growth has been historically weak since 2010—hovering around 2.5% between 2013 and 2015—and was even weaker in 2016, when it fell to 1.3%.<sup>11</sup> Cross-border foreign direct investments (FDI) also fell further in 2016.<sup>12</sup> Trade in particular is traditionally seen as both an important cause and an effect of global growth. A more neglected aspect of economic integration, however, is that both trade and FDI are key channels of the diffusion of technology, know-how, and innovation more broadly.<sup>13</sup> A reversal of globalized economic activity, and

**Box 1: Benchmarking R&D expenditures across countries**

Global expenditures on R&D (GERD) following the 2008–09 financial crisis have varied considerably (see Tables 1.1 and 1.2 on the following page). Some countries—such as China, India, Mexico, the Russian Federation, and Poland—did not decrease their R&D efforts during the crisis and have intensified them further after the crisis, with business expenditures on R&D (BERD) also following the same trend. Other countries saw declining GERD and BERD during the crisis, but above pre-crisis levels in 2015 (the latest year for

which data are available). These include traditionally high R&D spending economies, such as the United States of America, the United Kingdom, Germany, and the Netherlands, as well as relatively newer actors such as Chile and Slovakia.

In yet other countries (e.g., Colombia and Norway), GERD did not fall during the crisis, but BERD did. Governments pushed R&D investments to compensate for lower business R&D during the crisis; their efforts were rewarded with higher GERD and BERD after

the crisis. Finally, in a number of countries—such as Spain, Portugal, and Finland—R&D expenditures (both total and business) have not recovered yet, with GERD and BERD still below pre-crisis levels in 2015.

**Note**

Thanks to Antanina Garanasvili, PhD Candidate in Economics, University of Padova and Queen Mary, University of London, and our colleagues from the UNESCO Institute for Statistics (UIS) Martin Schaaper and Rohan Pathirage for help in producing Box 1.

*(Continued on next page)*

the associated networks of production and innovation, could have adverse consequences for economic catch-up and technological leapfrogging, which have been historically so critical for successful development cases such as China, Korea, and more recently Viet Nam.<sup>14</sup>

Fortunately, trade, FDI, and productivity growth are also forecast to be recovering in 2017 and further increasing in 2018, in conjunction with output growth and the cyclical recovery currently being experienced.<sup>15</sup>

Policy initiatives to sustain investment, human capital, innovation, and productivity growth could send a strong signal and be an important antidote to uncertainty.

**Crafting the foundations for innovation-driven growth as an antidote to uncertainty**

Laying the foundations for innovation-driven growth is paramount.

Although not at levels seen after the crisis, some government spending initiatives are underway again in major economies; an uptick in investment will be felt in 2016 and 2017.<sup>16</sup> Still, there is room for even

more initiatives aimed at satisfying economists’ omnipresent calls for more infrastructure investment in economies across the board.

To lay the foundation for future growth, policy actions that foster human capital, research and development (R&D), and other innovation inputs and outputs, as captured by the GII, are now required. Indeed, available economic evidence shows that an increase in R&D can effectively translate into an increase of GDP in the medium and longer term.<sup>17</sup>

Our study of global R&D data yields the following insights. Global R&D growth fell in the aftermath of the global financial crisis of 2009 (see Figure 1b and Box 1).<sup>18</sup> Governments stepped in to stimulate R&D effectively. Business R&D investments returned to faster growth in 2010. Encouragingly, by 2013 the share of business in total R&D had returned to its pre-crisis levels. Broadly speaking, our analysis indeed indicates that for the last four years, up until 2015 (when the most recent data are available), global R&D intensity—measured as global R&D expenditures relative to global GDP—was at 1.7%, and thus at levels similar to 2000–08.<sup>19</sup> GERD growth has also

consistently been higher than GDP growth, also a reflection of low general GDP growth in that period. Still, about eight years after the crisis, the worst-case scenario of permanently reduced R&D growth has to date been avoided, thanks to these anticyclical innovation policies and the role of R&D champions such as China, Germany, and Korea, which have consistently spent large and growing sums on R&D.

Yet, although permanently subdued R&D growth has been avoided, R&D growth is still inferior today than it was in 2011–13 immediately following the crisis, and much lower than in 2005–08 when it averaged around 6%. As governments have phased out some of their stimulus programmes, and as spending cuts are applied, tighter government R&D budgets in selected high-income countries and slower spending growth in key emerging countries explain part of this slowdown.<sup>20</sup>

Disconcertingly, and in addition to flattening public R&D, based on our estimates, business R&D growth seems to be losing momentum, with growth rates decreasing from about 6% in 2013 to 5% in 2014 and about 4.5% in 2015 (see Figure 1b).<sup>21</sup> In

### Box 1: Benchmarking R&D expenditures across countries (continued)

**Table 1.1: Gross domestic expenditure on R&D (GERD): Crisis and recovery compared**

Countries with no fall in GERD during the crisis that have expanded since

|                         | CRISIS |      | RECOVERY |      |                  |                  |
|-------------------------|--------|------|----------|------|------------------|------------------|
|                         | 2008   | 2009 | 2010–12* | 2013 | 2014             | 2015             |
| China                   | 100    | 126  | 165      | 212  | 231              | 253              |
| Poland                  | 100    | 113  | 145      | 167  | 187              | 207              |
| Costa Rica <sup>†</sup> | 100    | 134  | 140      | 166  | 179              | n/a              |
| Turkey                  | 100    | 111  | 134      | 157  | 172              | n/a              |
| Colombia <sup>†</sup>   | 100    | 100  | 118      | 174  | 167              | 166              |
| Korea, Rep.             | 100    | 106  | 133      | 155  | 166              | 168              |
| Mexico                  | 100    | 105  | 113      | 117  | 127 <sup>p</sup> | 134 <sup>p</sup> |
| Norway                  | 100    | 100  | 102      | 108  | 112              | 123              |
| Russian Fed.            | 100    | 111  | 107      | 114  | 118              | 118              |
| India <sup>†</sup>      | 100    | 106  | 120      | n/a  | n/a              | n/a              |

Countries with fall in GERD during the crisis but above pre-crisis levels in 2015

|                     | CRISIS           |                 | RECOVERY         |                  |                  |                    |
|---------------------|------------------|-----------------|------------------|------------------|------------------|--------------------|
|                     | 2008             | 2009            | 2010–12*         | 2013             | 2014             | 2015               |
| Slovakia            | 100              | 97              | 153              | 188              | 206              | 286                |
| Chile               | 100              | 93              | 103              | 126              | 125              | 130 <sup>p</sup>   |
| Israel              | 100 <sup>d</sup> | 96 <sup>d</sup> | 104 <sup>d</sup> | 115 <sup>d</sup> | 122 <sup>d</sup> | 124 <sup>d</sup>   |
| Netherlands         | 100              | 99              | 111              | 116              | 121              | 124 <sup>p</sup>   |
| Austria             | 100              | 97              | 108              | 117              | 121              | 123 <sup>p</sup>   |
| Brazil <sup>†</sup> | 100              | 99              | 112              | 124              | 121              | n/a                |
| Germany             | 100              | 99              | 108              | 112              | 116              | 118 <sup>p</sup>   |
| Singapore           | 100              | 82              | 95               | 101              | 114              | n/a                |
| United Kingdom      | 100              | 99              | 100              | 103              | 108              | 112 <sup>p</sup>   |
| United States       | 100 <sup>j</sup> | 99 <sup>j</sup> | 100 <sup>j</sup> | 104 <sup>j</sup> | 107 <sup>j</sup> | 111 <sup>j,p</sup> |

GERD below crisis levels in 2015

|                      | CRISIS |      | RECOVERY |      |      |                 |
|----------------------|--------|------|----------|------|------|-----------------|
|                      | 2008   | 2009 | 2010–12* | 2013 | 2014 | 2015            |
| Cuba <sup>†</sup>    | 100    | 125  | 91       | 107  | 91   | n/a             |
| Romania              | 100    | 75   | 78       | 66   | 67   | 89              |
| Iceland              | 100    | 98   | 90       | 68   | 79   | 89              |
| Spain                | 100    | 99   | 95       | 88   | 87   | 89              |
| South Africa         | 100    | 93   | 86       | 89   | n/a  | n/a             |
| Croatia <sup>†</sup> | 100    | 88   | 76       | 81   | 78   | 86              |
| Portugal             | 100    | 106  | 97       | 85   | 83   | 83 <sup>p</sup> |
| Finland              | 100    | 97   | 97       | 88   | 84   | 77              |
| Panama <sup>†</sup>  | 100    | 70   | 80       | 45   | n/a  | n/a             |

Source: OECD MSTI, February 2017; data used: Gross domestic expenditure on R&D (GERD) at constant 2010 PPPs, base year = 2008 (index 100).

\*Average values for the 2010 through 2012 period. <sup>†</sup> Country data source is the UNESCO UIS database: UNESCO-UIS Science & Technology Data Center, update from March 2017. Data used: GERD in '000 PPPs (in constant prices, 2005).

d = defence excluded (all or mostly); j = excludes most or all capital expenditure; p = provisional data.

**Table 1.2: Business enterprise expenditure on R&D (BERD): Crisis and recovery compared**

Countries with no fall in BERD during the crisis that have expanded since

|                         | CRISIS |      | RECOVERY |      |      |                  |
|-------------------------|--------|------|----------|------|------|------------------|
|                         | 2008   | 2009 | 2010–12* | 2013 | 2014 | 2015             |
| Poland                  | 100    | 104  | 149      | 236  | 281  | 312              |
| China                   | 100    | 126  | 169      | 222  | 244  | 265              |
| Costa Rica <sup>†</sup> | 100    | 114  | 102      | 174  | 216  | n/a              |
| Turkey                  | 100    | 101  | 132      | 168  | 193  | n/a              |
| Korea, Rep.             | 100    | 105  | 135      | 162  | 172  | 173              |
| Ireland                 | 100    | 117  | 118      | 122  | 128  | n/a              |
| Mexico                  | 100    | 112  | 111      | 107  | 115  | 122 <sup>p</sup> |
| France                  | 100    | 102  | 109      | 114  | 115  | 117 <sup>p</sup> |
| Russian Fed.            | 100    | 110  | 102      | 109  | 112  | 111              |
| India <sup>†</sup>      | 100    | 102  | 118      | n/a  | n/a  | n/a              |

Countries with fall in BERD during the crisis but above pre-crisis levels in 2015

|                | CRISIS           |                 | RECOVERY         |                  |                  |                    |
|----------------|------------------|-----------------|------------------|------------------|------------------|--------------------|
|                | 2008             | 2009            | 2010–12*         | 2013             | 2014             | 2015               |
| Colombia       | 100              | 73              | 106              | 139              | 172              | 179                |
| Netherlands    | 100              | 93              | 119              | 129              | 135              | 138 <sup>p</sup>   |
| Estonia        | 100              | 98              | 199              | 150              | 118              | 131 <sup>p</sup>   |
| Israel         | 100 <sup>d</sup> | 97 <sup>d</sup> | 105 <sup>d</sup> | 116 <sup>d</sup> | 124 <sup>d</sup> | 128 <sup>d</sup>   |
| Norway         | 100              | 97              | 100              | 107              | 114              | 125 <sup>p</sup>   |
| United Kingdom | 100              | 97              | 101              | 107              | 113              | 118 <sup>p</sup>   |
| Germany        | 100              | 97              | 106              | 108              | 113              | 115                |
| United States  | 100 <sup>j</sup> | 96 <sup>j</sup> | 96 <sup>j</sup>  | 103 <sup>j</sup> | 107 <sup>j</sup> | 112 <sup>j,p</sup> |
| Chile          | 100              | 68              | 84               | 110              | 103              | 110 <sup>p</sup>   |
| Japan          | 100              | 88              | 93               | 99               | 104              | 103                |

BERD below crisis levels in 2015

|                      | CRISIS           |                 | RECOVERY        |                 |                   |                 |
|----------------------|------------------|-----------------|-----------------|-----------------|-------------------|-----------------|
|                      | 2008             | 2009            | 2010–12*        | 2013            | 2014              | 2015            |
| Australia            | 100              | 96              | 97              | 98              | n/a               | n/a             |
| Sweden               | 100              | 90              | 88              | 92              | 87                | 97 <sup>p</sup> |
| Singapore            | 100              | 70              | 81              | 84              | 97                | n/a             |
| Canada               | 100 <sup>g</sup> | 99 <sup>g</sup> | 96 <sup>g</sup> | 90 <sup>g</sup> | 88 <sup>g,p</sup> | n/a             |
| Spain                | 100              | 93              | 90              | 85              | 84                | 85              |
| Portugal             | 100              | 100             | 92              | 80              | 77                | 78 <sup>p</sup> |
| South Africa         | 100              | 84              | 69              | 70              | n/a               | n/a             |
| Finland              | 100              | 93              | 91              | 81              | 77                | 69              |
| Luxembourg           | 100              | 96              | 71              | 57              | 60                | 60              |
| Uruguay <sup>†</sup> | 100              | 115             | 51              | 32              | 16                | n/a             |

Source: OECD MSTI, February 2017; data used: Business enterprise expenditure on R&D (BERD) at constant 2010 PPPs, base year = 2008 (index 100).

\*Average values for the 2010 through 2012 period. <sup>†</sup> Country data source is the UNESCO UIS database: UNESCO-UIS Science & Technology Data Center, update from March 2017. Data used: GERD, performed by Business enterprise (in '000 PPPs, constant prices, 2005).

d = defence excluded (all or mostly); p = provisional data; g = excluding R&D in the social sciences and humanities; j = excludes most or all capital expenditure.

several traditionally strong R&D countries, including the USA, Germany, Japan, Korea, and China, business R&D growth is not rapid enough to offset the trends of zero or negative growth elsewhere (see Figure 1b and Box 1).

The use of intellectual property (IP)—a sign of continued innovation—has intensified, albeit only in selected middle- and high-income economies. The latest figures point to a 7.8% patent filing growth in 2015, much higher than it was in the previous five years, yet that growth is mainly driven by China.<sup>22</sup> Turning to the future, as governments prepare policies to sustain the current growth momentum, a focus on R&D and innovation should be a priority. Novel business practices or new technologies could be potential triggers of much-needed productivity increases and engines of future economic growth. Historically, and to the present day, governments have played an important role in building human capital and driving research—as sponsors of basic or less applied R&D, as facilitators of private R&D with tax reductions, or by exercising strong demand on innovation via government procurement or strategic initiatives.<sup>23</sup> Governments might need to boost their involvement to inspire business with the confidence to invest and innovate.<sup>24</sup>

As demonstrated by this year's GII theme, these R&D and innovation efforts are not and should not be limited to sectors conventionally considered to be high-tech. For this reason, the 2017 GII edition on the theme of 'Innovation Feeding the World' focuses on innovation in agriculture and food systems and the many scientific, technological, and other innovative advances made in this field.

### **Innovation feeding the world**

It is commonplace to equate innovation with high-technology sectors. Yet the agriculture and food sector—traditionally considered low-technology—is an important source of technological change, innovation, and development. Today, more than ever before, failure to perceive agri-food systems as a source of innovation and to analyse their innovation input, outputs, linkages, and diffusion paths accordingly would be a mistake. Agri-food systems face an unprecedented rise in global food demand while, at the same time, competition for limited natural resources is at an all-time high. Feeding the world while simultaneously protecting the environment and providing balanced nutrition to growing populations remains a complex challenge.

### **Addressing the global food challenge**

The stakes of innovation in agriculture and food are at least as high, if not higher, than in other fields. As evidenced by the GII chapters this year, progress in reducing malnutrition is still too slow:

- Global food demand in 2050 is expected to increase by at least 60% above 2006 levels.<sup>25</sup>
- Around 795 million people in the world, or about one in nine, suffer from hunger.<sup>26</sup>
- About one in four people living in Sub-Saharan Africa suffers from chronic hunger, yet the region with the largest number of undernourished people is Southern Asia (281 million).<sup>27</sup>
- One in three people in the world is malnourished in one form or another.<sup>28</sup>

The situation is not improving. Challenges such as rapidly growing food demand, stagnating farm incomes, diminishing natural resources, and climate change all aggravate the factors that contribute to issues of malnutrition worldwide. Food security is more and more affected because droughts, floods, heat waves, and other extreme weather events destroy agricultural output. Risks of natural resource depletion and degradation call for intensified efforts towards greener, more sustainable agricultural practices (see Chapters 3, 4, 5, and 9).

Estimates indicate that global agricultural productivity and innovation is not growing fast enough to meet future food demand, mostly because of the lagging total factor productivity growth—a proxy for innovation—in low-income countries (see Chapter 3).

Innovation can help avert a global food crisis if policy makers and other actors change course on a global scale (see Box 2).

### **Innovation in food and agriculture: From moldboard plow to smart, digital agriculture**

The good news is that, historically, agricultural innovation has proven not only feasible but spectacularly successful, and has triggered key structural and socioeconomic development.

Innovations in agriculture and food production have been the starting point of humanity's progress towards organized social life. One can think in particular of the moldboard plow and the cotton gin in the 18th century; refrigeration in the 1850s; pasteurization in 1863; Mendel's scientific plant breeding and the combined harvester (early 20th century); and the green revolution in the 1950s, which took millions out of hunger.<sup>29</sup>

## Box 2: Innovation, agriculture, and the UN 2030 Agenda for Sustainable Development

In September 2015, the Member States of the United Nations (UN) adopted the 2030 Agenda for Sustainable Development, incorporating 17 Sustainable Development Goals (SDGs) and 169 targets that are being implemented at the national level by the UN Member States to shape global development in the period 2015–30.

The Agenda applies to all countries universally and aims at fostering social, environmental, and economic development. All the SDGs rely to a greater or lesser extent upon innovation for their means of implementation: Goal 9 (Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation) makes explicit reference to innovation and refers to several innovation factors referenced in the GII, such as infrastructure, access to credit, access to information and communication technologies (ICTs) and environmentally friendly technologies, scientific research, and technology capabilities.

As this report shows, the achievement of Goal 2 (‘End hunger, achieve food security and improved nutrition and promote sustainable agriculture’) will greatly benefit from innovation. The goal recognizes the role of new technologies in boosting agricultural productivity and the need for public and private investments in spurring technological change in this field.

The SDGs and their associated targets provide the basis for monitoring and reviewing countries’ progress in implementing sustainable development at the global, regional, and national levels. This process of review depends on a framework of statistical indicators being developed through an international consultative process led by the UN Statistical Commission.

Disaggregated data are important for monitoring and reviewing countries’ progress in implementing the SDGs as well as for assessing strengths and weaknesses and

identifying resource needs and priorities. On the basis of the GII, numerous workshops are taking place in different countries to bring innovation actors together with the aim of improving data availability, boosting the country’s innovation performance, and designing strategic policy actions. Partnerships are ongoing between the GII publishers and many UN partner organizations—such as the International Telecommunication Union (ITU), the International Labour Organization (ILO), the United Nations Educational, Scientific and Cultural Organization (UNESCO), and the United Nations Industrial Development Organization (UNIDO)—as well as private data providers to improve the required innovation metrics.

In the process of implementing the 2030 Agenda, the GII can provide countries with a data-based tool for policy making and contribute to this shared endeavour of working towards sustainable development globally.

As a result, agricultural productivity has enjoyed periods of extraordinary growth. From the 1960s until the 1990s, the expansion of land under cultivation and higher input use—especially in the form of fertilizers and high-yield varieties—accounted for the bulk of agricultural output growth (Chapter 3). Advances in genetic engineering gave rise to a wave of technological innovations and led the transition towards commercial agriculture in many regions. The green revolution enabled developing economies to import cheaper grains and grow crops with high-yield seed varieties, with tremendous benefits for the economy and society (see Chapters 5 and 10).<sup>30</sup>

### *Stimulating investment in innovative agriculture and food production*

In the same spirit, today a new innovation drive is needed to confront declining agricultural productivity and the bottlenecks of today’s

agricultural innovation systems (see Chapters 7, 9, 10, and 11).

First and foremost, lagging agricultural productivity growth in low- and middle-income countries and lagging agricultural R&D spending (public and/or private) across all economies (Chapter 3) need to be reversed. To reach that goal, both the public and private sectors will need to keep the R&D pipeline flowing; investments to ensure that innovative technologies and techniques are brought to fruition are required.

Second, innovations need to be better diffused throughout the agricultural and food sector, in particular in developing countries. Unfortunately, waves of technological advances roll out rather slowly in many parts of the world. As a consequence, a number of developing countries, most notably in Sub-Saharan Africa, have yet to benefit from earlier waves of agricultural innovations, such as high-yield varieties and drip

irrigation systems, slowing down their structural transformation and development processes.<sup>31</sup>

Indeed, in several developing countries, productivity growth is still the result of expansions of cultivated land and more intensive use of inputs; technological change is having a much smaller impact in these countries (Chapter 3). Arable land, however, cannot be expanded further because of growing urbanization and environmental requirements (Chapter 3). Concerns in these areas are already materializing (see the cases of Russia and Uganda in Chapters 9 and 11, respectively).

### *A wave of smart agricultural innovations on the horizon*

Helping to meet this need for innovation in agricultural systems, a wave of new agricultural technologies and innovations is taking place that could help overcome lagging productivity. The pace of agricultural innovation



has increased over the last 10 years, with innovations from other sectors spilling over to agricultural and food systems (see Chapters 3, 4, 5, and 8). In the next decades, advances in biotechnology, autonomous vehicles, and a broader shift of agricultural innovation to data, services, and software could enable vital progress.

Rapid progress is underway in radically new technologies and new processes as applied to agricultural and food production. Advances in areas such as genetics and nano- and biotechnologies have proven their ability to be a source of higher yields and better nutrient content, even though their full environmental and health impacts have yet to be fully understood. Chapter 9 mentions exciting examples of new-generation sequencing, bioreactor-based synthetic food production, total recycling, bio-controlled and artificial agroecosystems, and vertical farming, to name a few such innovations (see Table 1 in Chapter 9 and also Chapters 3, 4, 5 and 8).

An unprecedented convergence of biology, agronomy, plant and animal science, digitization, and robotics is transforming the agri-food value chain. Big data are reshaping the world of agriculture: digital agriculture has started to spread worldwide, helped by the development of innovations in information technology (IT)—for example, sensors, drones and robotics, and virtual and augmented reality—as well as data generation and analytics enabled by remote sensing, and geographic information systems.

#### **Fostering innovation along the agricultural value chain, including in services and processes**

New technologies aside, the brunt of agricultural innovation is found in improved processes and services that occur along the agricultural value chain, be it in high-income

or low-income economies (see Table 1 in Chapter 10 and Figure 2 in Chapter 11), and not only in novel technologies. Activities along the agri-food value chain range from supplying inputs such as seeds, wholesalers, and retailer agro-dealers to farming activities such as planting, farming, and harvesting and to post-harvest activities such as bulking and processing of raw output, branding and marketing of value-added agri-food products. Effective linkages and improved service delivery along this chain are just as critical, if not more, than new technologies that can maximize the innovation potential in agriculture.

In the case of developing countries, there are many significant bottlenecks along the value chain. These are mostly obstacles concerned with liquidity constraints, agricultural inputs of imperfect quality, insufficient information and awareness, and a lack of post-harvest and distribution infrastructure (see Chapter 11).

For example, most developing countries suffer from important weaknesses when it comes to benefiting from inputs appropriate to their particular circumstances, such as suitable seeds and services geared towards the country's context, such as finance and distribution (see, for example, the case of Uganda in Chapter 11). The financial sector provides an example: small rural farmers often face significant barriers in accessing credits and insurance. This reduces investment while increasing households' vulnerability (see also Chapter 3).

Organizational innovations are also as important as product or process innovations. Digitization of retail and logistics, equipment-sharing, and life-long learning are examples of ways organizational innovations can increase agricultural productivity (Chapter 9). Complex organizational changes—such as changes intended

to spur the consolidation of small farms into large commercial farms—also require innovation that makes farm management more efficient, for example (see Chapter 8).

Hence a mix of technological and non-technological innovation is required in agri-food value chains. Some technologies will need to diffuse and be adapted from rich countries to developing economies, while the latter are still adopting the technologies of the previous agricultural innovation wave (genetically modified crops, drip irrigation, and so on). At the same time, developing countries increasingly need to further engage in their own domestic R&D—for example, they need to pursue domestic seed varieties and set research priorities fitting for their specific contexts, such as R&D in aquaculture (see Chapter 9).

#### **Incentivizing agricultural innovation with good institutions, stronger linkages, and out-of-the-box thinking**

Public authorities have critical roles to play in helping stimulate innovation in food and agriculture. For a start, the agricultural and food sector should be part and parcel of any national innovation strategy (see Chapter 8 for Japan's approach to creating the project Technologies for Creating Next-Generation Agriculture, Forestry and Fisheries). To this day, this is very rarely the case because innovation policies often focus on new sectors while neglecting strengths in traditional or resource-based industries.<sup>32</sup>

On this basis, the promotion of specific activities that have the power to convince local players that progress is feasible and desirable should be undertaken.

More traditionally, policy makers have a responsibility to provide funding mechanisms to stimulate innovation in agriculture and food

production. The mechanisms can be in several forms:

- For example, as seen in Brazil (see Chapter 7), policy makers can create sectoral agricultural funds to foster technologies in areas such as agronomy, veterinary medicine, biotechnology, economics, and agricultural sociology; and to promote technological updates in the agriculture industry and stimulate the expansion of investments in tropical agricultural biotechnology and in the diffusion of new technologies.
- The creation of focused research institutes (e.g., the Institute of Innovation in Biotechnology in Sao Paolo) is also a possibility (see Chapter 7 on Brazil).
- Providing tax relief to enhance farmers' incomes and offering preferential access to land and market support for promising agricultural techniques and technologies is also a good way forward.

#### *Crafting balanced legal frameworks*

Improving national legal and regulatory frameworks in and around agriculture—for example, by promoting the uptake of patents and plant varieties; promoting the use of trademarks, which can support innovation; adopting public safety laws on biodiversity and genetically modified varieties; and more generally streamlining regulations and reducing bureaucracy around farmers—all contribute to a more conducive environment (see Chapter 10).

Governments and policy makers also have the delicate task of providing a proper balance between inefficient agriculture in need of more technology, better fertilizers, and so on and advanced bio-farming, as well as

between feeding the poor with modern intensive agriculture and creating ground-breaking new crop varieties (see Chapter 8), while also looking at environmental issues and health.

Cooperation and consultation remain a key ingredients needed to get popular support for the resulting policies and to leave room for out-of-the-box thinking.

#### *Fostering skills and inspiring agricultural entrepreneurship*

One of the key obstacles to the rapid adoption of innovative approaches in agriculture and food production still is to be found in inadequate information, a lack of skills, and, sometimes, the lack of acceptance of new products or ways to produce them. Experiences from various parts of the world in this year's GII chapters indicate how priorities need to be pursued in this area.

First, agricultural extension efforts to disseminate knowledge about new technologies and techniques, and to demonstrate their business case, are required. These services include training in technology and managerial skills and in the diffusion of information such as metrological data. This would provide adequate information to farmers, ensure that key workers along the value chain have sufficient relevant skills, and encourage the adoption of new products and processes.

Second, farmers need to be empowered by providing access to digital technology and the new service platforms that have immense potential to positively impact agriculture (see Chapters 3 and 5).

Third, entrepreneurship within the agriculture sector needs to be recognized and inspired to a much more significant extent. In India, for example, venture capital has started flowing to agricultural projects through programmes such as Startup

India (see Chapter 5). A flurry of new start-ups is on the rise, on par with other high-technology sectors, and with ideas that can have an immediate impact on societal well-being.

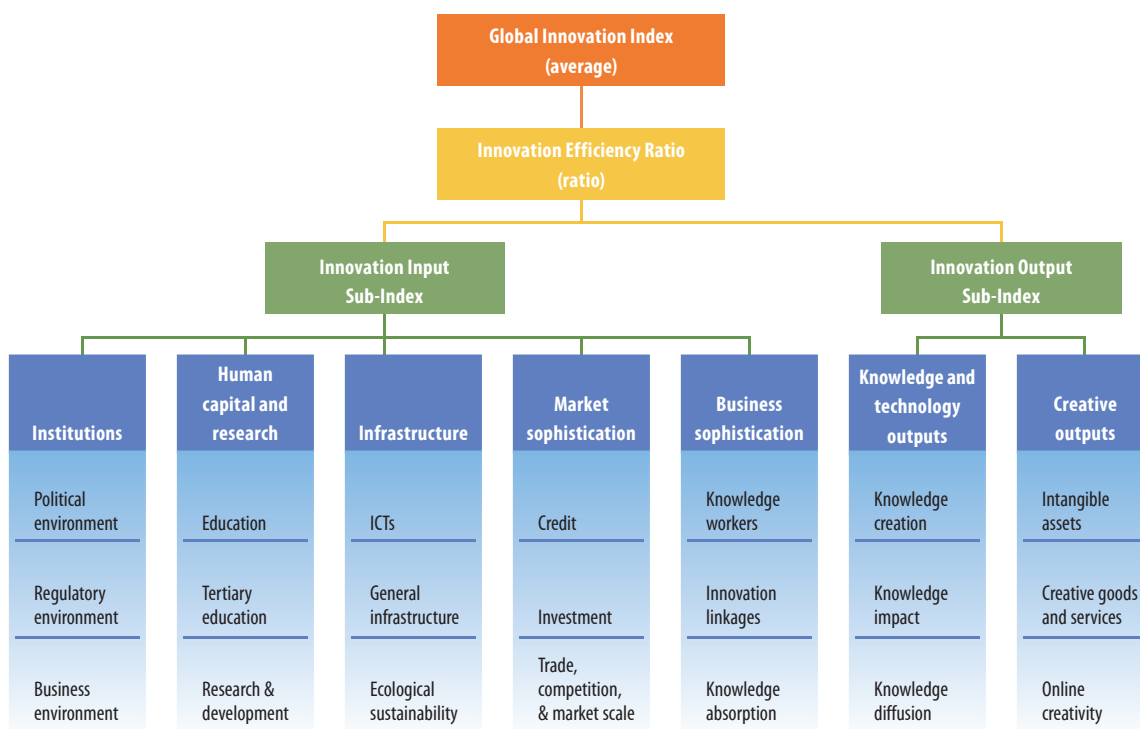
Fourth, both the private sector and government can also help infuse excellence and innovative attitudes in other vital sectors into the agriculture sector. In India, such an approach has helped enhance the impact of information technology (IT) in unlocking value for the grassroots level in areas such as mobile payments or health (see Chapter 5). Over the last five years, the Indian agriculture sector has also attracted leading IT companies and investors; available technology and digital solutions are expanding at an impressive pace.

#### *Scaling up local initiatives and ensuring technology diffusion*

Local (sub-national) initiatives are also important: grassroots innovations that can often be scaled up are happening in low- and middle-income economies' farming. In such contexts, links between public research institutions, firms, and the grassroots level are key.

Efforts to enhance the efficiency of the innovation system should focus on reducing lags between successful R&D efforts and the widespread adoption of agricultural innovations. In a number of countries (see Chapters 9, 10, and 11), several factors—including the lack of complementary investments and capacity—hamper spillovers from public research to enterprises. Accelerating technology transfers through the establishment of clear rules of engagement in university-industry interactions, including the commercialization of IP derived from these, is a good option.<sup>33</sup> Supporting the demand for innovation with farmers and commercial farming operations is equally important.

Figure 2: Framework of the Global Innovation Index 2017



**More accurately measuring agricultural innovation to simulate progress**

Agriculture today is radically different from agriculture a couple of decades ago: more digital, smarter, and more integrated. A better understanding of agricultural innovation in general, but these new forms of innovation in particular, is now crucial (Chapter 2 and Annex 4). Data are needed to better inform decision makers about gaps and opportunities in agricultural capacity, and to monitor and evaluate requirements and progress, recognizing the broader agricultural innovation system—including informal actors, households, extension services, rural advisory services and farmer organizations, and the quantitative and qualitative dimension of their interactions.<sup>34</sup> Annex 4 describes available and missing data sources,

and which countries lead and lag in agricultural innovation.

A transition towards sustainable growth is paramount if the world is to cope successfully with the global challenges it is facing today. Agriculture and food systems can play a tremendous role in this, but a concerted effort towards more granular agriculture-specific data collection is needed to understand what works and what does not, and how governments and public policies can help promote innovation in agriculture and food.

**The GII 2017 conceptual framework**

The GII helps to create an environment in which innovation factors are continually evaluated. It provides a key tool of detailed metrics for 127 economies this year, representing

92.5% of the world’s population and 97.6% of the world’s GDP (in current US dollars).

Four measures are calculated: the overall GII, the Input and Output Sub-Indices, and the Innovation Efficiency Ratio (Figure 2).

- **The overall GII score** is the simple average of the Input and Output Sub-Index scores.
- **The Innovation Input Sub-Index** is comprised of five input pillars that capture elements of the national economy that enable innovative activities: (1) Institutions, (2) Human capital and research, (3) Infrastructure, (4) Market sophistication, and (5) Business sophistication.

- **The Innovation Output Sub-Index** provides information about outputs that are the results of innovative activities within the economy. There are two output pillars: (6) Knowledge and technology outputs and (7) Creative outputs.
- **The Innovation Efficiency Ratio** is the ratio of the Output Sub-Index score over the Input Sub-Index score. It shows how much innovation output a given country is getting for its inputs.

Each pillar is divided into three sub-pillars and each sub-pillar is composed of individual indicators, for a total of 81 indicators this year.

Further details on the GII framework and the indicators used are provided in Annex 1. It is important to note that each year the variables included in the GII computation are reviewed and updated to provide the best and most current assessment of global innovation. Other methodological issues—such as missing data, revised scaling factors, and new countries added to the sample—also impact year-on-year comparability of the rankings (details of these changes to the framework and factors impacting year-on-year comparability are provided in Annex 2).

Most notably, a more stringent criterion for the inclusion of countries in the GII was adopted in 2016, following the Joint Research Centre (JRC) recommendation of past GII audits (see Annex 3 in this report and in previous years). Economies and countries were included in the GII 2017 only if 66% of data were available within each of the two sub-indices and if at least two of sub-pillars in each pillar could be computed. This more stringent criterion for inclusion in the GII ensures that country scores for the GII and for the two Input and Output Sub-Indices

are not particularly sensitive to the missing values. As noted by the audit, this more stringent threshold has notably improved the confidence in the country ranks for the GII and the two sub-indices, and thus the reliability of the GII rankings (see Annex 3). The rules on missing data and minimum coverage per sub-pillar will be progressively tightened, leading to the exclusion of countries that fail to meet the desired minimum coverage in any sub-pillar (see Annex 2 for more details).

### The Global Innovation Index 2017 results

The GII 2017 results have shown consistency in areas such as top rankings and the innovation divide. However, there also have been some new high-level developments as described below.

#### Stability at the top, led by Switzerland, Sweden, and the Netherlands

In 2017, the GII remains relatively stable at the top. Switzerland leads the rankings for the seventh consecutive year, while Sweden maintains its 2nd place. The Netherlands ranks 3rd, although most of this improvement is the result of methodological changes and improved data availability. The USA remains stable at the 4th spot, while the UK moves down two positions to take 5th place. Denmark improves another two positions this year, ranking 6th. Singapore, Finland, and Ireland move down, occupying the 7th, 8th, and 10th spots, respectively. Germany, which entered the top 10 in 2016, continues its advancement, moving up one position from last year and occupying the 9th spot. Hence, despite some movement, the top 10 does not see any new entrant this year.

Figure 3 shows movement in the top 10 ranked economies over the last four years:

1. *Switzerland*
2. *Sweden*
3. *Netherlands*
4. *United States of America*
5. *United Kingdom*
6. *Denmark*
7. *Singapore*
8. *Finland*
9. *Germany*
10. *Ireland*

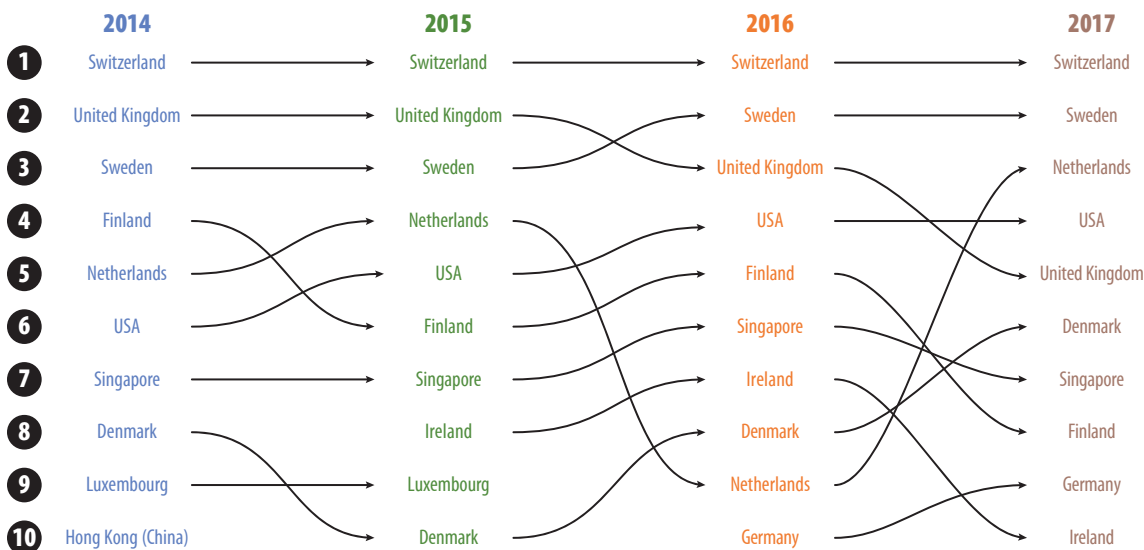
Furthermore, stability remains across the top 25 economies with only a few exceptions. China moves up by three places, becoming the 22nd most innovative economy in the world after entering the top 25 in the GII 2016. Israel gains four positions this year, ranking 17th and swapping spots with New Zealand (21st). Other economies move up by two or more places: Japan (14th), France (15th), and Norway (19th). Australia moves down four spots, ranking 23rd this year. Hong Kong (China) and Canada each lose two or more positions, ranking 16th and 18th respectively. The Czech Republic regains its place in the top 25, gaining three positions from last year and moving to 24th. Belgium leaves the top 25 this year, ranking 27th.

Box 3 discusses the measure of innovation quality among GII 2017 economies. Box 4 delves into the innovation divide between the top 25 ranked economies (24 of which are high-income) and the group of middle- and low-income economies.

### 2017 results: The world's top innovators

The following section describes and analyses the prominent features of the GII 2017 results for the global leaders in each component of the GII and the best performers in light of their income level.<sup>35</sup> A short discussion of the rankings at the regional level follows.<sup>36</sup>

Figure 3: Movement in the top 10 of the GII



Note: Year-on-year GII rank changes are influenced by performance and methodological considerations; see Annex 2.

Tables 1 through 3 on pages 14–19 present the rankings of all economies included in the GII 2017 for the GII and the Input and Output Sub-Indices.

**The top 10 in the Global Innovation Index**

**Switzerland** has earned the number 1 position in the GII for the seventh consecutive year. It has maintained this top spot since 2011, as well as its number 1 position in the Innovation Output Sub-Index and in the Knowledge and technology outputs pillar since 2012. Its lead seems largely uncontested. For the first time it ranks among the top 10 in all pillars and is the 3rd economy in the world in innovation quality (see Box 3). Thanks to its improvements in Institutions (8th), Infrastructure (6th), and Creative outputs (3rd), its Innovation Efficiency Ratio has improved from 5th to 2nd. As in previous years, it ranks among the top 25 in all sub-pillars, with only three exceptions: Business environment (33rd),

Education (28th), and Information and communication technologies (ICTs, 30th). Switzerland ranks 1st in Knowledge creation and in a number of important indicators, including patent families in 2 or more offices, PCT patent applications, and high- and medium-high-tech manufactures. With its favourable business environment and solid innovation capabilities, Switzerland remains highly successful in transforming its resources into more numerous, and more varied, innovation outputs. Despite this strong performance, Switzerland presents a few areas of weakness, especially on the input side. These include ease of starting a business, graduates in science and engineering, gross capital formation, ease of getting credit, and growth rate of GDP per worker.

**Sweden** holds the second highest position in the GII, remaining the top Nordic economy and ranking among the top 10 in all pillars with the exception of Creative outputs

(11th). It improves in the Innovation Input Sub-Index (2nd), with gains in all pillars but Market sophistication (10th). Among the largest improvements, Sweden gains 11 positions in Innovation linkages (6th), 10 positions in Knowledge impact (10th), 7 positions in ICTs (13th), and 6 positions in Knowledge absorption (7th). Its largest drops are in Tertiary education (28th), Ecological sustainability (20th), Trade, competition, and market scale (28th), and Creative goods and services (18th). At the indicator level, Sweden keeps its 1st position in PCT patent applications, while achieving a big leap in labour productivity growth. It improves the most in government’s online service, e-participation, and JV-strategic alliance deals, while benefiting from the new measure averaging FDI net in-flows (see Annex 2). Areas of weakness include pupil-teacher ratio, GDP per unit of energy use, ease of getting credit, FDI net inflows, trademarks by

Table 1: Global Innovation Index rankings

| Country/Economy          | Score (0–100) | Rank | Income | Rank | Region | Rank | Efficiency Ratio | Rank | Median: 0.62 |
|--------------------------|---------------|------|--------|------|--------|------|------------------|------|--------------|
| Switzerland              | 67.69         | 1    | HI     | 1    | EUR    | 1    | 0.95             | 2    |              |
| Sweden                   | 63.82         | 2    | HI     | 2    | EUR    | 2    | 0.83             | 12   |              |
| Netherlands              | 63.36         | 3    | HI     | 3    | EUR    | 3    | 0.93             | 4    |              |
| United States of America | 61.40         | 4    | HI     | 4    | NAC    | 1    | 0.78             | 21   |              |
| United Kingdom           | 60.89         | 5    | HI     | 5    | EUR    | 4    | 0.78             | 20   |              |
| Denmark                  | 58.70         | 6    | HI     | 6    | EUR    | 5    | 0.71             | 34   |              |
| Singapore                | 58.69         | 7    | HI     | 7    | SEAO   | 1    | 0.62             | 63   |              |
| Finland                  | 58.49         | 8    | HI     | 8    | EUR    | 6    | 0.70             | 37   |              |
| Germany                  | 58.39         | 9    | HI     | 9    | EUR    | 7    | 0.84             | 7    |              |
| Ireland                  | 58.13         | 10   | HI     | 10   | EUR    | 8    | 0.85             | 6    |              |
| Korea, Rep.              | 57.70         | 11   | HI     | 11   | SEAO   | 2    | 0.82             | 14   |              |
| Luxembourg               | 56.40         | 12   | HI     | 12   | EUR    | 9    | 0.97             | 1    |              |
| Iceland                  | 55.76         | 13   | HI     | 13   | EUR    | 10   | 0.86             | 5    |              |
| Japan                    | 54.72         | 14   | HI     | 14   | SEAO   | 3    | 0.67             | 49   |              |
| France                   | 54.18         | 15   | HI     | 15   | EUR    | 11   | 0.71             | 35   |              |
| Hong Kong (China)        | 53.88         | 16   | HI     | 16   | SEAO   | 4    | 0.61             | 73   |              |
| Israel                   | 53.88         | 17   | HI     | 17   | NAWA   | 1    | 0.77             | 23   |              |
| Canada                   | 53.65         | 18   | HI     | 18   | NAC    | 2    | 0.64             | 59   |              |
| Norway                   | 53.14         | 19   | HI     | 19   | EUR    | 12   | 0.66             | 51   |              |
| Austria                  | 53.10         | 20   | HI     | 20   | EUR    | 13   | 0.69             | 41   |              |
| New Zealand              | 52.87         | 21   | HI     | 21   | SEAO   | 5    | 0.65             | 56   |              |
| China                    | 52.54         | 22   | UM     | 1    | SEAO   | 6    | 0.94             | 3    |              |
| Australia                | 51.83         | 23   | HI     | 22   | SEAO   | 7    | 0.60             | 76   |              |
| Czech Republic           | 50.98         | 24   | HI     | 23   | EUR    | 14   | 0.83             | 13   |              |
| Estonia                  | 50.93         | 25   | HI     | 24   | EUR    | 15   | 0.79             | 19   |              |
| Malta                    | 50.60         | 26   | HI     | 25   | EUR    | 16   | 0.84             | 8    |              |
| Belgium                  | 49.85         | 27   | HI     | 26   | EUR    | 17   | 0.67             | 47   |              |
| Spain                    | 48.81         | 28   | HI     | 27   | EUR    | 18   | 0.70             | 36   |              |
| Italy                    | 46.96         | 29   | HI     | 28   | EUR    | 19   | 0.73             | 31   |              |
| Cyprus                   | 46.84         | 30   | HI     | 29   | NAWA   | 2    | 0.74             | 28   |              |
| Portugal                 | 46.05         | 31   | HI     | 30   | EUR    | 20   | 0.71             | 33   |              |
| Slovenia                 | 45.80         | 32   | HI     | 31   | EUR    | 21   | 0.68             | 44   |              |
| Latvia                   | 44.61         | 33   | HI     | 32   | EUR    | 22   | 0.74             | 26   |              |
| Slovakia                 | 43.43         | 34   | HI     | 33   | EUR    | 23   | 0.75             | 25   |              |
| United Arab Emirates     | 43.24         | 35   | HI     | 34   | NAWA   | 3    | 0.49             | 104  |              |
| Bulgaria                 | 42.84         | 36   | UM     | 2    | EUR    | 24   | 0.80             | 15   |              |
| Malaysia                 | 42.72         | 37   | UM     | 3    | SEAO   | 8    | 0.68             | 46   |              |
| Poland                   | 41.99         | 38   | HI     | 35   | EUR    | 25   | 0.67             | 48   |              |
| Hungary                  | 41.74         | 39   | HI     | 36   | EUR    | 26   | 0.73             | 30   |              |
| Lithuania                | 41.17         | 40   | HI     | 37   | EUR    | 27   | 0.59             | 84   |              |
| Croatia                  | 39.80         | 41   | HI     | 38   | EUR    | 28   | 0.66             | 52   |              |
| Romania                  | 39.16         | 42   | UM     | 4    | EUR    | 29   | 0.69             | 39   |              |
| Turkey                   | 38.90         | 43   | UM     | 5    | NAWA   | 4    | 0.84             | 9    |              |
| Greece                   | 38.85         | 44   | HI     | 39   | EUR    | 30   | 0.56             | 87   |              |
| Russian Federation       | 38.76         | 45   | UM     | 6    | EUR    | 31   | 0.61             | 75   |              |
| Chile                    | 38.70         | 46   | HI     | 40   | LCN    | 1    | 0.60             | 77   |              |
| Viet Nam                 | 38.34         | 47   | LM     | 1    | SEAO   | 9    | 0.84             | 10   |              |
| Montenegro               | 38.07         | 48   | UM     | 7    | EUR    | 32   | 0.63             | 62   |              |
| Qatar                    | 37.90         | 49   | HI     | 41   | NAWA   | 5    | 0.61             | 68   |              |
| Ukraine                  | 37.62         | 50   | LM     | 2    | EUR    | 33   | 0.83             | 11   |              |
| Thailand                 | 37.57         | 51   | UM     | 8    | SEAO   | 10   | 0.75             | 24   |              |
| Mongolia                 | 37.13         | 52   | LM     | 3    | SEAO   | 11   | 0.74             | 27   |              |
| Costa Rica               | 37.09         | 53   | UM     | 9    | LCN    | 2    | 0.69             | 43   |              |
| Moldova, Rep.            | 36.84         | 54   | LM     | 4    | EUR    | 34   | 0.78             | 22   |              |
| Saudi Arabia             | 36.17         | 55   | HI     | 42   | NAWA   | 6    | 0.53             | 96   |              |
| Kuwait                   | 36.10         | 56   | HI     | 43   | NAWA   | 7    | 0.79             | 18   |              |
| South Africa             | 35.80         | 57   | UM     | 10   | SSF    | 1    | 0.53             | 97   |              |
| Mexico                   | 35.79         | 58   | UM     | 11   | LCN    | 3    | 0.61             | 74   |              |
| Armenia                  | 35.65         | 59   | LM     | 5    | NAWA   | 8    | 0.80             | 17   |              |
| India                    | 35.47         | 60   | LM     | 6    | CSA    | 1    | 0.66             | 53   |              |
| TFYR of Macedonia        | 35.43         | 61   | UM     | 12   | EUR    | 35   | 0.59             | 80   |              |
| Serbia                   | 35.34         | 62   | UM     | 13   | EUR    | 36   | 0.61             | 67   |              |
| Panama                   | 34.98         | 63   | UM     | 14   | LCN    | 4    | 0.69             | 38   |              |
| Mauritius                | 34.82         | 64   | UM     | 15   | SSF    | 2    | 0.48             | 109  |              |

(Continued on next page)



Table 1: Global Innovation Index rankings (continued)

| Country/Economy            | Score (0–100) | Rank | Income | Rank | Region | Rank | Efficiency Ratio | Rank | Median: 0.62 |
|----------------------------|---------------|------|--------|------|--------|------|------------------|------|--------------|
| Colombia                   | 34.78         | 65   | UM     | 16   | LCN    | 5    | 0.52             | 100  |              |
| Bahrain                    | 34.67         | 66   | HI     | 44   | NAWA   | 9    | 0.56             | 88   |              |
| Uruguay                    | 34.53         | 67   | HI     | 45   | LCN    | 6    | 0.59             | 82   |              |
| Georgia                    | 34.39         | 68   | UM     | 17   | NAWA   | 10   | 0.63             | 60   |              |
| Brazil                     | 33.10         | 69   | UM     | 18   | LCN    | 7    | 0.52             | 99   |              |
| Peru                       | 32.90         | 70   | UM     | 19   | LCN    | 8    | 0.49             | 106  |              |
| Brunei Darussalam          | 32.89         | 71   | HI     | 46   | SEAO   | 12   | 0.34             | 124  |              |
| Morocco                    | 32.72         | 72   | LM     | 7    | NAWA   | 11   | 0.61             | 71   |              |
| Philippines                | 32.48         | 73   | LM     | 8    | SEAO   | 13   | 0.65             | 55   |              |
| Tunisia                    | 32.30         | 74   | LM     | 9    | NAWA   | 12   | 0.62             | 65   |              |
| Iran, Islamic Rep.         | 32.09         | 75   | UM     | 20   | CSA    | 2    | 0.80             | 16   |              |
| Argentina                  | 32.00         | 76   | UM     | 21   | LCN    | 9    | 0.55             | 94   |              |
| Oman                       | 31.83         | 77   | HI     | 47   | NAWA   | 13   | 0.46             | 115  |              |
| Kazakhstan                 | 31.50         | 78   | UM     | 22   | CSA    | 3    | 0.46             | 116  |              |
| Dominican Republic         | 31.17         | 79   | UM     | 23   | LCN    | 10   | 0.65             | 54   |              |
| Kenya                      | 30.95         | 80   | LM     | 10   | SSF    | 3    | 0.66             | 50   |              |
| Lebanon                    | 30.64         | 81   | UM     | 24   | NAWA   | 14   | 0.61             | 69   |              |
| Azerbaijan                 | 30.58         | 82   | UM     | 25   | NAWA   | 15   | 0.50             | 103  |              |
| Jordan                     | 30.52         | 83   | UM     | 26   | NAWA   | 16   | 0.65             | 57   |              |
| Jamaica                    | 30.36         | 84   | UM     | 27   | LCN    | 11   | 0.57             | 86   |              |
| Paraguay                   | 30.30         | 85   | UM     | 28   | LCN    | 12   | 0.61             | 72   |              |
| Bosnia and Herzegovina     | 30.23         | 86   | UM     | 29   | EUR    | 37   | 0.47             | 112  |              |
| Indonesia                  | 30.10         | 87   | LM     | 11   | SEAO   | 14   | 0.69             | 42   |              |
| Belarus                    | 29.98         | 88   | UM     | 30   | EUR    | 38   | 0.39             | 120  |              |
| Botswana                   | 29.97         | 89   | UM     | 31   | SSF    | 4    | 0.38             | 121  |              |
| Sri Lanka                  | 29.85         | 90   | LM     | 12   | CSA    | 4    | 0.65             | 58   |              |
| Trinidad and Tobago        | 29.75         | 91   | HI     | 48   | LCN    | 13   | 0.56             | 90   |              |
| Ecuador                    | 29.14         | 92   | UM     | 32   | LCN    | 14   | 0.62             | 66   |              |
| Albania                    | 28.86         | 93   | UM     | 33   | EUR    | 39   | 0.37             | 122  |              |
| Tajikistan                 | 28.16         | 94   | LM     | 13   | CSA    | 5    | 0.59             | 83   |              |
| Kyrgyzstan                 | 28.01         | 95   | LM     | 14   | CSA    | 6    | 0.47             | 114  |              |
| Tanzania, United Rep.      | 27.97         | 96   | LI     | 1    | SSF    | 5    | 0.73             | 29   |              |
| Namibia                    | 27.94         | 97   | UM     | 34   | SSF    | 6    | 0.48             | 108  |              |
| Guatemala                  | 27.90         | 98   | LM     | 15   | LCN    | 15   | 0.56             | 91   |              |
| Rwanda                     | 27.36         | 99   | LI     | 2    | SSF    | 7    | 0.33             | 125  |              |
| Senegal                    | 27.11         | 100  | LI     | 3    | SSF    | 8    | 0.54             | 95   |              |
| Cambodia                   | 27.05         | 101  | LM     | 16   | SEAO   | 15   | 0.63             | 61   |              |
| Uganda                     | 26.97         | 102  | LI     | 4    | SSF    | 9    | 0.47             | 113  |              |
| El Salvador                | 26.68         | 103  | LM     | 17   | LCN    | 16   | 0.48             | 107  |              |
| Honduras                   | 26.36         | 104  | LM     | 18   | LCN    | 17   | 0.52             | 101  |              |
| Egypt                      | 26.00         | 105  | LM     | 19   | NAWA   | 17   | 0.59             | 81   |              |
| Bolivia, Plurinational St. | 25.64         | 106  | LM     | 20   | LCN    | 18   | 0.57             | 85   |              |
| Mozambique                 | 24.55         | 107  | LI     | 5    | SSF    | 10   | 0.61             | 70   |              |
| Algeria                    | 24.34         | 108  | UM     | 35   | NAWA   | 18   | 0.47             | 111  |              |
| Nepal                      | 24.20         | 109  | LI     | 6    | CSA    | 7    | 0.49             | 105  |              |
| Ethiopia                   | 24.16         | 110  | LI     | 7    | SSF    | 11   | 0.72             | 32   |              |
| Madagascar                 | 24.15         | 111  | LI     | 8    | SSF    | 12   | 0.68             | 45   |              |
| Côte d'Ivoire              | 23.96         | 112  | LM     | 21   | SSF    | 13   | 0.69             | 40   |              |
| Pakistan                   | 23.80         | 113  | LM     | 22   | CSA    | 8    | 0.62             | 64   |              |
| Bangladesh                 | 23.72         | 114  | LM     | 23   | CSA    | 9    | 0.55             | 93   |              |
| Malawi                     | 23.45         | 115  | LI     | 9    | SSF    | 14   | 0.53             | 98   |              |
| Benin                      | 23.04         | 116  | LI     | 10   | SSF    | 15   | 0.47             | 110  |              |
| Cameroon                   | 22.58         | 117  | LM     | 24   | SSF    | 16   | 0.56             | 92   |              |
| Mali                       | 22.48         | 118  | LI     | 11   | SSF    | 17   | 0.60             | 78   |              |
| Nigeria                    | 21.92         | 119  | LM     | 25   | SSF    | 18   | 0.52             | 102  |              |
| Burkina Faso               | 21.86         | 120  | LI     | 12   | SSF    | 19   | 0.24             | 127  |              |
| Zimbabwe                   | 21.80         | 121  | LI     | 13   | SSF    | 20   | 0.56             | 89   |              |
| Burundi                    | 21.31         | 122  | LI     | 14   | SSF    | 21   | 0.41             | 117  |              |
| Niger                      | 21.18         | 123  | LI     | 15   | SSF    | 22   | 0.36             | 123  |              |
| Zambia                     | 20.83         | 124  | LM     | 26   | SSF    | 23   | 0.59             | 79   |              |
| Togo                       | 18.41         | 125  | LI     | 16   | SSF    | 24   | 0.28             | 126  |              |
| Guinea                     | 17.41         | 126  | LI     | 17   | SSF    | 25   | 0.40             | 118  |              |
| Yemen                      | 15.64         | 127  | LM     | 27   | NAWA   | 19   | 0.40             | 119  |              |

Note: World Bank Income Group Classification (July 2016): LI = low income; LM = lower-middle income; UM = upper-middle income; and HI = high income. Regions are based on the United Nations Classification: EUR = Europe; NAC = Northern America; LCN = Latin America and the Caribbean; CSA = Central and Southern Asia; SEAO = South East Asia, East Asia, and Oceania; NAWA = Northern Africa and Western Asia; SSF = Sub-Saharan Africa.

Table 2: Innovation Input Sub-Index rankings

| Country/Economy          | Score (0–100) | Rank | Income | Rank | Region | Rank | Median: 43.15 |
|--------------------------|---------------|------|--------|------|--------|------|---------------|
| Singapore                | 72.25         | 1    | HI     | 1    | SEAO   | 1    |               |
| Sweden                   | 69.72         | 2    | HI     | 2    | EUR    | 1    |               |
| Switzerland              | 69.60         | 3    | HI     | 3    | EUR    | 2    |               |
| Finland                  | 68.93         | 4    | HI     | 4    | EUR    | 3    |               |
| United States of America | 68.87         | 5    | HI     | 5    | NAC    | 1    |               |
| Denmark                  | 68.68         | 6    | HI     | 6    | EUR    | 4    |               |
| United Kingdom           | 68.25         | 7    | HI     | 7    | EUR    | 5    |               |
| Hong Kong (China)        | 66.95         | 8    | HI     | 8    | SEAO   | 2    |               |
| Netherlands              | 65.79         | 9    | HI     | 9    | EUR    | 6    |               |
| Canada                   | 65.57         | 10   | HI     | 10   | NAC    | 2    |               |
| Japan                    | 65.45         | 11   | HI     | 11   | SEAO   | 3    |               |
| Australia                | 64.61         | 12   | HI     | 12   | SEAO   | 4    |               |
| New Zealand              | 64.14         | 13   | HI     | 13   | SEAO   | 5    |               |
| Norway                   | 63.99         | 14   | HI     | 14   | EUR    | 7    |               |
| France                   | 63.41         | 15   | HI     | 15   | EUR    | 8    |               |
| Korea, Rep.              | 63.34         | 16   | HI     | 16   | SEAO   | 6    |               |
| Germany                  | 63.33         | 17   | HI     | 17   | EUR    | 9    |               |
| Austria                  | 62.92         | 18   | HI     | 18   | EUR    | 10   |               |
| Ireland                  | 62.86         | 19   | HI     | 19   | EUR    | 11   |               |
| Israel                   | 61.01         | 20   | HI     | 20   | NAWA   | 1    |               |
| Iceland                  | 60.10         | 21   | HI     | 21   | EUR    | 12   |               |
| Belgium                  | 59.53         | 22   | HI     | 22   | EUR    | 13   |               |
| United Arab Emirates     | 57.96         | 23   | HI     | 23   | NAWA   | 2    |               |
| Luxembourg               | 57.36         | 24   | HI     | 24   | EUR    | 14   |               |
| Spain                    | 57.28         | 25   | HI     | 25   | EUR    | 15   |               |
| Estonia                  | 56.99         | 26   | HI     | 26   | EUR    | 16   |               |
| Czech Republic           | 55.72         | 27   | HI     | 27   | EUR    | 17   |               |
| Malta                    | 54.91         | 28   | HI     | 28   | EUR    | 18   |               |
| Italy                    | 54.43         | 29   | HI     | 29   | EUR    | 19   |               |
| Slovenia                 | 54.40         | 30   | HI     | 30   | EUR    | 20   |               |
| China                    | 54.22         | 31   | UM     | 1    | SEAO   | 7    |               |
| Cyprus                   | 53.92         | 32   | HI     | 31   | NAWA   | 3    |               |
| Portugal                 | 53.80         | 33   | HI     | 32   | EUR    | 21   |               |
| Lithuania                | 51.92         | 34   | HI     | 33   | EUR    | 22   |               |
| Latvia                   | 51.25         | 35   | HI     | 34   | EUR    | 23   |               |
| Malaysia                 | 50.94         | 36   | UM     | 2    | SEAO   | 8    |               |
| Poland                   | 50.20         | 37   | HI     | 35   | EUR    | 24   |               |
| Greece                   | 49.73         | 38   | HI     | 36   | EUR    | 25   |               |
| Slovakia                 | 49.66         | 39   | HI     | 37   | EUR    | 26   |               |
| Brunei Darussalam        | 49.27         | 40   | HI     | 38   | SEAO   | 9    |               |
| Hungary                  | 48.36         | 41   | HI     | 39   | EUR    | 27   |               |
| Chile                    | 48.31         | 42   | HI     | 40   | LCN    | 1    |               |
| Russian Federation       | 48.21         | 43   | UM     | 3    | EUR    | 28   |               |
| Croatia                  | 47.96         | 44   | HI     | 41   | EUR    | 29   |               |
| Bulgaria                 | 47.61         | 45   | UM     | 4    | EUR    | 30   |               |
| Saudi Arabia             | 47.33         | 46   | HI     | 42   | NAWA   | 4    |               |
| Mauritius                | 47.13         | 47   | UM     | 5    | SSF    | 1    |               |
| Qatar                    | 46.96         | 48   | HI     | 43   | NAWA   | 5    |               |
| South Africa             | 46.85         | 49   | UM     | 6    | SSF    | 2    |               |
| Montenegro               | 46.83         | 50   | UM     | 7    | EUR    | 31   |               |
| Romania                  | 46.36         | 51   | UM     | 8    | EUR    | 32   |               |
| Colombia                 | 45.75         | 52   | UM     | 9    | LCN    | 2    |               |
| TFYR of Macedonia        | 44.53         | 53   | UM     | 10   | EUR    | 33   |               |
| Mexico                   | 44.52         | 54   | UM     | 11   | LCN    | 3    |               |
| Bahrain                  | 44.41         | 55   | HI     | 44   | NAWA   | 6    |               |
| Peru                     | 44.21         | 56   | UM     | 12   | LCN    | 4    |               |
| Costa Rica               | 43.97         | 57   | UM     | 13   | LCN    | 5    |               |
| Serbia                   | 43.79         | 58   | UM     | 14   | EUR    | 34   |               |
| Botswana                 | 43.58         | 59   | UM     | 15   | SSF    | 3    |               |
| Brazil                   | 43.47         | 60   | UM     | 16   | LCN    | 6    |               |
| Uruguay                  | 43.47         | 61   | HI     | 45   | LCN    | 7    |               |
| Oman                     | 43.46         | 62   | HI     | 46   | NAWA   | 7    |               |
| Belarus                  | 43.24         | 63   | UM     | 17   | EUR    | 35   |               |
| Kazakhstan               | 43.15         | 64   | UM     | 18   | CSA    | 1    |               |

(Continued on next page)



Table 2: Innovation Input Sub-Index rankings (continued)

| Country/Economy            | Score (0–100) | Rank | Income | Rank | Region | Rank | Median: 43.15 |
|----------------------------|---------------|------|--------|------|--------|------|---------------|
| Thailand                   | 42.92         | 65   | UM     | 19   | SEAO   | 10   |               |
| India                      | 42.84         | 66   | LM     | 1    | CSA    | 2    |               |
| Mongolia                   | 42.71         | 67   | LM     | 2    | SEAO   | 11   |               |
| Turkey                     | 42.32         | 68   | UM     | 20   | NAWA   | 8    |               |
| Georgia                    | 42.16         | 69   | UM     | 21   | NAWA   | 9    |               |
| Albania                    | 42.03         | 70   | UM     | 22   | EUR    | 36   |               |
| Viet Nam                   | 41.75         | 71   | LM     | 3    | SEAO   | 12   |               |
| Argentina                  | 41.38         | 72   | UM     | 23   | LCN    | 8    |               |
| Moldova, Rep.              | 41.35         | 73   | LM     | 4    | EUR    | 37   |               |
| Panama                     | 41.28         | 74   | UM     | 24   | LCN    | 9    |               |
| Bosnia and Herzegovina     | 41.14         | 75   | UM     | 25   | EUR    | 38   |               |
| Rwanda                     | 41.07         | 76   | LI     | 1    | SSF    | 4    |               |
| Ukraine                    | 41.05         | 77   | LM     | 5    | EUR    | 39   |               |
| Azerbaijan                 | 40.70         | 78   | UM     | 26   | NAWA   | 10   |               |
| Morocco                    | 40.59         | 79   | LM     | 6    | NAWA   | 11   |               |
| Kuwait                     | 40.30         | 80   | HI     | 47   | NAWA   | 12   |               |
| Tunisia                    | 39.99         | 81   | LM     | 7    | NAWA   | 13   |               |
| Armenia                    | 39.71         | 82   | LM     | 8    | NAWA   | 14   |               |
| Philippines                | 39.40         | 83   | LM     | 9    | SEAO   | 13   |               |
| Jamaica                    | 38.69         | 84   | UM     | 27   | LCN    | 10   |               |
| Trinidad and Tobago        | 38.22         | 85   | HI     | 48   | LCN    | 11   |               |
| Kyrgyzstan                 | 38.16         | 86   | LM     | 10   | CSA    | 3    |               |
| Lebanon                    | 37.99         | 87   | UM     | 28   | NAWA   | 15   |               |
| Dominican Republic         | 37.80         | 88   | UM     | 29   | LCN    | 12   |               |
| Namibia                    | 37.76         | 89   | UM     | 30   | SSF    | 5    |               |
| Paraguay                   | 37.62         | 90   | UM     | 31   | LCN    | 13   |               |
| Kenya                      | 37.19         | 91   | LM     | 11   | SSF    | 6    |               |
| Jordan                     | 37.07         | 92   | UM     | 32   | NAWA   | 16   |               |
| Uganda                     | 36.71         | 93   | LI     | 2    | SSF    | 7    |               |
| Sri Lanka                  | 36.28         | 94   | LM     | 12   | CSA    | 4    |               |
| Ecuador                    | 36.07         | 95   | UM     | 33   | LCN    | 14   |               |
| El Salvador                | 36.06         | 96   | LM     | 13   | LCN    | 15   |               |
| Guatemala                  | 35.86         | 97   | LM     | 14   | LCN    | 16   |               |
| Iran, Islamic Rep.         | 35.71         | 98   | UM     | 34   | CSA    | 5    |               |
| Indonesia                  | 35.68         | 99   | LM     | 15   | SEAO   | 14   |               |
| Tajikistan                 | 35.50         | 100  | LM     | 16   | CSA    | 6    |               |
| Burkina Faso               | 35.28         | 101  | LI     | 3    | SSF    | 8    |               |
| Senegal                    | 35.23         | 102  | LI     | 4    | SSF    | 9    |               |
| Honduras                   | 34.77         | 103  | LM     | 17   | LCN    | 17   |               |
| Cambodia                   | 33.19         | 104  | LM     | 18   | SEAO   | 15   |               |
| Algeria                    | 33.12         | 105  | UM     | 35   | NAWA   | 17   |               |
| Egypt                      | 32.69         | 106  | LM     | 19   | NAWA   | 18   |               |
| Bolivia, Plurinational St. | 32.62         | 107  | LM     | 20   | LCN    | 18   |               |
| Nepal                      | 32.51         | 108  | LI     | 5    | CSA    | 7    |               |
| Tanzania, United Rep.      | 32.31         | 109  | LI     | 6    | SSF    | 10   |               |
| Benin                      | 31.30         | 110  | LI     | 7    | SSF    | 11   |               |
| Niger                      | 31.18         | 111  | LI     | 8    | SSF    | 12   |               |
| Malawi                     | 30.75         | 112  | LI     | 9    | SSF    | 13   |               |
| Bangladesh                 | 30.64         | 113  | LM     | 21   | CSA    | 8    |               |
| Mozambique                 | 30.45         | 114  | LI     | 10   | SSF    | 14   |               |
| Burundi                    | 30.21         | 115  | LI     | 11   | SSF    | 15   |               |
| Pakistan                   | 29.43         | 116  | LM     | 22   | CSA    | 9    |               |
| Cameroon                   | 29.03         | 117  | LM     | 23   | SSF    | 16   |               |
| Nigeria                    | 28.94         | 118  | LM     | 24   | SSF    | 17   |               |
| Togo                       | 28.81         | 119  | LI     | 12   | SSF    | 18   |               |
| Madagascar                 | 28.78         | 120  | LI     | 13   | SSF    | 19   |               |
| Côte d'Ivoire              | 28.39         | 121  | LM     | 25   | SSF    | 20   |               |
| Ethiopia                   | 28.16         | 122  | LI     | 14   | SSF    | 21   |               |
| Mali                       | 28.14         | 123  | LI     | 15   | SSF    | 22   |               |
| Zimbabwe                   | 27.98         | 124  | LI     | 16   | SSF    | 23   |               |
| Zambia                     | 26.14         | 125  | LM     | 26   | SSF    | 24   |               |
| Guinea                     | 24.86         | 126  | LI     | 17   | SSF    | 25   |               |
| Yemen                      | 22.38         | 127  | LM     | 27   | NAWA   | 19   |               |

Note: World Bank Income Group Classification (July 2016): LI = low income; LM = lower-middle income; UM = upper-middle income; and HI = high income. Regions are based on the United Nations Classification: EUR = Europe; NAC = Northern America; LCN = Latin America and the Caribbean; CSA = Central and Southern Asia; SEAO = South East Asia, East Asia, and Oceania; NAWA = Northern Africa and Western Asia; SSF = Sub-Saharan Africa.

Table 3: Innovation Output Sub-Index rankings

| Country/Economy          | Score (0–100) | Rank | Income | Rank | Region | Rank | Median: 25.60 |
|--------------------------|---------------|------|--------|------|--------|------|---------------|
| Switzerland              | 65.78         | 1    | HI     | 1    | EUR    | 1    |               |
| Netherlands              | 60.92         | 2    | HI     | 2    | EUR    | 2    |               |
| Sweden                   | 57.92         | 3    | HI     | 3    | EUR    | 3    |               |
| Luxembourg               | 55.43         | 4    | HI     | 4    | EUR    | 4    |               |
| United States of America | 53.93         | 5    | HI     | 5    | NAC    | 1    |               |
| United Kingdom           | 53.52         | 6    | HI     | 6    | EUR    | 5    |               |
| Germany                  | 53.46         | 7    | HI     | 7    | EUR    | 6    |               |
| Ireland                  | 53.41         | 8    | HI     | 8    | EUR    | 7    |               |
| Korea, Rep.              | 52.06         | 9    | HI     | 9    | SEAO   | 1    |               |
| Iceland                  | 51.42         | 10   | HI     | 10   | EUR    | 8    |               |
| China                    | 50.87         | 11   | UM     | 1    | SEAO   | 2    |               |
| Denmark                  | 48.71         | 12   | HI     | 11   | EUR    | 9    |               |
| Finland                  | 48.06         | 13   | HI     | 12   | EUR    | 10   |               |
| Israel                   | 46.75         | 14   | HI     | 13   | NAWA   | 1    |               |
| Malta                    | 46.29         | 15   | HI     | 14   | EUR    | 11   |               |
| Czech Republic           | 46.24         | 16   | HI     | 15   | EUR    | 12   |               |
| Singapore                | 45.14         | 17   | HI     | 16   | SEAO   | 3    |               |
| France                   | 44.94         | 18   | HI     | 17   | EUR    | 13   |               |
| Estonia                  | 44.87         | 19   | HI     | 18   | EUR    | 14   |               |
| Japan                    | 43.99         | 20   | HI     | 19   | SEAO   | 4    |               |
| Austria                  | 43.27         | 21   | HI     | 20   | EUR    | 15   |               |
| Norway                   | 42.29         | 22   | HI     | 21   | EUR    | 16   |               |
| Canada                   | 41.73         | 23   | HI     | 22   | NAC    | 2    |               |
| New Zealand              | 41.59         | 24   | HI     | 23   | SEAO   | 5    |               |
| Hong Kong (China)        | 40.81         | 25   | HI     | 24   | SEAO   | 6    |               |
| Spain                    | 40.34         | 26   | HI     | 25   | EUR    | 17   |               |
| Belgium                  | 40.17         | 27   | HI     | 26   | EUR    | 18   |               |
| Cyprus                   | 39.75         | 28   | HI     | 27   | NAWA   | 2    |               |
| Italy                    | 39.50         | 29   | HI     | 28   | EUR    | 19   |               |
| Australia                | 39.06         | 30   | HI     | 29   | SEAO   | 7    |               |
| Portugal                 | 38.30         | 31   | HI     | 30   | EUR    | 20   |               |
| Bulgaria                 | 38.08         | 32   | UM     | 2    | EUR    | 21   |               |
| Latvia                   | 37.97         | 33   | HI     | 31   | EUR    | 22   |               |
| Slovenia                 | 37.21         | 34   | HI     | 32   | EUR    | 23   |               |
| Slovakia                 | 37.20         | 35   | HI     | 33   | EUR    | 24   |               |
| Turkey                   | 35.48         | 36   | UM     | 3    | NAWA   | 3    |               |
| Hungary                  | 35.13         | 37   | HI     | 34   | EUR    | 25   |               |
| Viet Nam                 | 34.92         | 38   | LM     | 1    | SEAO   | 8    |               |
| Malaysia                 | 34.49         | 39   | UM     | 4    | SEAO   | 9    |               |
| Ukraine                  | 34.19         | 40   | LM     | 2    | EUR    | 26   |               |
| Poland                   | 33.78         | 41   | HI     | 35   | EUR    | 27   |               |
| Moldova, Rep.            | 32.33         | 42   | LM     | 3    | EUR    | 28   |               |
| Thailand                 | 32.22         | 43   | UM     | 5    | SEAO   | 10   |               |
| Romania                  | 31.95         | 44   | UM     | 6    | EUR    | 29   |               |
| Kuwait                   | 31.91         | 45   | HI     | 36   | NAWA   | 4    |               |
| Croatia                  | 31.63         | 46   | HI     | 37   | EUR    | 30   |               |
| Armenia                  | 31.60         | 47   | LM     | 4    | NAWA   | 5    |               |
| Mongolia                 | 31.55         | 48   | LM     | 5    | SEAO   | 11   |               |
| Lithuania                | 30.42         | 49   | HI     | 38   | EUR    | 31   |               |
| Costa Rica               | 30.20         | 50   | UM     | 7    | LCN    | 1    |               |
| Russian Federation       | 29.31         | 51   | UM     | 8    | EUR    | 32   |               |
| Montenegro               | 29.30         | 52   | UM     | 9    | EUR    | 33   |               |
| Chile                    | 29.09         | 53   | HI     | 39   | LCN    | 2    |               |
| Qatar                    | 28.84         | 54   | HI     | 40   | NAWA   | 6    |               |
| Panama                   | 28.67         | 55   | UM     | 10   | LCN    | 3    |               |
| United Arab Emirates     | 28.52         | 56   | HI     | 41   | NAWA   | 7    |               |
| Iran, Islamic Rep.       | 28.47         | 57   | UM     | 11   | CSA    | 1    |               |
| India                    | 28.11         | 58   | LM     | 6    | CSA    | 2    |               |
| Greece                   | 27.96         | 59   | HI     | 42   | EUR    | 34   |               |
| Mexico                   | 27.07         | 60   | UM     | 12   | LCN    | 4    |               |
| Serbia                   | 26.90         | 61   | UM     | 13   | EUR    | 35   |               |
| Georgia                  | 26.61         | 62   | UM     | 14   | NAWA   | 8    |               |
| TFYR of Macedonia        | 26.32         | 63   | UM     | 15   | EUR    | 36   |               |
| Uruguay                  | 25.60         | 64   | HI     | 43   | LCN    | 5    |               |

(Continued on next page)

Table 3: Innovation Output Sub-Index rankings (continued)

| Country/Economy            | Score (0–100) | Rank | Income | Rank | Region | Rank | Median: 25.60 |
|----------------------------|---------------|------|--------|------|--------|------|---------------|
| Philippines                | 25.57         | 65   | LM     | 7    | SEAO   | 12   |               |
| Saudi Arabia               | 25.00         | 66   | HI     | 44   | NAWA   | 9    |               |
| Bahrain                    | 24.92         | 67   | HI     | 45   | NAWA   | 10   |               |
| Morocco                    | 24.85         | 68   | LM     | 8    | NAWA   | 11   |               |
| South Africa               | 24.74         | 69   | UM     | 16   | SSF    | 1    |               |
| Kenya                      | 24.71         | 70   | LM     | 9    | SSF    | 2    |               |
| Tunisia                    | 24.62         | 71   | LM     | 10   | NAWA   | 12   |               |
| Dominican Republic         | 24.54         | 72   | UM     | 17   | LCN    | 6    |               |
| Indonesia                  | 24.52         | 73   | LM     | 11   | SEAO   | 13   |               |
| Jordan                     | 23.96         | 74   | UM     | 18   | NAWA   | 13   |               |
| Colombia                   | 23.82         | 75   | UM     | 19   | LCN    | 7    |               |
| Tanzania, United Rep.      | 23.63         | 76   | LI     | 1    | SSF    | 3    |               |
| Sri Lanka                  | 23.42         | 77   | LM     | 12   | CSA    | 3    |               |
| Lebanon                    | 23.28         | 78   | UM     | 20   | NAWA   | 14   |               |
| Paraguay                   | 22.99         | 79   | UM     | 21   | LCN    | 8    |               |
| Brazil                     | 22.72         | 80   | UM     | 22   | LCN    | 9    |               |
| Argentina                  | 22.62         | 81   | UM     | 23   | LCN    | 10   |               |
| Mauritius                  | 22.51         | 82   | UM     | 24   | SSF    | 4    |               |
| Ecuador                    | 22.20         | 83   | UM     | 25   | LCN    | 11   |               |
| Jamaica                    | 22.03         | 84   | UM     | 26   | LCN    | 12   |               |
| Peru                       | 21.60         | 85   | UM     | 27   | LCN    | 13   |               |
| Trinidad and Tobago        | 21.27         | 86   | HI     | 46   | LCN    | 14   |               |
| Cambodia                   | 20.91         | 87   | LM     | 13   | SEAO   | 14   |               |
| Tajikistan                 | 20.81         | 88   | LM     | 14   | CSA    | 4    |               |
| Azerbaijan                 | 20.46         | 89   | UM     | 28   | NAWA   | 15   |               |
| Oman                       | 20.19         | 90   | HI     | 47   | NAWA   | 16   |               |
| Ethiopia                   | 20.16         | 91   | LI     | 2    | SSF    | 5    |               |
| Guatemala                  | 19.93         | 92   | LM     | 15   | LCN    | 15   |               |
| Kazakhstan                 | 19.85         | 93   | UM     | 29   | CSA    | 5    |               |
| Côte d'Ivoire              | 19.53         | 94   | LM     | 16   | SSF    | 6    |               |
| Madagascar                 | 19.53         | 95   | LI     | 3    | SSF    | 7    |               |
| Bosnia and Herzegovina     | 19.32         | 96   | UM     | 30   | EUR    | 37   |               |
| Egypt                      | 19.31         | 97   | LM     | 17   | NAWA   | 17   |               |
| Senegal                    | 18.98         | 98   | LI     | 4    | SSF    | 8    |               |
| Bolivia, Plurinational St. | 18.66         | 99   | LM     | 18   | LCN    | 16   |               |
| Mozambique                 | 18.64         | 100  | LI     | 5    | SSF    | 9    |               |
| Pakistan                   | 18.16         | 101  | LM     | 19   | CSA    | 6    |               |
| Namibia                    | 18.11         | 102  | UM     | 31   | SSF    | 10   |               |
| Honduras                   | 17.96         | 103  | LM     | 20   | LCN    | 17   |               |
| Kyrgyzstan                 | 17.86         | 104  | LM     | 21   | CSA    | 7    |               |
| El Salvador                | 17.31         | 105  | LM     | 22   | LCN    | 18   |               |
| Uganda                     | 17.23         | 106  | LI     | 6    | SSF    | 11   |               |
| Mali                       | 16.82         | 107  | LI     | 7    | SSF    | 12   |               |
| Bangladesh                 | 16.80         | 108  | LM     | 23   | CSA    | 8    |               |
| Belarus                    | 16.72         | 109  | UM     | 32   | EUR    | 38   |               |
| Brunei Darussalam          | 16.51         | 110  | HI     | 48   | SEAO   | 15   |               |
| Botswana                   | 16.36         | 111  | UM     | 33   | SSF    | 13   |               |
| Malawi                     | 16.15         | 112  | LI     | 8    | SSF    | 14   |               |
| Cameroon                   | 16.12         | 113  | LM     | 24   | SSF    | 15   |               |
| Nepal                      | 15.90         | 114  | LI     | 9    | CSA    | 9    |               |
| Albania                    | 15.69         | 115  | UM     | 34   | EUR    | 39   |               |
| Zimbabwe                   | 15.61         | 116  | LI     | 10   | SSF    | 16   |               |
| Algeria                    | 15.56         | 117  | UM     | 35   | NAWA   | 18   |               |
| Zambia                     | 15.52         | 118  | LM     | 25   | SSF    | 17   |               |
| Nigeria                    | 14.90         | 119  | LM     | 26   | SSF    | 18   |               |
| Benin                      | 14.78         | 120  | LI     | 11   | SSF    | 19   |               |
| Rwanda                     | 13.66         | 121  | LI     | 12   | SSF    | 20   |               |
| Burundi                    | 12.40         | 122  | LI     | 13   | SSF    | 21   |               |
| Niger                      | 11.18         | 123  | LI     | 14   | SSF    | 22   |               |
| Guinea                     | 9.97          | 124  | LI     | 15   | SSF    | 23   |               |
| Yemen                      | 8.90          | 125  | LM     | 27   | NAWA   | 19   |               |
| Burkina Faso               | 8.45          | 126  | LI     | 16   | SSF    | 24   |               |
| Togo                       | 8.02          | 127  | LI     | 17   | SSF    | 25   |               |

Note: World Bank Income Group Classification (July 2016): LI = low income; LM = lower-middle income; UM = upper-middle income; and HI = high income. Regions are based on the United Nations Classification: EUR = Europe; NAC = Northern America; LCN = Latin America and the Caribbean; CSA = Central and Southern Asia; SEAO = South East Asia, East Asia, and Oceania; NAWA = Northern Africa and Western Asia; SSF = Sub-Saharan Africa.

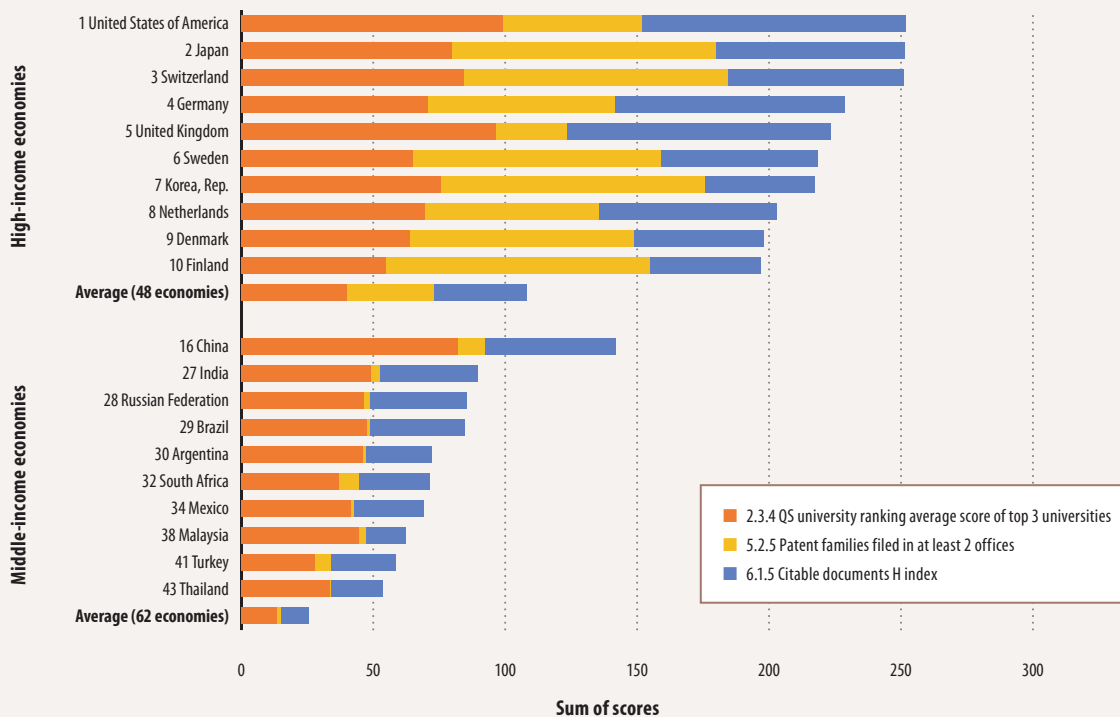
### Box 3: Innovation quality: The USA, Japan, the UK, China, and India at the top of their income groups

Measuring the quality of innovation-related input and output indicators is as essential as tracking their magnitude. To this end, three additional indicators were introduced into the GII in 2013: (1) quality of local universities (indicator 2.3.4, QS university ranking

average score of top 3 universities); (2) internationalization of local inventions (indicator 5.2.5, patent families filed in three offices, changed to patent families filed in two offices in the GII 2016); and (3) the number of citations that local research documents

receive abroad (indicator 6.1.5, citable documents H index). Figure 3.1 shows how the scores on these three indicators add up, and captures the top 10 highest performing high- and middle-income economies.

Figure 3.1: Metrics for quality of innovation: Top 10 high- and top 10 middle-income economies



Source: GII 2017 data.

Notes: Numbers to the left of the economy name are the innovation quality rank. Economies are classified by income according to the World Bank Income Group Classification (July 2016). Upper- and lower-middle income categories are grouped together as middle-income economies.

(Continued on next page)

origin, and printing and publishing manufactures.

**The Netherlands** reaches the 3rd position this year, ranking 2nd in the Innovation Output Sub-Index and 4th in the Innovation Efficiency Ratio. Indeed, the Netherlands had lost five positions last year as a result of large fluctuations in selected data

points (see page 26 in the GII 2016), which are now better accounted for.<sup>37</sup> As a result, this year the Netherlands ranks 6th in FDI net inflows and 1st in outflows. As discussed in more detail in Box 4, newly available data positively affect two pillars of the Netherlands—Business sophistication (1st) and Knowledge

and technology outputs (2nd). The Netherlands has improved its rankings in a number of other areas as well, including Education (18th), Innovation linkages (7th), and Knowledge impact (17th), in part because of gains in GERD financed by abroad and expenditure in education. Areas of weakness include

### Box 3: Innovation quality: The USA, Japan, the UK, China, and India at the top of their income groups (continued)

#### Top 10 high-income economies: The USA, Japan, Switzerland, and Germany in the lead

Among the high-income group, five economies—the United States of America (USA), Japan, Switzerland, Germany, and the United Kingdom (UK)—have remained among the top five in innovation quality since the inception of this metric. This year the USA moves to the 1st position, taking the place of Japan. The USA achieves this ranking as a result of continuous top scores in particular quality indicators and an improvement in its score in patent families. The USA takes the top position in citable papers, sharing this spot with the UK for the fifth consecutive year. In 2017 the USA also remains the world leader in the quality of its universities, outranking the UK for the second consecutive year. Also contributing to the USA's improvement, Japan shows a reduction in the scores for both university rankings and citable documents this year.

This year, for the first time, Switzerland ranks 3rd in the quality of innovation metric. Although showing a slightly weaker performance than last year in the quality of universities and a constant one in citable documents, the country enjoys a top score in patent families, helping it to achieve an overall quality score above those of both the UK and Germany. These two countries, on the other hand, show stable scores in citable documents this year, but a reduction in those for patent families and university rankings, respectively.

Sweden improves its rankings, moving up two positions to replace the Republic of Korea (Korea) at the 6th position. Although

Korea keeps the top spot in patent families, a reduction in its scores for university rankings, combined with a significant improvement in patent families for Sweden, can explain this switch. The Netherlands (8th, up by two) scores better in patent families, compensating for a fall in university rankings. Denmark and Finland enter the top 10 this year, replacing France and Canada. While the latter two show high scores in both university rankings and citable papers, improved scores for patents filed from both Denmark and Finland is the main reason for this change.

#### Top 10 middle-income economies: China and India lead; the Russian Federation and Argentina re-join the group

A large gap remains between high-income and middle-income economies. Without China, the difference in average scores between these two groups in both the university rankings (1.13) and citable documents (0.64) is expanding, while in patents filed the distance is narrowing (0.14).

China moves up one spot to 16th position in innovation quality, retaining for the fifth consecutive year its position as the top middle-income economy and getting closer to high-income economies. This movement can be attributed to higher scores in university rankings (4th) and citable documents (14th). Although other middle-income economies still depend greatly on their university rankings to move ahead in the quality of innovation, China—and to some extent South Africa—display a balance between the three components of the quality index.

India is 2nd in innovation quality for the second consecutive year. India's positive performance is the result of maintaining its 2nd position in both university rankings and citable documents among middle-income economies. The country shows a small reduction in the score of patent families, which, however, does not affect its quality of innovation ranking.

With slight reductions in all three indicators, the Russian Federation moves to the 3rd position among the upper-middle-income economies and 28th overall, positioned between India and Brazil. Brazil's performance also shows slight reductions in scores for all three indicators, resulting in a ranking of 29th among middle-income economies.

Argentina, 5th among middle-income economies and 30th overall, shows reduced scores in university rankings and patent families and a marginal improvement in citable documents, yet its overall score puts it ahead of South Africa (6th among middle-income and 32nd overall) and Mexico (7th and 34th).

The inclusion of the Russian Federation and Argentina in the middle-income group led to the downward movement of Mexico, Malaysia, Turkey, and Thailand—economies that have been in the middle-income top 10 since the innovation quality metric was introduced. In addition, this inclusion also moved Colombia and Ukraine out of this list, although the performance of these economies has diverged greatly from that of previous years.

Tertiary education (49th), General infrastructure (30th), Ecological sustainability (39th), Credit (35th), and Investment (26th).

**The United States of America (USA)** maintains its 4th position this year. The USA keeps its top ranking in pillar 4—Market sophistication—and ranks among the top 25 in all

other pillars. It improves its position in Human capital and research (13th), Business sophistication (8th), and Creative outputs (10th), while losing eight positions in Infrastructure (21st) and three in Knowledge and technology outputs (7th). At the sub-pillar level, the USA ranks in the top 25 with just four exceptions: Education (41st),

Tertiary education (54th), Ecological sustainability (61st), and Intangible assets (38th). In the latter, the country improves by seven positions this year, a welcome improvement as this is the only output sub-pillar where the USA does not rank in the top 25. The USA holds the top rank in many indicators, including QS university ranking,

#### Box 4: The global innovation divide

The top 25 GII ranks are occupied by a stable set of high-income countries that consistently lead in innovation. One major change took place last year: China, as the only middle-income economy included in this group of innovation leaders, took up the 25th position in 2016. China remains in this top group and keeps moving ahead (22nd this year). China's innovation ranking in 2017 reflects scores in Business sophistication and Knowledge and technology outputs that are above the average of the rest of the 11–25 group. In particular, top scores in some indicators—domestic market scale, firms offering formal training, patents by origin, utility models by origin, high-tech exports less re-exports, industrial designs by origin, and creative goods exports—are all factors contributing to this improved ranking. Over the past two years, in both absolute and relative terms in relation to other countries, China has shown the strongest improvement in patent applications by origin, university rankings, citable documents H index, utility model applications by origin, gross expenditure on R&D, and PCT international applications by origin. In addition, China this year displays a strong performance in three indicators introduced in the GII 2016: global R&D companies, domestic market scale, and research talent in business enterprise.

Stability is a feature among the top 10 economies this year, with Switzerland at number 1 for the seventh consecutive year. Although some variations in rankings are noticed, such as the Netherlands regaining 3rd place (thanks in part to methodological reasons explained in the country description on page 20), no economy moves in or out of this group in 2017. The Netherlands' noteworthy upward movement relies mostly on its consistently high performance in areas such as Business sophistication, Creative outputs, and Knowledge and technology outputs. Within Knowledge diffusion, available data for intellectual property receipts and ICT services exports rank the Netherlands in the top 10. FDI net outflows is also a strength and partly responsible for this improvement in

ranking. In addition, top marks for intellectual property payments, ICT services imports, and country-code TLDs help explain this rise.

Some changes occur this year in the composition of the top 25 group. For one, Belgium drops out of the top 25 this year while the Czech Republic moves back by relying on a better performance in high- and medium-high-tech manufactures, as well as improved scores for domestic credit to private sector and FDI net outflows.

The distance between the top 25 and the groups that follow is still apparent. Figure 4.1 shows the average scores for six groups: (1) the top 10, composed of all high-income economies; (2) ranks 11 through 25, which are also all high-income economies with the sole exception of upper-middle-income China; (3) other high-income economies; (4) upper-middle-income economies; (5) lower-middle-income economies; and (6) low-income economies.

#### The difference between the top 10 innovation leaders and others in the top 25

Overall, the top 10 perform better than the 11–25 group in all pillars. The gap between these two groups is larger this year in both of the output-side pillars of the index. This contrast shows also that variations in performance are narrower in two of the input-side pillars, Institutions and Market sophistication. In contrast, these gaps have expanded in Human capital and research, Infrastructure, and Business sophistication.

A number of high-income economies in the 11–25 range—Hong Kong (China) (16th), Canada (18th), Norway (19th), and New Zealand (21st)—perform above the top 10 average in various pillars (i.e., Institutions, Infrastructure, and Market sophistication). This year, for the first time, China displays a score higher than the top 10 average in Knowledge and technology outputs. Furthermore, China shows that the gaps are narrower between the top 10 average scores and its scores in Institutions, Human capital and research, Infrastructure, and Creative

outputs. Conversely, this distance is larger this year in both Market and Business sophistication. This change is in addition to China scoring higher in Business sophistication and Knowledge and technology outputs than its peers in the 11–25 group.

#### Middle-income economies: China, the only middle-income economy among the top 25 group; Bulgaria and Malaysia still at great distance

Aside from China, which has been among the top 25 since 2016, this year Bulgaria and Malaysia are the two middle-income economies nearest to that group, with Malaysia slipping back to 37th and Bulgaria overtaking it. Bulgaria (36th) is now the closest upper-middle-income economy to the top 25. In particular, Bulgaria performs better this year in Information and communication technologies (ICTs) with an improved performance in government's online service and e-participation as well as in variables in other pillars, including research talent in business enterprise and growth rate of PPP\$ GDP per worker. Malaysia, on the other hand, maintains strengths in graduates in science and engineering, high-tech imports and exports, and creative goods exports, among other indicators. Both of these economies continue to operate close to those high-income economies outside of the top 10, which is especially evident in Business sophistication, Knowledge and technology outputs, and Creative outputs.

With the exception of these two countries, the gap between the group of 11–25 ranked economies (as well as high-income economies) and the upper-middle-income group remains wide, especially in Institutions, Human capital and technology, and Infrastructure; the gap is less wide in Creative outputs. With respect to last year, partially influenced by methodological considerations, the divide between these groups increases in Institutions and, to a lesser extent, in Market sophistication. Yet the gap seems to be lessening in Infrastructure and Human capital and research.

*(Continued on next page)*

**Box 4: The global innovation divide (continued)**

Only a few upper-middle-income economies—Romania (42nd), Turkey (43rd), the Russian Federation (45th), Viet Nam (47th), Montenegro (48th), and Ukraine (50th)—are among the top 50 this year.

**Low-income economies moving closer to middle-income ones**

Continuing with the trend identified in earlier editions, the group of low-income economies keeps closing the gap that separates them from the middle-income group. However, this gap remains significant in Infrastructure, Market sophistication, Creative outputs, and Knowledge and technology outputs. This year there is no difference between these groups in the Institutions and Business

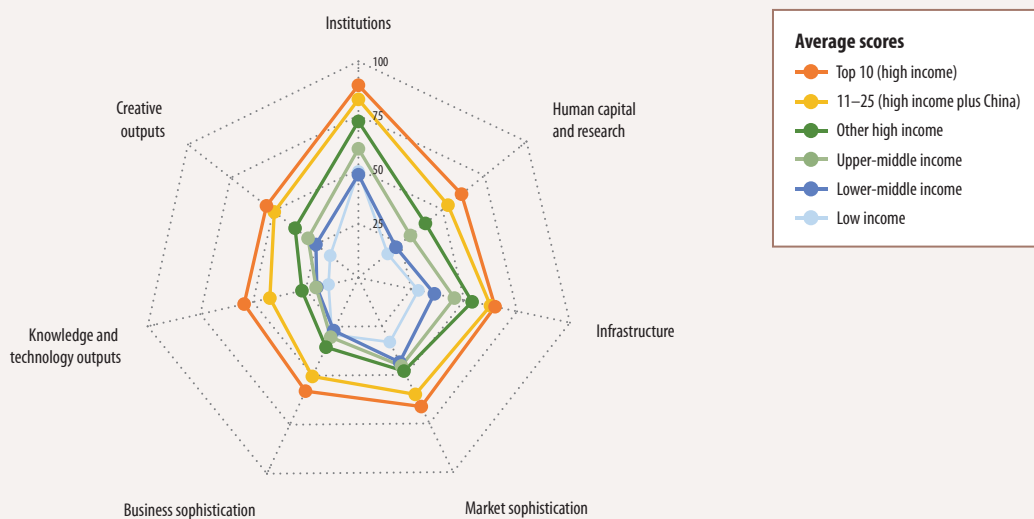
sophistication pillars, areas in which this group also continues to perform above the average of the lower-middle-income group. This suggests that efforts to strengthen institutions and enable the necessary factors to promote stronger business environments continue to expand among these countries.

**The persistence of regional innovation divides: Regional scores**

The regional rankings based on the GII scores shows that the Northern America region—consisting of the USA and Canada—is still at the top (57.5; 2 economies), followed by Europe (47.1; 39 economies) and South East Asia, East Asia, and Oceania (44.0; 15 economies). Northern Africa and Western Asia (34.3;

19 economies) and Latin America and the Caribbean (31.7; 18 economies) have similar scores while the difference in average scores between Central and Southern Asia (28.5; 9 economies) and Sub-Saharan Africa (24.8; 25 economies) is expanding. When contrasted with the 2016 results, these averages show Latin America and the Caribbean to be the region with the widest average improvement, followed by Central and Southern Asia, Northern Africa and Western Asia, and Europe. Conversely, Sub-Saharan Africa shows the largest average score reduction, followed by South East Asia, East Asia, and Oceania and Northern America.

**Figure 4.1: Innovation divide: China rising among the top 25**



Source: GII 2017 data.  
 Note: Countries/economies are classified according to the World Bank Income Group Classification (July 2016).

venture capital deals, citable documents, computer software spending, and IP receipts; it also gains the 1st position in global R&D companies, state of cluster development (see also the Special Section on Clusters, which shows that the USA has largest number of clusters in the world), ICTs and organizational model creation, and cultural and creative services exports. This year the country also ranks 1st in the quality of innovation aggregate, overtaking Japan (see Box 3).

**The United Kingdom (UK)** moves to 5th place this year. The UK improves its position in a number of input pillars, namely Institutions (9th), Human capital and research (6th), and Business sophistication (13th).<sup>38</sup> At the sub-pillar levels, the UK's largest gains are in Political environment (18th), Education (22nd), and Knowledge absorption (28th). The country loses ground in both output pillars—Knowledge and technology outputs (13th) goes down by four, with the largest drop in Knowledge diffusion (38th); and Creative outputs (4th) by one. At the indicator level, expenditure on education, government expenditure by pupil, IP payments, ICT services imports and exports, growth rate of GDP per worker, and national feature films see some of the largest improvements. By contrast, items such as PISA results, ICT use, and patent families lose most positions (see also Box 3). The UK maintains its 1st spot in citable documents, and gains the 1st rank in government's online services, e-participation, and ICT and business model creation.

**Denmark** ranks 6th in this year's GII, improving in both the Innovation Input and Output Sub-Indices, where it ranks respectively 6th and 12th. Denmark has the most notable forward shift in the top 10 (progressing continuously, from 10th overall in the GII 2015 and 8th in

2016). The country improves in all pillars except for Market sophistication, where it retains the 6th spot, and Knowledge and technology outputs (16th), where it loses two positions. At the sub-pillar level, Denmark improves the most in Education (4th), ICTs (14th), Ecological sustainability (11th), Innovation linkages (17th), Knowledge diffusion (17th), and Intangible assets (25th). Denmark ranks in the top 3 in a number of indicators, including expenditures on education, researchers, ICT use, and scientific and technical articles. It also improves its position in many areas such as government expenditure per pupil, PISA scales, GDP per unit of energy use, university/industry research collaboration, JV-strategic alliance deals, ICT services exports, and ICTs and organizational model creation. Opportunities for further improvement still exist, notably in Tertiary education (19th), General infrastructure (44th), Trade, competition, and market scale (37th), and Knowledge impact (34th). Relatively weak indicators include graduates in science and engineering, gross capital formation, utility models by origin, growth rate of GDP per worker, and trademarks by origin.

**Singapore** still holds the top rank in the South East Asia, East Asia, and Oceania region while dropping by one position (see Box 6). It keeps its top spot in the Innovation Input Sub-Index and gains three positions in the Innovation Output Sub-Index (17th). Singapore ranks in the top 5 in all input pillars and 1st in Institutions. In terms of innovation outputs, Singapore loses one position in Knowledge and technology outputs (11th) while gaining one in Creative outputs (32nd). At the sub-pillar level, Singapore holds its 1st spot in Political environment, Regulatory environment, and Tertiary education, and gains the top rank in

Investment. It improves substantially also in Education and Creative goods and services, moving up by nine positions in both sub-pillars. Despite these improvements, Singapore shows a relatively weak position in Education, where it ranks 76th. In this sub-pillar, Singapore is weak in all indicators except PISA results. Room for improvement also exists in growth rate of GDP per worker, ICT services exports, and trademarks and industrial designs by origin. Apart from these areas of opportunity, Singapore maintains its 1st place in FDI net outflows, while losing it in high- and medium-high-tech manufactures, high-tech exports, market capitalization, and FDI net inflows. Singapore ranks 1st also in other eight indicators: government effectiveness, regulatory quality, cost of redundancy dismissal, PISA scales, tertiary inbound mobility, ease of protecting minority investors, applied tariff rate, and IP payments.

**Finland** moves down to the 8th position this year from 5th in 2016. Finland keeps its 4th place in the Input Sub-Index, but loses three positions in the Output Sub-Index (13th). It maintains its 1st rank in Human capital and research, while improving in Infrastructure (8th). In all other pillars, however, Finland loses between one and four positions. At the sub-pillar level, 12 out of 21 sub-pillars move down. The largest drops are in Creative goods and services (40th), Political environment (8th), and Knowledge diffusion (14th). The largest gains are in ICTs (9th) and Knowledge impact (32nd). Finland also loses positions in a number of indicators, including venture capital deals, GERD performed by business, IP receipts and payments, ICTs and business model creation, ICTs and organizational model creation, cultural and creative services exports, and national feature films.



Indeed, as this list shows, Finland's downward movement this year is the result of a drop in a variety of indicators. Apart from Human capital and research and the sub-pillar Business environment, Finland ranks 1st in several indicators: rule of law, ease of resolving insolvency, environmental performance, and patent families.

**Germany** continues its climb up the GII rankings, gaining a position from last year when it entered the top 10 for the first time. Germany is 1st in logistics performance and patents by origin. It is 2nd in global R&D companies expenditures, down from 1st place in 2016, and 3rd in state of cluster development and citable documents—the same as last year. On the pillar level, Germany safeguards all its respectable positions while improving in Infrastructure (20th). It ranks in the top 25 economies across all pillars, and in the top 10 economies for output pillars. Areas of opportunity include Education (29th), Ecological sustainability (36th), Credit (28th), Investment (41st), and Creative goods and services (28th). At the indicator level, Germany improves in government expenditure by pupil (up by 5 spots), tertiary enrolment (up by 11), government's online service (up by 13), market capitalization (up by 6), FDI net inflows (up by 19), and ICTs and business model creation (up by 6). Germany has opportunity for improvement in ease of starting a business, gross capital formation, females employed with advanced degrees, IP payments, growth rate of GDP per worker, and new businesses.

**Ireland** is ranked 10th this year, down three positions from last year. Ireland ranks in the top 25 across all pillars, but loses positions in Market sophistication (25th), Business sophistication (10th), Knowledge and technology outputs (5th), and Creative outputs (13th). At the sub-pillar level, Ireland places in the top 2 in two

important sub-pillars: Knowledge impact (2nd) and Knowledge diffusion (1st). Opportunities lie in General infrastructure (34th), Credit (40th), Investment (29th), Knowledge creation (38th), and Creative goods and services (33rd). Ireland shows weakness in a number of particular indicators, including domestic credit to private sector, market capitalization, intensity of local competition, industrial designs by origin, and cultural and creative services exports. Ireland holds the top position in IP payments, ICT services exports, and FDI net outflows, and shows a better ranking than in 2016 in a number of important indicators, including PISA results, researchers, global R&D companies, gross capital formation, and GDP per unit of energy use.

#### The top 10 in the Innovation Input Sub-Index

The Innovation Input Sub-Index considers the elements of an economy that enable innovative activity across five pillars. The top 10 economies in the Innovation Input Sub-Index are Singapore, Sweden, Switzerland, Finland, the USA, Denmark, the UK, Hong Kong (China), the Netherlands, and Canada. Hong Kong (China) and Canada are the only economies in this group that are not also in the GII top 10. The Netherlands entered the top 10 in 2017, while Japan, ranked 9th on the input side last year, exited the top 10 this year.

**Hong Kong (China)** drops from 2nd to 8th in the Innovation Input Sub-Index this year and ranks 16th overall, down from 14th in 2016. It retains its good positions in Institutions (3rd) and Market sophistication (2nd), but falls in three out of five input pillars, with the largest drop in Human capital and research (28th). In 9 of the 15 input sub-pillars, Hong Kong (China) ranks in the top 10, holding top spots in Regulatory

environment (2nd), Business environment (2nd), Ecological sustainability (1st), Credit (3rd), and Knowledge absorption (3rd). Hong Kong (China), however, drops significantly in Education (73rd), which is a weak sub-pillar this year, and R&D (33rd). This is partly the result of a new missing value (school life expectancy) and a drop in global R&D companies (43rd). Other weak indicators include GERD financed by abroad, IP payments, and ICT services imports and exports. Despite these downward movements, Hong Kong (China) preserves its top spot in JV-strategic alliance deals, high-tech imports, and FDI net inflows and improves its rank in PISA results, patents by origin, and utility models by origin.

**Canada** remains in the 10th position in the Innovation Input Sub-Index, while ranking 18th overall, down three positions from 2016. Canada's strengths on the input side are a result of having top 25 rankings in six of the seven pillars. Canada shows particular strengths in Institutions (7th) and Market sophistication (3rd), while improving in Human capital and research (20th). This year, however, Canada loses seven positions in Infrastructure (18th) and four in Business sophistication (24th). In Infrastructure, it loses positions in all sub-pillars—in particular in Ecological sustainability, where it loses 19 positions in ISO 14001 environmental certificates (73rd). In Business sophistication, Canada drops most in innovation linkages, driven by a decline in ranking in university/industry research collaboration. Top 10 sub-pillar rankings for Canada this year are Political environment (6th, a strength), Regulatory environment (10th), Business environment (7th), General infrastructure (7th), Credit (8th), and Investment (2nd, also a strength). Canada improves in

Education in 2017, in part because of stronger rankings in expenditure on education, government expenditure by pupil, and PISA results.

### The top 10 in the Innovation Output Sub-Index

The Innovation Output Sub-Index variables provide information on elements that are the result of innovation within an economy. Although scores on the Input and Output Sub-Indices might differ substantially, leading to important shifts in rankings from one sub-index to the other for particular countries, the data confirm that efforts made to improve enabling environments are rewarded with better innovation outputs. The top 10 economies in the Innovation Output Sub-Index this year are Switzerland, the Netherlands, Sweden, Luxembourg, the USA, the UK, Germany, Ireland, Korea, and Iceland.

The 10 economies leading the Innovation Output Sub-Index remain broadly consistent with their rankings in 2016, with several shifts and one substitution: three economies move upward within the top 10 (the Netherlands, the USA, and Germany), while five economies move downward (Sweden, Luxembourg, the UK, Ireland, and Iceland). Korea enters the top 10 on the Output side, while Finland exits the top 10 in 2017. Seven of these economies are ranked in the GII top 10; the profiles of the other three economies are discussed below.

**Luxembourg** ranks 4th in the Innovation Output Sub-Index in 2017 and 12th in the overall GII. On the output side, Luxembourg loses four positions in Knowledge and technology outputs (15th), while gaining 1st place in Creative outputs. In this pillar, it maintains its strengths in cultural and creative services exports, national feature films, and generic top-level domains (TLDs) and improves in

industrial designs by origin and ICT and organizational model creation. Luxembourg also keeps the top position in the Innovation Efficiency Ratio rankings.

**The Republic of Korea (Korea)** attains the 9th position in the Innovation Output Sub-Index this year, up by two positions. Korea gains six positions in Creative outputs, ranking 15th this year. It improves in Creative goods and services (35th) and maintains the top spot in industrial designs by origin. Although the country drops one spot in Knowledge and technology outputs (6th), it improves in one of its areas of greatest strength—Knowledge creation (2nd)—where it maintains its top rankings in patents by origin and PCT patent applications and advances to the top spot in utility models by origin. Korea also improves its rank in Human capital and research (2nd), where it holds its 1st place in R&D. Although its gross R&D expenditure goes down by one position, Korea manages to retain its 2nd and 3rd positions in GERD performed by business and GERD financed by business, respectively. The country's areas of relative weakness include ICT services exports and printing and publishing manufactures on the side of outputs; and tertiary inbound mobility, GDP per unit of energy use, knowledge-intensive employment, and FDI inflows on the inputs side.

**Iceland** ranks 10th in the Innovation Output-Sub Index in 2017. This year, Iceland gains four positions in Knowledge and technology outputs (18th) and reaches 2nd place in Creative outputs. Iceland maintains the top spot in Creative goods and services and Online creativity, ranking 1st in three of the indicators across these sub-pillars: national feature films, printing and publishing manufactures, and generic top-level domains (TLDs). Iceland

advances its ranking in Knowledge creation (13th) and Knowledge diffusion (21st), ranking 1st in scientific and technical articles and improving in PCT patent applications, growth rate of GDP per worker, ISO 9001 quality certificates, IP receipts, ICT services exports, and FDI net outflows.

### Top performers by income group

Viewing economies among their income-group peers can illustrate important relative competitive advantages and help decision makers glean important lessons for improved performance that are applicable on the ground. The GII also assesses results relative to the development stages of countries.

Table 4 shows the 10 best-ranked economies in each index by income group. Switzerland, Sweden, and the Netherlands are among the high-income top 10 on the three main indices, and the top 3 in the Innovation Output Sub-Index. Compared to last year, Hungary and Estonia leave the group, making space for the Czech Republic and Korea.

Among the 10 highest-ranked upper-middle-income economies, nine remain from 2016 (see also Box 4): China (22nd this year), Bulgaria (36th), Malaysia (37th), Romania (42nd), Turkey (43rd), Montenegro (48th), Thailand (51st), Costa Rica (53rd), and South Africa (57th). The newcomer to this group of the 10 best upper-middle-income performers is the Russian Federation (45th), which displaces Mauritius (64th). China, Malaysia, Bulgaria, and Romania are among the 10 best-ranked upper-middle-income economies across all three main indices and in the Innovation Efficiency Ratio.

The same analysis for lower-middle-income countries shows that eight of the top 10 countries

Table 4: Ten best-ranked economies by income group (rank)

|  | Global Innovation Index           | Innovation Input Sub-Index         | Innovation Output Sub-Index       | Innovation Efficiency Ratio       |
|--|-----------------------------------|------------------------------------|-----------------------------------|-----------------------------------|
| <b>High-income economies (48 in total)</b>         |                                   |                                    |                                   |                                   |
| 1  | <b>Switzerland (1)</b>            | Singapore (1)                      | <b>Switzerland (1)</b>            | Luxembourg (1)                    |
| 2  | <b>Sweden (2)</b>                 | <b>Sweden (2)</b>                  | <b>Netherlands (2)</b>            | <b>Switzerland (2)</b>            |
| 3  | <b>Netherlands (3)</b>            | <b>Switzerland (3)</b>             | <b>Sweden (3)</b>                 | <b>Netherlands (4)</b>            |
| 4  | United States of America (4)      | Finland (4)                        | Luxembourg (4)                    | Iceland (5)                       |
| 5  | United Kingdom (5)                | United States of America (5)       | United States of America (5)      | Ireland (6)                       |
| 6  | Denmark (6)                       | Denmark (6)                        | United Kingdom (6)                | Germany (7)                       |
| 7  | Singapore (7)                     | United Kingdom (7)                 | Germany (7)                       | Malta (8)                         |
| 8  | Finland (8)                       | Hong Kong (China) (8)              | Ireland (8)                       | <b>Sweden (12)</b>                |
| 9  | Germany (9)                       | <b>Netherlands (9)</b>             | Korea, Rep. (9)                   | Czech Republic (13)               |
| 10   | Ireland (10)                      | Canada (10)                        | Iceland (10)                      | Korea, Rep. (14)                  |
| <b>Upper-middle-income economies (35 in total)</b> |                                   |                                    |                                   |                                   |
| 1  | <b>China (22)</b>                 | <b>China (31)</b>                  | <b>China (11)</b>                 | <b>China (3)</b>                  |
| 2  | <b>Bulgaria (36)</b>              | <b>Malaysia (36)</b>               | <b>Bulgaria (32)</b>              | Turkey (9)                        |
| 3  | <b>Malaysia (37)</b>              | Russian Federation (43)            | Turkey (36)                       | <b>Bulgaria (15)</b>              |
| 4  | <b>Romania (42)</b>               | <b>Bulgaria (45)</b>               | <b>Malaysia (39)</b>              | Iran, Islamic Rep. (16)           |
| 5  | Turkey (43)                       | Mauritius (47)                     | Thailand (43)                     | Thailand (24)                     |
| 6  | Russian Federation (45)           | South Africa (49)                  | <b>Romania (44)</b>               | Panama (38)                       |
| 7  | Montenegro (48)                   | Montenegro (50)                    | Costa Rica (50)                   | <b>Romania (39)</b>               |
| 8  | Thailand (51)                     | <b>Romania (51)</b>                | Russian Federation (51)           | Costa Rica (43)                   |
| 9  | Costa Rica (53)                   | Colombia (52)                      | Montenegro (52)                   | <b>Malaysia (46)</b>              |
| 10   | South Africa (57)                 | TFYR of Macedonia (53)             | Panama (55)                       | Dominican Republic (54)           |
| <b>Lower-middle-income economies (27 in total)</b> |                                   |                                    |                                   |                                   |
| 1  | <b>Viet Nam (47)</b>              | <b>India (66)</b>                  | <b>Viet Nam (38)</b>              | <b>Viet Nam (10)</b>              |
| 2  | <b>Ukraine (50)</b>               | <b>Mongolia (67)</b>               | <b>Ukraine (40)</b>               | <b>Ukraine (11)</b>               |
| 3  | <b>Mongolia (52)</b>              | <b>Viet Nam (71)</b>               | <b>Moldova, Rep. (42)</b>         | <b>Armenia (17)</b>               |
| 4  | <b>Moldova, Rep. (54)</b>         | <b>Moldova, Rep. (73)</b>          | <b>Armenia (47)</b>               | <b>Moldova, Rep. (22)</b>         |
| 5  | <b>Armenia (59)</b>               | <b>Ukraine (77)</b>                | <b>Mongolia (48)</b>              | <b>Mongolia (27)</b>              |
| 6  | <b>India (60)</b>                 | Morocco (79)                       | <b>India (58)</b>                 | Côte d'Ivoire (40)                |
| 7  | Morocco (72)                      | Tunisia (81)                       | <b>Philippines (65)</b>           | Indonesia (42)                    |
| 8  | <b>Philippines (73)</b>           | <b>Armenia (82)</b>                | Morocco (68)                      | Kenya (50)                        |
| 9  | Tunisia (74)                      | <b>Philippines (83)</b>            | Kenya (70)                        | <b>India (53)</b>                 |
| 10   | Kenya (80)                        | Kyrgyzstan (86)                    | Tunisia (71)                      | <b>Philippines (55)</b>           |
| <b>Low-income economies (17 in total)</b>          |                                   |                                    |                                   |                                   |
| 1  | <b>Tanzania, United Rep. (96)</b> | Rwanda (76)                        | <b>Tanzania, United Rep. (76)</b> | <b>Tanzania, United Rep. (29)</b> |
| 2  | Rwanda (99)                       | Uganda (93)                        | Ethiopia (91)                     | Ethiopia (32)                     |
| 3  | <b>Senegal (100)</b>              | Burkina Faso (101)                 | Madagascar (95)                   | Madagascar (45)                   |
| 4  | Uganda (102)                      | <b>Senegal (102)</b>               | <b>Senegal (98)</b>               | <b>Mozambique (70)</b>            |
| 5  | <b>Mozambique (107)</b>           | <b>Nepal (108)</b>                 | <b>Mozambique (100)</b>           | Mali (78)                         |
| 6  | <b>Nepal (109)</b>                | <b>Tanzania, United Rep. (109)</b> | Uganda (106)                      | Zimbabwe (89)                     |
| 7  | Ethiopia (110)                    | Benin (110)                        | Mali (107)                        | <b>Senegal (95)</b>               |
| 8  | Madagascar (111)                  | Niger (111)                        | <b>Malawi (112)</b>               | <b>Malawi (98)</b>                |
| 9  | <b>Malawi (115)</b>               | <b>Malawi (112)</b>                | <b>Nepal (114)</b>                | <b>Nepal (105)</b>                |
| 10   | Benin (116)                       | <b>Mozambique (114)</b>            | Zimbabwe (116)                    | Benin (110)                       |

Note: Economies with top 10 positions in the GI, the Input Sub-Index, the Output Sub-Index and the Innovation Efficiency Ratio within their income group are highlighted in bold.

from 2016 remain in the top 10 this year. These include Viet Nam (47th), Ukraine (50th), the Republic of Moldova (54th), Armenia (59th), India (60th), Morocco (72nd), the Philippines (73rd), and Kenya (80th). New this year to the top 10 lower-middle-income countries are Mongolia (52nd) and Tunisia (74th), which displace Georgia (68th) and Tajikistan (94th). Seven of the top 10 lower-middle-income countries have rankings in the top 10 for each of the three indices and the Innovation Efficiency Ratio, with the exceptions of Morocco, Tunisia, and Kenya.

There has also been a strong consistency among low-income countries, with eight out of 10 economies remaining in the top 10. The United Republic of Tanzania is the top-ranked low-income country (96th), having moved up nine spots in the overall GII since 2016, and with improvements in the Innovation Input (109th) and Output (76th) Sub-Indices (see Box 5). Following in the ranking of low-income countries are Rwanda (99th), Senegal (100th), which displaces the now-lower-middle-income economy Cambodia (101st), Uganda (102nd), Mozambique (107th), Nepal (109th), Ethiopia (110th), Madagascar (111th), Malawi (115th), and Benin (116th), which displaces Mali (118th). Ranking well across all main indices of the GII, the United Republic of Tanzania, Senegal, Mozambique, Nepal, and Malawi are among the top 10 low-income countries. All economies in the low-income top 10, except Rwanda and Uganda, are in the low-income top 10 in the Innovation Efficiency Ratio.

#### **Maximizing innovation resources and synergies: The Innovation Efficiency Ratio**

The Innovation Efficiency Ratio is calculated as the ratio of the Output Sub-Index score over the Input

Sub-Index score. It assesses the effectiveness of innovation systems and policies. It must be noted, however, that economies might also reach a relatively high Innovation Efficiency Ratio as a result of particularly low input scores. Because of this, efficiency ratios must be analysed jointly with GII, Input, and Output scores, and with the development stages of the economies in mind.

The 10 countries with the highest Innovation Efficiency Ratios are countries that combine certain levels of innovation inputs with more robust output results (see Table 1): Luxembourg, Switzerland, China, the Netherlands, Iceland, Ireland, Germany, Malta, Turkey, and Viet Nam. Compared to previous years, new middle-income economies joined the top 10 most efficient economies: China, which entered the top 10 last year, is accompanied this year by Turkey and a lower-middle-income economy, Viet Nam, which makes the most spectacular progress this year (see Box 6).

Economies from Europe; South East Asia, East Asia, and Oceania; and Northern Africa and West Asia take up the first 20 positions in this ratio ranking. Among high-income economies, Sweden, the Czech Republic, Korea, Kuwait, Estonia, and the UK are in the group of the 20 most efficient economies in innovation. Among upper-middle-income economies, Bulgaria and the Islamic Republic of Iran are in the top 20 in terms of efficiency. From the lower-middle-income group, the top 20 most efficient economies include Ukraine and Armenia. No low-income economies are in the top 20 this year in innovation efficiency rankings.

#### **Clustering innovation leaders, innovation achievers, and innovation performers at and below development relative to GDP: The GII bubble chart**

The GII helps also identify countries' performance in innovation relative to their level of GDP. Figure 4 on pages 30–31 presents the GII scores plotted against GDP per capita in PPP\$ (in natural logs). The economies that appear close to the trend line show results that are in accordance with what is expected based on their level of development. The further up and above the trend line a country appears, the better its innovation performance is when compared with that of its peers at the same stage of development. Red-coloured bubbles in the figure correspond to the efficient innovators (a majority of them are situated above the trend line), while the blue-coloured bubbles represent those countries in the lower half of the Innovation Efficiency Ratio.

In the group of innovation leaders we find the same top 25 economies as in 2016, with two exceptions: the Czech Republic is moving back into this group while Belgium is moving out. All of these are high-income economies, with the sole exception of China, which belongs to the upper-middle-income group. These economies are located in four regions, with the majority in South East Asia, East Asia, and Oceania and in Europe, and the rest in Northern America and in Northern Africa and Western Asia. All of the economies in this group have a GII score above 50. These economies show mature innovation systems with solid institutions and high levels of market and business sophistication, allowing investment in human capital and infrastructure to translate into quality innovation outputs.

Economies that perform at least 10% above their peers for their level

of GDP are called ‘innovation achievers.’ These are shown in Table 5 listed by income group and years as an innovation achiever. These economies show better results in innovation because they continuously improve their innovation systems, have more structured institutional frameworks, develop linkages that allow knowledge absorption and the flow of highly skilled human capital, and foster a higher integration with international markets. Although these traits translate into proper resource allocation for education, higher levels of economic growth, and income for workers, they are not homogenous among these economies.

A total of 17 economies compose the group of innovation achievers. This group has grown since the 2016 edition of the GII. Most of these economies—nine in total—come from the Sub-Saharan Africa region, followed by three economies in the Eastern region of Europe. A stronger performance in innovation outputs this year allows the Czech Republic to leave the achiever group and move into the group of leader economies. Portugal moves also out of this group and into the group of economies performing on par with their development for their level of GDP, partially as a result of a weaker performance in general infrastructure and knowledge absorption. Two new economies join this group: Burundi and the United Republic of Tanzania from Sub-Saharan Africa, while Armenia from Northern Africa and Western Asia and Bulgaria from the Eastern Europe region appear in this list for the second year in a row.

Importantly, Kenya, Rwanda, Senegal, Uganda, Mozambique, and Malawi stand out for being innovation achievers at least five times in the previous six years. Madagascar has done so in the two most recent years and both Burundi and the

**Table 5: Innovation achievers: Income group and years as an innovation achiever**

| Economy               | Income group        | Years as an innovation achiever (total)      |
|-----------------------|---------------------|--|
| Viet Nam              | Lower-middle income | 2017, 2016, 2015, 2014, 2013, 2012, 2011 (7) |
| Kenya                 | Lower-middle income | 2017, 2016, 2015, 2014, 2013, 2012, 2011 (7) |
| Moldova, Rep.         | Lower-middle income | 2017, 2016, 2015, 2014, 2013, 2012, 2011 (7) |
| India                 | Lower-middle income | 2017, 2016, 2015, 2014, 2013, 2012, 2011 (7) |
| Armenia               | Lower-middle income | 2017, 2016, 2015, 2014, 2013, 2012 (6)       |
| Ukraine               | Lower-middle income | 2017, 2016, 2015, 2014, 2012 (5)             |
| Rwanda                | Low income          | 2017, 2016, 2015, 2014, 2012 (5)             |
| Uganda                | Low income          | 2017, 2016, 2015, 2014, 2013 (5)             |
| Mozambique            | Low income          | 2017, 2016, 2015, 2014, 2012 (5)             |
| Malawi                | Low income          | 2017, 2016, 2015, 2014, 2012 (5)             |
| Senegal               | Low income          | 2017, 2015, 2014, 2013, 2012 (5)             |
| Tajikistan            | Lower-middle income | 2017, 2016, 2013 (3)                         |
| Malta                 | High income         | 2017, 2016, 2015 (3)                         |
| Madagascar            | Low income          | 2017, 2016 (2)                               |
| Bulgaria              | Upper-middle income | 2017, 2015 (2)                               |
| Burundi               | Low income          | 2017 (1)                                     |
| Tanzania, United Rep. | Low income          | 2017 (1)                                     |

Note: World Bank Income Group Classification (July 2016): LI = low income; LM = lower-middle income; UM = upper-middle income; and HI = high income.

United Republic of Tanzania only in 2017. With the exception of Senegal, Bulgaria, and the latter two economies, all have been identified as innovation achievers in the two most recent years. Kenya, the chief innovation achiever in the region, has been considered as such every year since 2011. Most of these economies perform above their peers in Innovation linkages, particularly in GERD financed by abroad and FDI net inflows. These economies also share strengths in government expenditure on education per pupil, gross capital formation, and the growth rate of GDP per worker.

This analysis also allows for identifying a group of economies that perform at least 10% below their peers for their level of GDP. This cluster includes 39 countries from different regions and income groups: 9 are from the high-income group (6 of these are from the Northern Africa and Western Asia region), 17 are from the upper-middle-income group, 11 are from the lower-middle-income

group, and 2 are low-income economies.

### Regional rankings

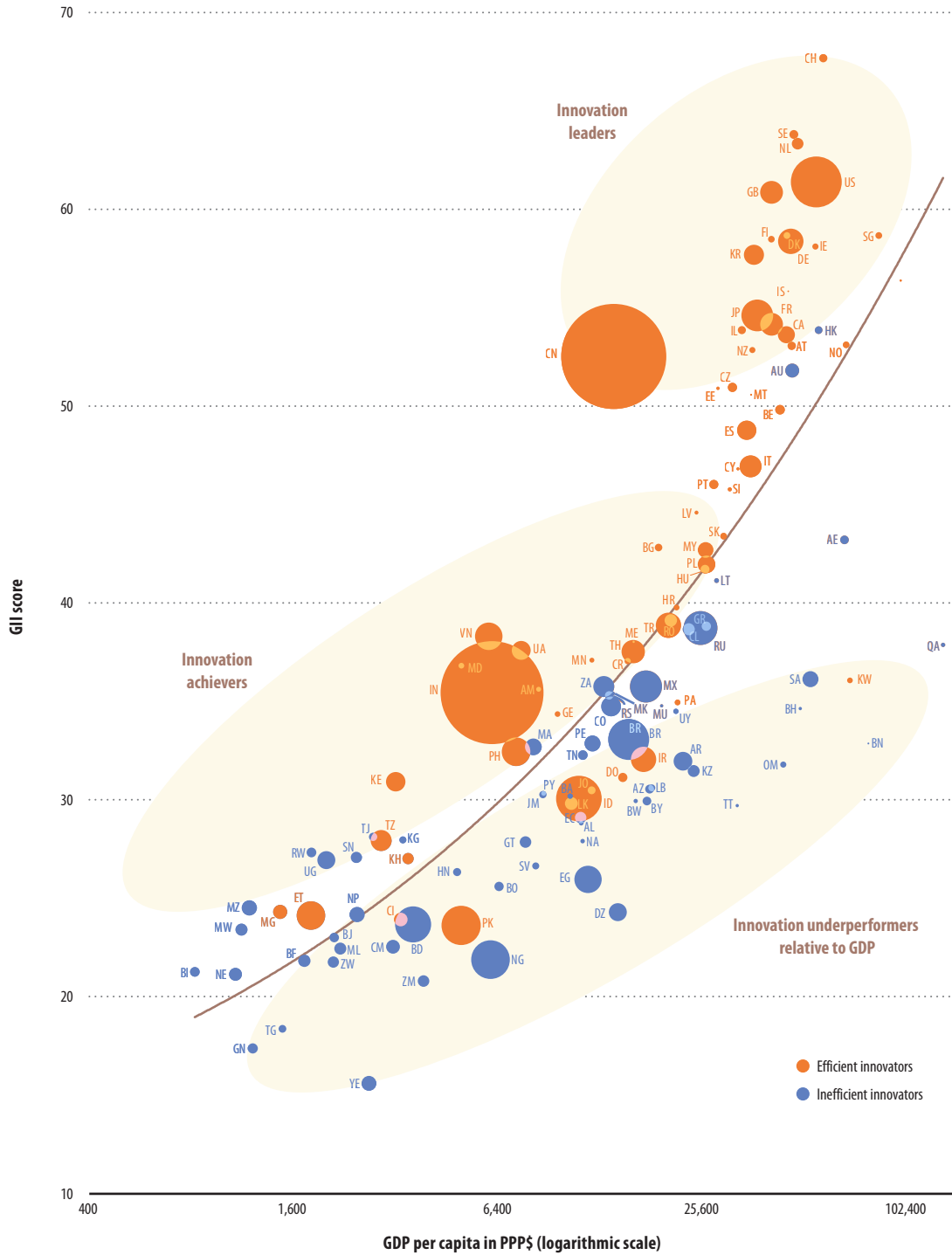
This section discusses regional and sub-regional trends, with snapshots for some of the economies leading in the rankings.

Table 6 on page 32 presents a heatmap with the scores for the top 10, along with average scores by income and regional group. To put the discussion of rankings further into perspective, Figure 5 on page 33 presents, for each region, bars representing the median pillar scores (second quartile) as well as the range of scores determined by the first and second quartile; regions are presented in decreasing order of their average GII rankings (except for the EU, which is placed at the end).

#### Northern America (2 economies)

Northern America, the UN-defined region that includes both the USA and Canada, holds two of the top

Figure 4: GII scores and GDP per capita in PPP\$ (bubbles sized by population)



Note: 'Efficient innovators' are countries/economies with Innovation Efficiency ratios  $\geq 0.62$ ; 'Inefficient innovators' have ratios  $< 0.62$ ; the trend line is a polynomial of degree three with intercept ( $R^2 = 0.6431$ ).



Figure 4: GII scores and GDP per capita in PPP\$ (bubbles sized by population): ISO-2 Country Codes

| Country/ Economy               | Code | Country/ Economy       | Code | Country/ Economy              | Code |
|--------------------------------|------|------------------------|------|-------------------------------|------|
| Albania.....                   | AL   | Guatemala .....        | GT   | Oman .....                    | OM   |
| Algeria .....                  | DZ   | Guinea.....            | GN   | Pakistan .....                | PK   |
| Argentina.....                 | AR   | Honduras .....         | HN   | Panama.....                   | PA   |
| Armenia .....                  | AM   | Hong Kong (China)..... | HK   | Paraguay.....                 | PY   |
| Australia.....                 | AU   | Hungary.....           | HU   | Peru.....                     | PE   |
| Austria .....                  | AT   | Iceland .....          | IS   | Philippines .....             | PH   |
| Azerbaijan .....               | AZ   | India.....             | IN   | Poland.....                   | PL   |
| Bahrain .....                  | BH   | Indonesia .....        | ID   | Portugal .....                | PT   |
| Bangladesh .....               | BD   | Iran, Islamic Rep..... | IR   | Qatar .....                   | QA   |
| Belarus.....                   | BY   | Ireland.....           | IE   | Romania.....                  | RO   |
| Belgium .....                  | BE   | Israel.....            | IL   | Russian Federation.....       | RU   |
| Benin .....                    | BJ   | Italy.....             | IT   | Rwanda.....                   | RW   |
| Bolivia, Plurinational St..... | BO   | Jamaica.....           | JM   | Saudi Arabia.....             | SA   |
| Bosnia and Herzegovina.....    | BA   | Japan .....            | JP   | Senegal .....                 | SN   |
| Botswana.....                  | BW   | Jordan .....           | JO   | Serbia.....                   | RS   |
| Brazil.....                    | BR   | Kazakhstan.....        | KZ   | Singapore.....                | SG   |
| Brunei Darussalam.....         | BN   | Kenya.....             | KE   | Slovakia.....                 | SK   |
| Bulgaria .....                 | BG   | Korea, Rep.....        | KR   | Slovenia .....                | SI   |
| Burkina Faso.....              | BF   | Kuwait.....            | KW   | South Africa .....            | ZA   |
| Burundi .....                  | BI   | Kyrgyzstan .....       | KG   | Spain.....                    | ES   |
| Cambodia.....                  | KH   | Latvia .....           | LV   | Sri Lanka .....               | LK   |
| Cameroon.....                  | CM   | Lebanon.....           | LB   | Sweden .....                  | SE   |
| Canada.....                    | CA   | Lithuania.....         | LT   | Switzerland.....              | CH   |
| Chile.....                     | CL   | Luxembourg.....        | LU   | Tajikistan.....               | TJ   |
| China.....                     | CN   | Madagascar.....        | MG   | Tanzania, United Rep. ....    | TZ   |
| Colombia.....                  | CO   | Malawi .....           | MW   | Thailand.....                 | TH   |
| Costa Rica.....                | CR   | Malaysia.....          | MY   | TFYR of Macedonia.....        | MK   |
| Côte d'Ivoire .....            | CI   | Mali.....              | ML   | Togo .....                    | TG   |
| Croatia.....                   | HR   | Malta.....             | MT   | Trinidad and Tobago.....      | TT   |
| Cyprus .....                   | CY   | Mauritius.....         | MU   | Tunisia.....                  | TN   |
| Czech Republic.....            | CZ   | Mexico.....            | MX   | Turkey .....                  | TR   |
| Denmark .....                  | DK   | Moldova, Rep. ....     | MD   | Uganda .....                  | UG   |
| Dominican Republic.....        | DO   | Mongolia.....          | MN   | Ukraine .....                 | UA   |
| Ecuador .....                  | EC   | Montenegro .....       | ME   | United Arab Emirates .....    | AE   |
| Egypt.....                     | EG   | Morocco .....          | MA   | United Kingdom.....           | GB   |
| El Salvador .....              | SV   | Mozambique.....        | MZ   | United States of America..... | US   |
| Estonia .....                  | EE   | Namibia .....          | NA   | Uruguay .....                 | UY   |
| Ethiopia.....                  | ET   | Nepal .....            | NP   | Viet Nam .....                | VN   |
| Finland.....                   | FI   | Netherlands .....      | NL   | Yemen.....                    | YE   |
| France .....                   | FR   | New Zealand.....       | NZ   | Zambia.....                   | ZM   |
| Georgia .....                  | GE   | Niger.....             | NE   | Zimbabwe .....                | ZW   |
| Germany .....                  | DE   | Nigeria .....          | NG   |                               |      |
| Greece.....                    | GR   | Norway .....           | NO   |                               |      |

**Table 6: Heatmap for GII top 10 economies and regional and income group averages (1–100)**

| Country/Economy                         | GI           | Institutions | Human capital and research | Infrastructure | Market sophistication | Business sophistication | Input        | Knowledge and technology outputs | Creative outputs | Output       | Efficiency  |
|---|--------------|--------------|----------------------------|----------------|-----------------------|-------------------------|--------------|----------------------------------|------------------|--------------|-------------|
| Switzerland                             | 67.69        | 89.47        | 63.29                      | 65.10          | 67.51                 | 62.61                   | 69.60        | 69.06                            | 62.50            | 65.78        | 0.95        |
| Sweden                                  | 63.82        | 88.31        | 63.71                      | 69.13          | 64.87                 | 62.58                   | 69.72        | 62.51                            | 53.33            | 57.92        | 0.83        |
| United Kingdom                          | 63.36        | 88.24        | 54.70                      | 63.32          | 59.02                 | 63.69                   | 65.79        | 62.88                            | 58.97            | 60.92        | 0.93        |
| United States of America                | 61.40        | 86.25        | 57.21                      | 61.04          | 83.45                 | 56.41                   | 68.87        | 54.38                            | 53.48            | 53.93        | 0.78        |
| Finland                                 | 60.89        | 88.44        | 63.32                      | 67.14          | 70.19                 | 52.18                   | 68.25        | 46.49                            | 60.54            | 53.52        | 0.78        |
| Singapore                               | 58.70        | 91.43        | 66.13                      | 63.19          | 70.17                 | 52.50                   | 68.68        | 43.93                            | 53.48            | 48.71        | 0.71        |
| Ireland                                 | 58.69        | 94.36        | 63.67                      | 69.15          | 71.20                 | 62.88                   | 72.25        | 47.33                            | 42.94            | 45.14        | 0.62        |
| Denmark                                 | 58.49        | 92.18        | 66.41                      | 64.35          | 61.59                 | 60.12                   | 68.93        | 48.79                            | 47.32            | 48.06        | 0.70        |
| Netherlands                             | 58.39        | 83.53        | 60.13                      | 61.55          | 60.00                 | 51.44                   | 63.33        | 51.06                            | 55.85            | 53.46        | 0.84        |
| Germany                                 | 58.13        | 87.62        | 55.07                      | 62.06          | 55.05                 | 54.51                   | 62.86        | 55.88                            | 50.94            | 53.41        | 0.85        |
| <b>Average</b>                          | <b>37.12</b> | <b>63.05</b> | <b>34.03</b>               | <b>46.19</b>   | <b>47.23</b>          | <b>34.97</b>            | <b>45.10</b> | <b>25.77</b>                     | <b>32.53</b>     | <b>29.15</b> | <b>0.63</b> |
| Region                                  |              |              |                            |                |                       |                         |              |                                  |                  |              |             |
| Northern America                        | 57.53        | 88.62        | 55.26                      | 61.54          | 78.56                 | 52.13                   | 67.22        | 46.52                            | 49.14            | 47.83        | 0.71        |
| Europe                                  | 47.10        | 75.57        | 46.41                      | 56.10          | 51.72                 | 42.93                   | 54.54        | 35.24                            | 44.05            | 39.65        | 0.72        |
| South East Asia, East Asia, and Oceania | 44.03        | 69.62        | 41.40                      | 52.80          | 57.37                 | 41.08                   | 52.46        | 33.73                            | 37.50            | 35.61        | 0.68        |
| Northern Africa and Western Asia        | 34.33        | 59.33        | 32.43                      | 46.35          | 44.87                 | 28.62                   | 42.32        | 22.80                            | 29.89            | 26.34        | 0.61        |
| Latin America and the Caribbean         | 31.73        | 54.51        | 26.84                      | 43.56          | 45.11                 | 31.11                   | 40.23        | 17.35                            | 29.13            | 23.24        | 0.58        |
| Central and Southern Asia               | 28.53        | 47.28        | 24.25                      | 37.52          | 43.78                 | 27.29                   | 36.02        | 20.57                            | 21.51            | 21.04        | 0.59        |
| Sub-Saharan Africa                      | 24.88        | 52.19        | 18.53                      | 30.45          | 36.21                 | 27.88                   | 33.05        | 14.77                            | 18.64            | 16.71        | 0.51        |
| Income level                            |              |              |                            |                |                       |                         |              |                                  |                  |              |             |
| High income                             | 48.85        | 79.28        | 48.34                      | 58.64          | 55.46                 | 44.41                   | 57.23        | 36.65                            | 44.30            | 40.47        | 0.70        |
| Upper-middle income                     | 34.13        | 59.47        | 31.50                      | 45.74          | 45.69                 | 31.05                   | 42.69        | 21.14                            | 30.00            | 25.57        | 0.60        |
| Lower-middle income                     | 28.80        | 47.61        | 22.34                      | 35.91          | 43.48                 | 27.02                   | 35.27        | 19.75                            | 24.92            | 22.34        | 0.62        |
| Low income                              | 23.38        | 49.11        | 17.44                      | 28.32          | 33.13                 | 28.99                   | 31.40        | 14.17                            | 16.55            | 15.36        | 0.49        |

Worst

Average

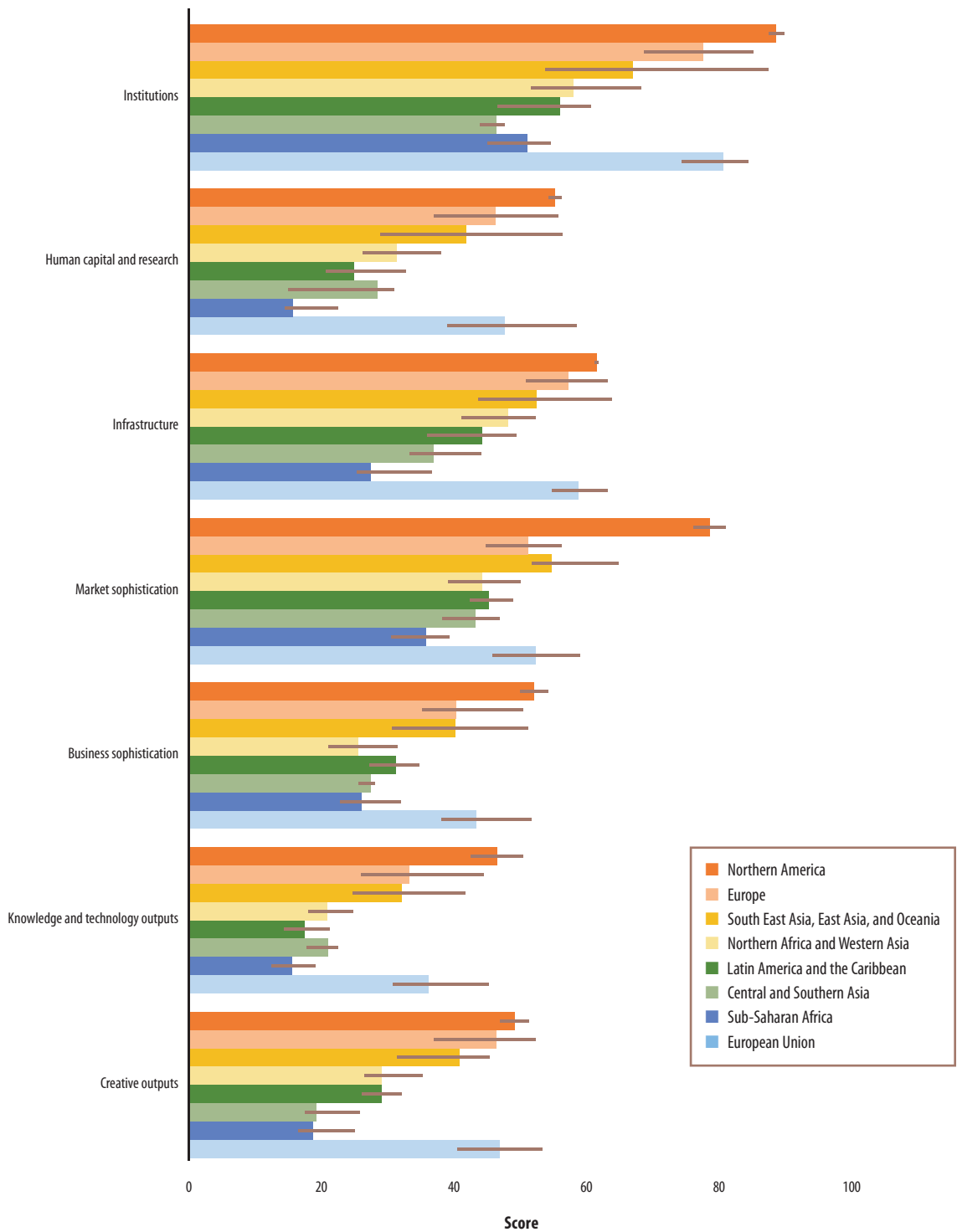
Best

Source: GII 2017 data.

Note: Darker shadings indicate better performances. Countries/economies are classified according to the World Bank Income Group (July 2016; see <https://blogs.worldbank.org/opendata/new-country-classifications-2016>); and special classification based on the online version of the United Nations publication *Standard Country or Area Codes for Statistical Use*, originally published as Series M, No. 49, and now commonly referred to as the M49 standard (April 2017; see <https://unstats.un.org/unsd/methodology/m49/>).



Figure 5: Median scores by regional group and by pillar



Source: GII 2017 data.

Note: The bars show the median scores (second quartiles); the lines show the range for scores between the first and third quartiles. Countries/economies are classified according to the United Nations geographical classification. The European Union overlaps (it includes 27 European countries, and Cyprus in Western Asia).

25 economies in this year's GII. Both the USA and Canada are high-income economies and rank in the top 10 economies in terms of GDP. The USA ranks 4th overall this year, unchanged from 2016, and is

in the top 10 economies in both the Innovation Input Sub-Index (5th) and the Innovation Output Sub-Index (5th). Canada is 18th overall and is in the top 25 economies in the Innovation Input Sub-Index (10th) and the Innovation Output Sub-Index (23rd), unchanged from last year.

### Sub-Saharan Africa (25 economies)

For several editions, the GII has noted that the Sub-Saharan Africa region performs relatively well on innovation (see Box 5). Since 2012, Sub-Saharan Africa has had more countries among the group of innovation achievers than any other region. It will be important for Africa

### Box 5: Sub-Saharan Africa: The innovation momentum in the most promising region continues

Since 2012 and to this day, the number of Sub-Saharan Africa countries in the group of innovation achievers has been the highest among all regions.<sup>1</sup> Strengths in the region remain in areas considered crucial for the expansion of innovation locally. Factors such as improved business environments offer the necessary stimulus to maintain the positive development seen in Sub-Saharan Africa over the past years.

Boosted by economies such as Mauritius, Botswana, South Africa, Namibia, Rwanda, and Burkina Faso, this year Sub-Saharan Africa has its highest scores in Institutions and Market sophistication, where these countries perform on par or better than some of their peers in Europe and South East Asia, East Asia, and Oceania. In addition to developments in

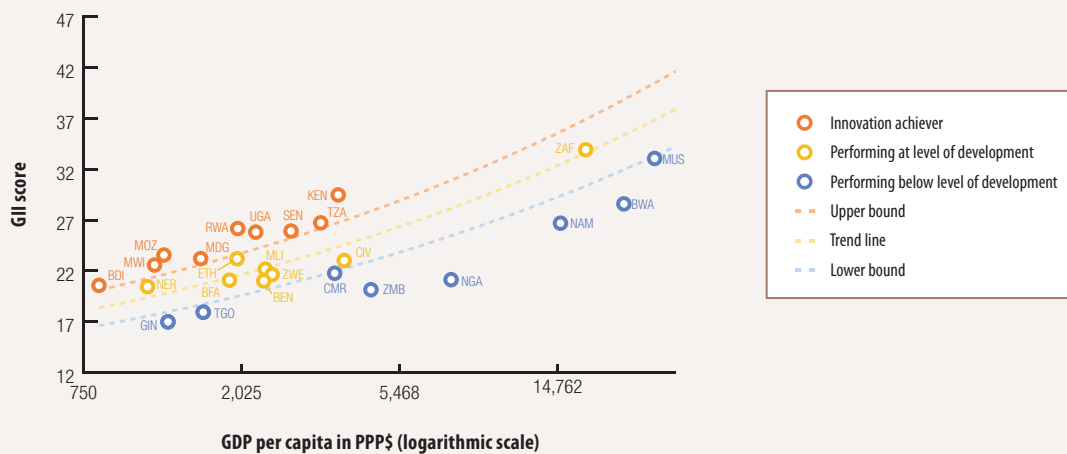
Business sophistication, efforts to improve Human capital and research as well as Infrastructure have also translated into higher regional scores in these pillars. Although larger economies such as South Africa, Botswana, Namibia, and Kenya help foster the expansion in Infrastructure, others such as Senegal, Mauritius, Rwanda, and Zimbabwe are helping to do so in Human capital and research.

This box showcases the regional innovation performance of Sub-Saharan Africa countries by considering both the overall GII scores and those of the seven individual GII pillars. Countries are termed 'innovation achievers' and said to outperform their peers if their GII scores are higher than expected based on their level of economic development (as

measured by GDP per capita). Countries also have the opportunity to be 'pillar outperformers' if they outperform their peers on more than half of the seven GII pillars. Countries that meet both of these benchmarks are referred to as 'innovation outperformers'.

Although the number of countries featured in the GII this year is similar to last year's, the number of countries identified as innovation achievers is slightly higher.<sup>2</sup> Figure 5.1 shows the performance of all 25 economies in Sub-Saharan Africa. This year over 50% of innovation achievers come from Sub-Saharan Africa, allowing this region to continue to lead in this metric. A total of nine economies—Kenya, Rwanda, Uganda, Mozambique, Malawi, Senegal, Madagascar, Burundi, and the United Republic of Tanzania

Figure 5.1: Innovation achievers in Sub-Saharan Africa



Note: BDI = Burundi; BEN = Benin; BFA = Burkina Faso; BWA = Botswana; CIV = Côte d'Ivoire; CMR = Cameroon; ETH = Ethiopia; GIN = Guinea; KEN = Kenya; MDG = Madagascar; MLI = Mali; MOZ = Mozambique; MUS = Mauritius; MWI = Malawi; NAM = Namibia; NER = Niger; NGA = Nigeria; RWA = Rwanda; SEN = Senegal; TGO = Togo; TZA = Tanzania, United Republic of; UGA = Uganda; ZAF = South Africa; ZMB = Zambia; ZWE = Zimbabwe.

(Continued on next page)

to preserve its current innovation momentum.

This year South Africa takes the top spot among all economies in the region (57th), followed by Mauritius (64th), Kenya (80th), Botswana (89th), the United Republic of Tanzania (96th), Namibia (97th), Rwanda (99th), and Senegal (100th).

Among these, only Botswana and the United Republic of Tanzania improve their GII ranking compared to 2016, while Kenya remains stable and the other four economies (South Africa, Mauritius, Namibia, and Rwanda) lose positions.

The remaining 17 economies in this region can be found at ranks

lower than 100. Eight of them have improved since 2016: Benin (116th), Cameroon (117th), Burkina Faso (120th), Burundi (122nd), Niger (123rd), Zambia (124th), Togo (125th), and Guinea (126th). See Box 5 for more details.

Because of issues with data coverage, Ghana drops out of the GII this

### Box 5: Sub-Saharan Africa: The innovation momentum in the most promising region continues (continued)

(Tanzania)—perform better than their level of development would predict (see Figure 5.1 for details). The innovation achiever economies are shown in red and located above the upper-bound, farthest from the trend line. A total of eight economies are identified as performing at development (yellow). In the same way, the remaining eight are signalled as performing below development (blue).<sup>3</sup>

Kenya, Mozambique, Malawi, Rwanda, Uganda, and Senegal stand out for being innovation achievers at least five times in the past six years. Kenya, the chief innovation achiever in the region, has been credited as such every year since 2011—including in 2017. With the exception of Malawi, these economies, along with Mauritius, South Africa, Tanzania, and Niger, outperform their peers in

more than half of the seven GII pillars and thus are also labelled pillar outperformers.<sup>4</sup>

Most of these innovation achiever economies outperform in Institutions, Infrastructure, and Market sophistication; they outperform this year also in Human capital and research and in Business sophistication, but not as much as they could.<sup>5</sup> Uganda outperforms in all seven pillars, followed by Kenya and Rwanda that do so in six. South Africa and Tanzania outperform in five; while Mauritius, Mozambique, and Niger only in four. Malawi outperforms in three, while Madagascar and Burundi do so in two and therefore are the only innovation achievers that are not pillar outperformers.

This year four of the innovation achievers mentioned above—Kenya, Rwanda, Uganda,

and Mozambique—are labelled innovation outperformers within the Sub-Saharan Africa region.<sup>6</sup> Table 5.1 shows the full list of achievers and outperformers in this region.

However, although the region's relatively strong performance in innovation signals strengths, differences between the innovation levels of some of its economies still show large disparities. Because, since the big dip experienced in parts of the region last year, economies in Africa aim for economic recovery in 2017 and in the years following, and while commodity prices are recovering, it will be important for other less-developed economies to keep improving their innovation performance to maintain the momentum of the region's innovation efforts.

**Table 5.1: Sub-Saharan Africa: Innovation achievers, pillar outperformers, and innovation outperformers, 2011–17**

| Economy               | Income group        | Years as an innovation achiever (total)      | Years as a pillar outperformer (total)       | Innovation outperformer |
|-----------------------|---------------------|--|--|-------------------------|
| Kenya                 | Lower-middle income | 2017, 2016, 2015, 2014, 2013, 2012, 2011 (7) | 2017, 2016, 2015, 2014, 2013, 2012, 2011 (7) | Yes                     |
| Rwanda                | Low income          | 2017, 2016, 2015, 2014, 2012 (5)             | 2017, 2016, 2015, 2014, 2013, 2012, 2011 (7) | Yes                     |
| Uganda                | Low income          | 2017, 2016, 2015, 2014, 2013 (5)             | 2017, 2016, 2015, 2014, 2013 (5)             | Yes                     |
| Mozambique            | Low income          | 2017, 2016, 2015, 2014, 2012 (5)             | 2017, 2016, 2015, 2014, 2013, 2012 (6)       | Yes                     |
| Malawi                | Low income          | 2017, 2016, 2015, 2014, 2012 (5)             | 2016, 2015, 2014, 2012, 2011 (5)             | No                      |
| Senegal               | Low income          | 2017, 2015, 2014, 2013, 2012 (5)             | 2017, 2015 (2)                               | No                      |
| Madagascar            | Low income          | 2017, 2016 (2)                               | 2012 (1)                                     | No                      |
| Burundi               | Low income          | 2017 (1)                                     |  | No                      |
| Tanzania, United Rep. | Low income          | 2017 (1)                                     | 2017, 2014 (2)                               | No                      |

Note: World Bank Income Group Classification (July 2016): LI = low income; LM = lower-middle income; UM = upper-middle income; and HI = high income. This table includes GII 2017. Economies identified as an innovation achiever and a pillar outperformer for two or more consecutive years, including 2016 and 2015, are also considered innovation outperformers.

#### Notes

Notes for this box appear at the end of the chapter.

year, while Zimbabwe is added (see Annex 2).

### Latin America and the Caribbean (18 economies)

Latin America and the Caribbean includes only upper- and lower-middle-income economies, with three exceptions: Chile, Uruguay, and Trinidad and Tobago, which are all high-income economies. Still leading the region in the GII rankings for another year, Chile (46th) loses two positions, and is followed by Costa Rica (53rd, down by eight) and Mexico (58th, up by three).

Following these countries, and ranking in the top half of the GII this year, is Panama (63rd). The top 100 economies overall include Colombia (65th), Uruguay (67th), Brazil (69th), Peru (70th), Argentina (76th), Dominican Republic (79th), Jamaica (84th), Paraguay (85th), Trinidad and Tobago (91st), Ecuador (92nd), and Guatemala (98th). The remaining economies in the region rank below 100 in the GII this year: El Salvador (103rd), Honduras (104th), and the Plurinational State of Bolivia (106th).

Although important regional potential exists, the GII rankings of countries in Latin America relative to other regions have not steadily improved. In recent years and in 2017, no economies from this region are identified as innovation achievers (see Box 4 in the 2015 edition of the GII).

As previously mentioned, the minimum data coverage threshold rule was adjusted this year to retain only those economies with sufficient data coverage in the GII. As a result, Nicaragua and the Bolivarian Republic of Venezuela drop from the GII 2017 (see Annex 2).

**Chile** ranks 46th in the GII this year, at the top spot in the region, but down two positions since 2016. It is ranked 42nd and 53rd in the

Innovation Input Sub-Index and Innovation Output Sub-Index, respectively, with a place in the top 50 economies across five pillars: Institutions (41st), Infrastructure (47th), Market sophistication (50th), Business sophistication (46th), and Knowledge and technology outputs (49th). Its improvements in 2017 lie in Knowledge and technology outputs, where it gains 10 positions, and Human capital and research (61st), where it advances one spot. In Knowledge and technology outputs, major improvements are in Knowledge diffusion (34th), with better rankings in IP receipts and FDI net outflows, and in a number of individual indicators, including PCT patent applications, scientific and technical articles, and growth rate of GDP per worker. In Human capital and research, Chile improves mainly in Education (65th), gaining eight positions since last year and seeing its ranking in every indicator in this sub-pillar improve. Tertiary education (55th) also gains one position, as Chile becomes the 5th economy in the world in tertiary enrolment. Despite the improvements, Chile still shows areas of weakness in pillar 2, Human capital and research, in a total of four indicators including government expenditure in education (60th), pupil-teacher ratio (83rd), tertiary inbound mobility (96th), and global companies by R&D (43rd).

**Brazil** is ranked 69th in the GII 2017, the same position as last year. Brazil's strongest pillar ranking is in Business sophistication (43rd), where it sees one of its highest rankings in IP payments (8th). Brazil's biggest improvements are in Human capital and research (50th, up by 10) and Creative outputs (83rd, up by 7). In Human capital and research, Brazil improved its rank in all sub-pillars, in particular in expenditure on education and QS university ranking. In

Creative outputs, gains are seen in Intangible assets and Online creativity, primarily in ICTs and business model creation, Wikipedia edits, and video uploads on YouTube. Although Business environment and Tertiary education still have room for improvement, Brazil is also relatively weak in Credit and Knowledge impact. Some indicators where the economy could improve further include PISA results, graduates in science and engineering, tertiary inbound mobility, gross capital formation, JV-strategic alliance deals, and growth rate of GDP per worker. Persistence will be needed in a time of political and economic uncertainty to benefit from the economic uptick as described at the outset of the chapter.

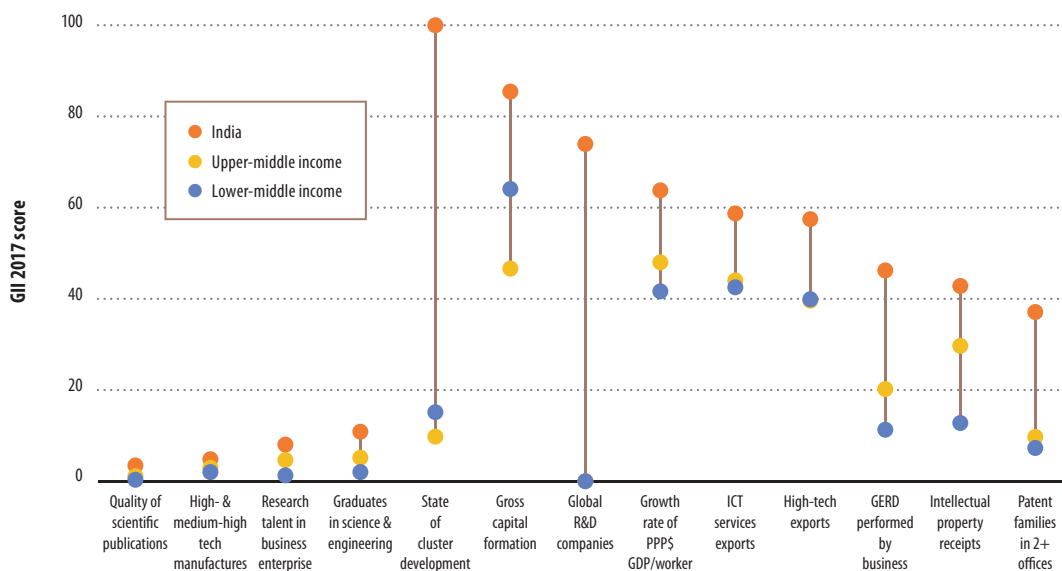
### Central and Southern Asia (9 economies)

Economies of the Central and Southern Asia region have seen further improvements in their rankings since 2016, with seven economies improving their rankings and with India moving into the top half of the GII this year.

India maintains its top place in the region, moving up six spots—from 66th last year to 60th this year overall. The Islamic Republic of Iran becomes 2nd in the region, moving from 78th to 75th and leaving its 78th spot to Kazakhstan, which drops three positions from 2016. The remaining economies rank in order within the region as follows: Sri Lanka shows a one-position improvement this year (90th); this is followed by Tajikistan (94th), Kyrgyzstan (95th), Nepal (109th), Pakistan (113th), and Bangladesh (114th). Despite the improvements in data coverage in the region, Bhutan does not meet the 66% data coverage threshold (see Annex 2) and is thus excluded from the 2017 GII.

**India** remains 1st in the region and 6th among lower-middle-income

**Figure 6: India ahead of average lower-middle- and upper-middle-income economies**



Source: GII 2017 data.

economies. India has also outperformed on innovation relative to its GDP per capita for many years in a row (see Figure 4). India ranks 60th overall in the GII this year, is also among the top 50 economies in two pillars: Market sophistication (39th) and Knowledge and technology outputs (38th). It improves its rankings in five pillars: Institutions (up 4 spots), Infrastructure (up 14 spots), Business sophistication (up 2 spots), Knowledge and technology outputs (up 5 spots), and Creative outputs (up 9 spots). By contrast, Human capital and research (64th) and Market sophistication lose one and six positions respectively. At the sub-pillar level, India enjoys its largest gains in areas such as Knowledge absorption, Knowledge impact, and Intangible assets. Despite remaining a weak sub-pillar, India improves in Education, where it advances four positions because of better relative government expenditure by pupil.

At the indicator level, India improves in a number of areas this

year, including government's online services, e-participation, logistics performance, gross capital formation, high-tech imports, and industrial designs. Also worth mentioning is the six-position gain in global R&D companies, where India ranks 14th, considerably better than the respective groups of lower- and upper-middle-income economies on average. Other such areas in which India does far better than most middle-income economies include graduates in science and engineering, gross capital formation, state of cluster development, GERD performed by business, research talent, and patent families in two or more offices on the input side; and quality of scientific publications, growth rate of GDP per worker, high-tech and ICT services exports, high-tech manufactures, and IP receipts on the output side (Figure 6).

India still has more potential. Business environment (121st) is an area where the country can improve on most indicators. On the input side, in environmental performance, PISA

results, and tertiary inbound mobility Indian scores are lower than the average for lower-middle-income economies. The same is true for other Human capital and research indicators, including researchers and tertiary enrolment, and for FDI net inflows. On the output side, a number of indicators—such as scientific and technical articles and trademarks by origin—are lower than upper-middle-income economy averages. Other indicators on the output side that show room for improvement include indicators measuring new businesses and industrial design filings.

In the same way as other countries (on Viet Nam, see Box 6), India has worked intensively to improve its innovation performance, including by hosting innovation workshops and instituting important work in recent years with the use of the GII, and by instituting a high-level Task Force on Innovation to suggest ways the country can improve its innovation eco-system.<sup>39</sup> In this context, India has considerably improved its

data coverage in the 2016 and 2017 editions of the GII. Work is ongoing to overcome other data issues—for example, issues with R&D-related indicators, such as GERD performed by business data dating from 2011 (see India's Country/Economy Profile for missing or outdated variables).

### South East Asia, East Asia, and Oceania (15 economies)

This year all economies but Cambodia (101st) within the South

East Asia, East Asia, and Oceania region are ranked within the top 100 in the GII. With the exception also of Cambodia and of Brunei Darussalam, which enters the GII this year thanks to improved data coverage, all other economies in the region are also in the top 100 in the Innovation Input Sub-Index, the Innovation Output Sub-Index, and the Innovation Efficiency Ratio.

The top five economies in the region rank in the top 25 overall for

the GII, the Innovation Input Sub-Index, and the Innovation Output Sub-Index: Singapore (7th), Korea (11th), Japan (14th), Hong Kong (China) (16th), and New Zealand (21st). China ranks next (22nd), being the third most efficient economy in the world; Australia follows (at 23rd).

Malaysia moves down two positions to 37th, due mostly to a 10-position drop in Institutions (53rd), a drop driven by lower

### Box 6: ASEAN: Singapore and the new Asian Tigers?

Ten out of the 15 economies in the South East Asia, East Asia, and Oceania region are members of the Association of Southeast Asian Nations (ASEAN).<sup>1</sup> These economies are Brunei Darussalam, Cambodia, Indonesia, Lao People's Democratic Republic, Malaysia, Myanmar, the Philippines, Singapore, Thailand, and Viet Nam. In 2015, intra-ASEAN exports represented the 26% of exports by ASEAN countries.<sup>2</sup> Electrical machinery and equipment is the single most exported commodity within ASEAN.<sup>3</sup>

Since the 1980s, Singapore—along with Hong Kong (China), the Republic of Korea, and, to some extent, Malaysia—has been labelled one of the Asian Tigers. Singapore has managed to sustain its high economic growth rate to become one of the richest economies in the world. Correspondingly, it has ranked in the top 10 since the first edition of the GII. In comparison, the other ASEAN members are less rich and advanced.

However, some of the ASEAN economies—in particular, Indonesia, the Philippines, Thailand, and Viet Nam—are now considered to be 'new Asian Tigers' on the rise. These economies participate more and more in a number of regional and global value chains, including some in relatively high-tech sectors. These countries have also become active in improving their innovation performance, sometimes in showcasing best practice use of the GII findings, paired with remarkable innovation results. In 2017, for example, the Vietnamese government mandated Resolution 19-2017/NQ-CP.<sup>4</sup>

Through this resolution, the Vietnamese government has assigned responsibilities to ministries, agencies, and local governments to undertake actions to improve Viet Nam's performance, and the Ministry of Science and Technology (MOST) has been tasked with coordinating these efforts. A MOST workshop in cooperation with the World Intellectual Property Organization (WIPO) was organized in Hanoi in March 2017 to address missing and outdated data and to help leverage Viet Nam's innovation strengths and overcome related weaknesses.

In the broader ASEAN analysis, both differences and similarities in innovation performance are evident across ASEAN economies. Figures 6.1 and 6.2 show the scores of these economies in selected innovation input and output indicators. Three findings emerge from these figures. First, a certain stability exists at the top of the ASEAN rankings. Singapore has the highest scores among ASEAN members in all selected indicators, except for expenditure on education (topped by Viet Nam), gross capital formation (topped by Brunei Darussalam), ICT service exports (topped by the Philippines), and trademarks by origin (topped by Thailand). Cambodia is relatively new in terms of economic catch-up. Although improving, it lags behind in most of the input indicators selected here, although it is second in FDI net inflows among ASEAN economies, foreshadowing welcome development ahead.

Second, each economy is making an effort to build its innovation system: in each,

areas of excellence are emerging, while others are still works in progress. For example, Viet Nam shows the best score of the group in expenditure on education and is also performing well in ICT use, gross capital formation, and FDI net inflows; at the same time, it has some of the lowest scores in tertiary enrolment, state of cluster development, university/industry research collaboration, and knowledge-intensive employment. Malaysia ranks second in the ASEAN group in expenditure on education, state of cluster development, university/industry research collaboration, and ICT use, but has low scores in PISA scores in reading, maths, and science; tertiary enrolment; and knowledge-intensive employment.

Third, the distance between the top performer and the other ASEAN economies in output indicators is much larger than the distance in inputs. It takes time for economies to create the conditions and accumulate the capabilities required to convert a fertile innovation environment and solid innovation inputs into tangible innovation outputs and outcomes. Among ASEAN economies, Singapore is the top performer in the selected innovation outputs, with two exceptions: ICT services exports, where the Philippines leads; and trademarks by origin, where Viet Nam presents the highest score in the group. Malaysia has the second highest scores in patents by origin, scientific and technical articles, and ICT services exports. Thailand's strengths are in citable documents and trademarks by origin, where it places 2nd.

*(Continued on next page)*

Box 6: ASEAN: Singapore and the new Asian Tigers? (continued)

Figure 6.1: ASEAN scores in selected input indicators

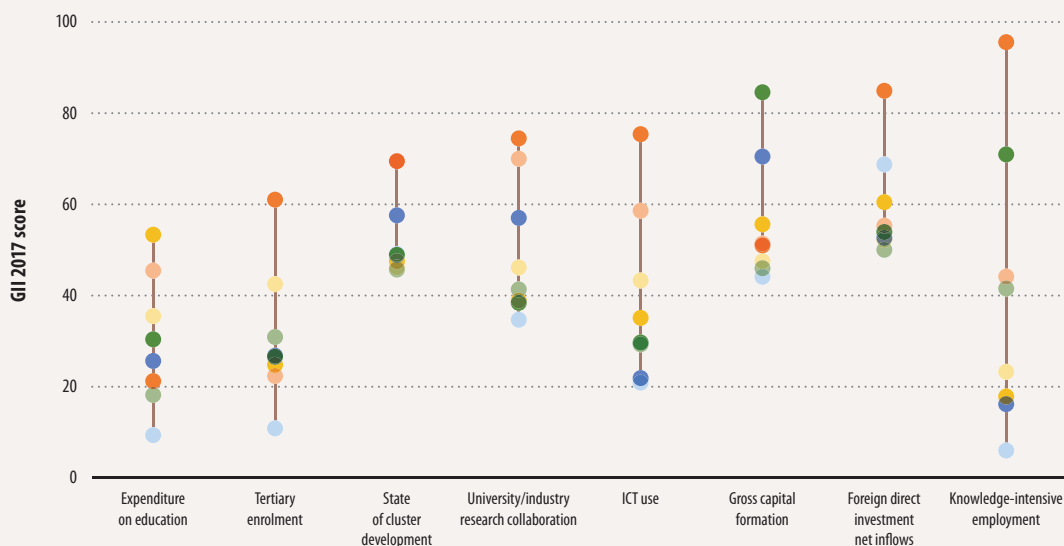
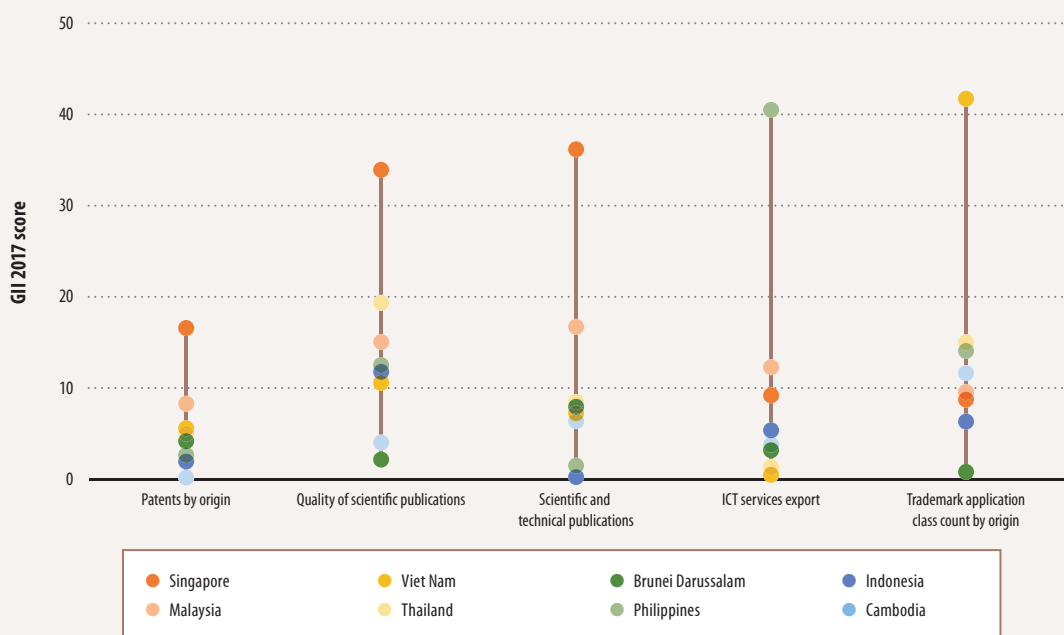


Figure 6.2: ASEAN scores in selected output indicators



Source: GII 2017 data.

Note: No data are available for Lao People's Democratic Republic or Myanmar, which are also omitted from the GII 2017.

Notes

- 1 Among other objectives, ASEAN aims to accelerate economic growth and socioeconomic development, promoting active collaboration and mutual assistance on matters of common interest, including trade. Details are available at <http://asean.org/asean/about-asean/overview/>.
- 2 Data from ASEANstats, available at [http://asean.org/storage/2016/11/Table18\\_as-of-6-dec-2016.pdf](http://asean.org/storage/2016/11/Table18_as-of-6-dec-2016.pdf).
- 3 Data from ASEANstats, available at [http://asean.org/storage/2016/11/Table23\\_as-of-6-dec-2016.pdf](http://asean.org/storage/2016/11/Table23_as-of-6-dec-2016.pdf).
- 4 For more information, see Viet Nam's Ministry of Planning and Investment website at <http://www.mpi.gov.vn/en/Pages/tinbai.aspx?idTin=35994&idcm=121>.



rankings in Business environment (50th, down by 22) and a 19-position fall in Business sophistication (48th)—driven mainly by its rank in Knowledge workers, where Malaysia moved from 35th to 93rd this year (see also Box 6). The latter move is affected by the use of two more recent data points for firms offering formal training (from 25th to 79th) and GERD financed by business (from 11th to 75th). Malaysia is also among the middle-income economies that are the closest to the top 25 this year (see Box 4 on the innovation divide).

Viet Nam, by contrast, gains 12 positions this year, ranking 47th. Viet Nam maintains its top place among lower-middle-income economies and enters the world's top 10 in the Innovation Efficiency Ratio (see Box 6). Thailand (51st) and Mongolia (52nd) follow Viet Nam, ranking in the top half of the GII this year as well. Brunei Darussalam, the Philippines, and Indonesia rank 71st, 73rd, and 87th, respectively. Cambodia closes the rankings for the region, coming in at 101st.

**Japan** has risen in the GII rankings each year for the last four years, moving up to 14th in 2017. Japan ranks 11th overall in the Innovation Input Sub-Index and 20th overall in the Innovation Output Sub-Index, up by four positions since 2016. This year Japan improves its rank in Institutions (13th) and Knowledge and technology outputs (12th), where it advances in all sub-pillars. Japan ranks in the top 10 economies for six sub-pillars: Research and development (3rd), Information and communication technologies (5th), Trade, competition, and market scale (3rd), Knowledge absorption (8th), Knowledge creation (9th), and Knowledge diffusion (10th). Japan ranks 1st in a number of input and

output indicators, including intensity of local competition, GERD financed by business, patent families in two or more offices, patents by origin, and PCT patent applications. Opportunities for further improvement still exist, including in ease of getting credit, growth rate of GDP per worker, new businesses, and cultural and creative services exports.

#### **Northern Africa and Western Asia (19 economies)**

Israel (17th) and Cyprus (30th) achieve the top two spots in the region for the fifth consecutive year, improving by four and one positions, respectively. Third in the region is the United Arab Emirates (35th) which moves up six places from last year, the most striking upward move in the region. In the case of the United Arab Emirates, data collaboration has also increased data availability, reducing missing values from 17 last year to 11 this year. Important data points, however, are still missing, making it difficult to evaluate certain pillars, most notably in Education, where three out of five variables are not available, and Knowledge workers, with two out of five indicators missing.

Sixteen of the 19 economies in the Northern Africa and Western Asia region are in the top 100, including Turkey (43rd), Qatar (49th), Saudi Arabia (55th), Kuwait (56th), Armenia (59th), Bahrain (66th), Georgia (68th), Morocco (72nd), Tunisia (74th), Oman (77th), Lebanon (81st), Azerbaijan (82nd), and Jordan (83rd). Of all the economies in the region, Kuwait sees the most improvement in its overall GII ranking, having moved up 11 spots.

**Israel** moves up four places, from 21st to 17th in 2017, remaining number 1 in the Northern Africa and Western Asia region.

Israel is the only economy in the region to rank in the top 10 for any pillar (5th, Business sophistication, up one spot; and 9th, Knowledge and technology outputs, up three). The country ranks 20th and 14th in the Innovation Input Sub-Index and Innovation Output Sub-Index, respectively, seeing the most gains in Tertiary education (62nd, up 11 spots), Knowledge absorption (9th, up 7 spots), and Knowledge diffusion (8th, up 6 spots). Israel keeps its 1st place in researchers, venture capital deals, GERD performed by business, and research talent in business enterprise. It also gains top 3 positions in gross expenditure on R&D (1st), university/industry research collaboration (3rd), ICT services export (1st), and Wikipedia edits (3rd). Weaknesses for Israel are found in the input side of the GII and are more prominent in variables such as gross fixed capital formation. On the output side, two areas show possibilities for improvement: the growth rate of GDP per worker and trademarks by origin.

#### **Europe (39 economies)**

In this year's edition of the GII, 15 of the top 25 economies come from Europe. This region is home to the top 3 economies of the GII 2017: Switzerland (1st), Sweden (2nd), and the Netherlands (3rd). Following these regional leaders among this group of top 25 are the UK (5th), Denmark (6th), Finland (8th), Germany (9th), Ireland (10th), Luxembourg (12th), Iceland (13th), France (15th), Norway (19th), Austria (20th), the Czech Republic (24th), and Estonia (25th). It should be noted that most of the economies in this region have the fewest missing values, leading them to display the most accurate GII rankings (see Annex 2). This includes the following



economies with 100% data coverage in the Innovation Input Sub-Index, the Innovation Output Sub-Index, or both: Denmark, Finland, Germany, France, Austria, the Czech Republic, Italy, Portugal, Bulgaria, Poland, Hungary, Romania, and the Russian Federation.

Eighteen economies follow among the top 50 and have maintained relatively stable rankings since 2014: Malta (26th), Belgium (27th), Spain (28th), Italy (29th), Portugal (31st), Slovenia (32nd), Latvia (33rd), Slovakia (34th), Bulgaria (36th), Poland (38th), Hungary (39th), Lithuania (40th), Croatia (41st), Romania (42nd), Greece (44th), the Russian Federation (45th), Montenegro (48th, which joins the top 50 this year), and Ukraine (which joins the top 50 this year at the 50th position, moving up by six).

The remaining European economies remain among the top 100 economies overall. The region's rankings continue as follows: the Republic of Moldova (54th), the Former Yugoslav Republic of Macedonia (61st), Serbia (62nd), Bosnia and Herzegovina (86th), Belarus (88th), and Albania (93rd), with Serbia and Bosnia and Herzegovina as the only improving economies in this group.

**France** moves up another three spots in 2017, from 18th to 15th. France ranks 15th in the Innovation Input Sub-Index and gains one spot in the Innovation Output Sub-Index (18th). It ranks in the top 25 economies in all pillars, showing improvements in Institutions (24th), Market sophistication (11th), Knowledge and technology outputs (20th), and Creative outputs (12th). France's three most-improved sub-pillars—Investment (10th), Knowledge impact (36th), and Intangible assets (7th)—gain positions in market capitalization, growth rate of GDP per worker, and ICT and business model

creation. France loses the most positions in Infrastructure (12th), and in all its sub-pillars, including losses of the top spots in government's online service and e-participation. Furthermore, France becomes relatively weak in pupil-teacher ratio, while retaining all the other areas of weaknesses that it presented last year.

### Assessing regional innovation clusters

This year the GII makes a first attempt at assessing sub-national innovation clusters. The Special Section on Clusters in this report sets out the approach and main findings in more detail.

The importance of innovation hubs at the sub-national and international level has been at the forefront of GII discussions for the last 10 years for two main reasons.

- First, successful innovation clusters, and thus agglomerations of innovation activity, are considered essential for national innovation performance. By pooling talent, know-how, research labs, and manufacturing capabilities they constitute 'spikes' or 'peaks of excellence' with critical innovation linkages. A discussion on this issue has been at the forefront of almost every GII edition. In particular, the GII 2013 on the theme 'Local Dynamics of Innovation' analysed clusters, asking which kinds of linkages exist among them, and to what extent knowledge spillovers occur. Importantly, some of these clusters are international in nature. They do not coincide with boundaries of sub-national cities or regions; rather they cross national borders.
- Second, over the last 10 years, one of the most frequent questions asked by countries has

been whether the GII model can be applied at the sub-national level to assess innovation clusters more broadly. Various countries have approached the GII co-publishers to create regional innovation indices on the basis of the GII model. In January 2017, the Indian government decided to rank the performance of Indian states in the 'India Innovation Index'.<sup>40</sup>

A shared conviction underlying both points is that the interaction of critical innovation inputs and outputs happens at the local level, and this phenomenon requires improved metrics. Yet this is where the problem lies, as shown in Table 7.<sup>41</sup>

Despite the progress that has been made, measuring the territorial dimension of innovation remains challenging. Only a few GII indicators are readily available at the regional or city level for a large set of countries. A case in point is that, at this time, the GII model relies on a survey-based question to assess the 'state of cluster development' (indicator 5.2.1) rather than official data. As a testament to imperfect data availability on this critical innovation dimension, efforts to replace this variable with hard data from recognized sources have so far failed. Besides, clusters often do not stop at national borders. By definition, they thus do not map to nationally available data sources; the search for readily available data is elusive.

To make progress on this front, a first step is to identify clusters in an innovative way. The GII 2017 edition makes progress in this regard. In the Special Section on Clusters at the end of the report, Bergquist, Fink, and Raffo propose a novel approach to assess the inventive capacity in clusters based on patenting data. By the means of inventor addresses, and using underlying geo-coding, the

**Table 7: Top cluster of countries or cross-border regions within the top 100**

| Rank | Cluster name               | Territory(ies)              |
|------|----------------------------|-----------------------------|
| 1    | Tokyo–Yokohama             | Japan                       |
| 2    | Shenzhen–Hong Kong (China) | China/Hong Kong (China)     |
| 3    | San Jose–San Francisco, CA | United States               |
| 4    | Seoul                      | Korea, Rep.                 |
| 10   | Paris                      | France                      |
| 12   | Frankfurt–Mannheim         | Germany                     |
| 18   | Eindhoven                  | Netherlands/Belgium         |
| 21   | London                     | United Kingdom              |
| 22   | Tel Aviv                   | Israel                      |
| 24   | Stockholm                  | Sweden                      |
| 31   | Zurich                     | Switzerland/Germany         |
| 34   | Helsinki–Espoo             | Finland                     |
| 35   | Singapore                  | Singapore                   |
| 36   | Basel                      | Switzerland/France/Germany  |
| 39   | Copenhagen                 | Denmark                     |
| 43   | Bengaluru                  | India                       |
| 44   | Sydney                     | Australia                   |
| 45   | Rotterdam–The Hague        | Netherlands                 |
| 47   | Montreal, QC               | Canada                      |
| 52   | Barcelona                  | Spain                       |
| 54   | Brussels–Leuven            | Belgium                     |
| 57   | Moscow                     | Russian Federation          |
| 58   | Milan                      | Italy                       |
| 65   | Lausanne                   | Switzerland/France          |
| 71   | Vienna                     | Austria                     |
| 82   | Aachen                     | Germany/Netherlands/Belgium |
| 92   | Kuala Lumpur               | Malaysia                    |

Source: Derived from Annex 2 of the Special Section on Clusters.

authors identify the largest inventive clusters as measured by PCT patenting activity, possibly up to the street level thanks to advanced mapping techniques. Table 7 presents some of the leading innovation clusters that result from this analysis.

In the coming years, attempts to foster data on local innovation clusters should receive increased attention, and consideration of clusters may possibly become a more

important component of the GII and other innovation measurement efforts.

### Conclusions

The theme for this year's GII is 'Innovation Feeding the World'. This chapter has provided an overview of the current trends, strategies, and policies for innovation in agriculture and food systems. Within agri-food systems, innovation needs to be a priority to achieve sustainable productivity growth and address the global food challenge. Successfully

addressing this challenge will require a mix of technological and non-technological solutions: organizational changes, public and private investment in R&D, and more effective technology transfer mechanisms are all important elements of agri-food innovation systems.

Historically, innovation in agriculture has proven not only feasible but highly successful. Today, a new innovation drive is required among high-, middle-, and low-income economies. In high- and middle-income economies, a new innovation wave is on the horizon: innovations from other sectors are spilling over to agricultural and food systems, making them smart and digital. In low-income economies, the focus is on reducing the bottlenecks of agri-food innovation systems, while speeding up innovation convergence with more productive economies. In all economies, public policy is fundamental to promoting an enabling environment that encourages technology uptake, entrepreneurship and skills, and innovation. The remaining chapters of the report provide more details on this year's theme from academic, business, and particular country perspectives from leading experts and decision makers.

This chapter has also presented the main GII 2017 results, distilling main messages and noting some important evolutions that have taken place since last year. Three main findings stand out. First—and in a turn of events—a novel and more sustained growth momentum is currently in place. Second, more rapid economic growth can lay the foundation for innovation-driven economic development, but more investment would be needed to boost productivity growth, which is still at historic lows. To this end, R&D efforts from both the public and private sector would also need to be intensified.

Third, while the GII results point to a certain stability at the top, new opportunities are emerging: new Asian Tigers are active in improving their innovation performance, and new innovation actors from various regions are climbing in the GII rankings.

Over the last years, the GII has established itself as a leading reference on innovation, becoming a 'tool for action' for decision makers wishing to improve their countries' innovation performance. Numerous workshops in different countries have brought innovation actors together, helped improve data availability, and contributed to designing effective innovation policies. These exchanges on the ground also generate feedback that, in turn, improves the GII and assists the journey towards improved innovation measurement and policy. This valuable feedback will continue to be integrated into future iterations of this lead chapter of the GII in the years to come.

### Notes for Box 5

- 1 In 2011 most innovation achievers were located in the South East Asia, East Asia, and Oceania region. In 2012 and 2013 Europe and Sub-Saharan Africa shared the same number of innovation achievers: six and four in each year, respectively.
- 2 This can be partially attributed to improvements to data coverage. A stricter cut-off rule that increases the minimum required threshold for all countries in the GII to at least 66% of all indicators in each of the sub-indices was introduced this year (see Appendix IV: Technical Notes for more details). This procedure translates into more precise measurements of the innovation performance of each country and thus into a better identification of those that can be identified as innovation achievers. As a result of this improvement, however, two economies from this region identified as innovation achievers in previous years are no longer in the GII ranks: Gambia (2014) and Ghana (2011).

- 3 The general trend line is defined by the scores and economic development level of all countries considered in the GII. The threshold bounds are defined as 10% above and 10% below the scores defined by trend line (see Box 2 in Escalona Reynoso et al., 2015).
- 4 In addition to these 9 Sub-Saharan Africa countries, 26 countries (35 total) were identified as pillar outperformers this year. These come from Europe (9); South East Asia, East Asia, and Oceania (6); Latin America and the Caribbean (5); Northern Africa and Western Asia (4); and Central and Southern Asia (2).
- 5 This can be partially attributed to the higher overall average scores in both of these indicators displayed by the region, which makes it harder for individual countries to perform above that level.
- 6 For a country to be labelled an 'innovation outperformer' it has to be identified as an 'innovation achiever' and it must also score above its income group average in four or more GII pillars for two or more years, including the two most recent—2015 and 2016. In 2017, 10 economies were identified as innovation outperformers. The other countries identified as innovation outperformers this year are Viet Nam, the Republic of Moldova, India, Armenia, Ukraine, and Tajikistan. See Escalona Reynoso et al. (2015) for more details.
- 7 Fernald, 2014. See also Chapter 1 in WIPO 2015.
- 8 WTO, 2017.
- 9 UNCTAD, 2016, 2017.
- 10 Cornell et al., 2016; WIPO, 2015, 2017 (forthcoming). On slowing technology diffusion see also Andrews et al., 2015; Decker et al., 2016; Haltiwanger, 2011; Haltiwanger et al., 2014; OECD, 2015.
- 11 See Lee, 2016, for the case of Korea, for instance.
- 12 IMF, 2017; UNCTAD, 2017; WTO, 2017. The productivity forecast draws on The Conference Board, Total Economy Database (adjusted version), May 2017 release, available at <http://www.conference-board.org/data/economydatabase/>.
- 13 OECD, 2009, 2017a.
- 14 IMF, 2016.
- 15 These estimates are based on preliminary calculations using GDP, GERD, and BERD figures at constant \$PPP 2005 prices from the UNESCO-UIS Science & Technology Data Center, updated March 2017. Economies included: Afghanistan, Albania, Algeria, Angola, Antigua and Barbuda, Argentina, Armenia, Australia, Austria, Azerbaijan, Bahamas, Bahrain, Bangladesh, Barbados, Belarus, Belgium, Belize, Benin, Bermuda, Bhutan, Bolivia (Plurinational State of), Bosnia and Herzegovina, Botswana, Brazil, Brunei Darussalam, Bulgaria, Burkina Faso, Burundi, Cabo Verde, Cambodia, Cameroon, Canada, Central African Republic, Chad, Chile, China, China (Hong Kong Special Administrative Region), China (Macao Special Administrative Region), Colombia, Comoros, Congo, Costa Rica, Croatia, Cuba, Cyprus, Czech Republic, Côte d'Ivoire, Democratic Republic of the Congo, Denmark, Djibouti, Dominica, Dominican Republic, Ecuador, Egypt, El Salvador, Equatorial Guinea, Eritrea, Estonia, Ethiopia, Fiji, Finland, France, Gabon, Gambia, Georgia, Germany, Ghana, Greece, Grenada, Guatemala, Guinea, Guinea-Bissau, Guyana, Haiti, Honduras, Hungary, Iceland, India, Indonesia, Iran (Islamic Republic of), Iraq, Ireland, Israel, Italy, Jamaica, Japan, Jordan, Kazakhstan, Kenya, Kiribati, Kuwait, Kyrgyzstan, Lao People's Democratic Republic, Latvia, Lebanon, Lesotho, Liberia, Libya, Lithuania, Luxembourg, Madagascar, Malawi, Malaysia, Maldives, Mali, Malta, Marshall Islands, Mauritania, Mauritius, Mexico, Micronesia (Federated States of), Mongolia, Montenegro, Morocco, Mozambique, Namibia, Nepal, Netherlands, New Zealand, Nicaragua, Niger, Nigeria, Norway, Oman, Pakistan, Palau, Palestine, Panama, Papua New Guinea, Paraguay, Peru, Philippines, Poland, Portugal, Puerto Rico, Qatar, Republic of Korea, Republic of Moldova, Romania, Russian Federation, Rwanda, Saint Kitts and Nevis, Saint Lucia, Saint Vincent and the Grenadines, Samoa, Sao Tome and Principe, Saudi Arabia, Senegal, Serbia, Seychelles, Sierra Leone, Singapore, Slovakia, Slovenia, Solomon Islands, South Africa, Spain, Sri Lanka, Sudan, Suriname,

### Notes for Chapter 1

- 1 Conference Board, 2017; IMF, 2017; OECD, 2017a. According to the World Bank (2017), the world economy will grow at 2.7% in 2017, up by 0.4% from 2016, with a downward revision of 0.1% from June 2016. For 2018, the OECD (2017a) and IMF (2017) forecast a growth rate of 3.6% without recent revisions. The World Bank (2017) predicted global GDP growth at 2.9%, and recently revised it downward by 0.1%.
- 2 IMF, 2017.
- 3 IMF, 2017; OECD, 2017a; World Bank, 2017.
- 4 IMF, 2017, with Russian GDP growth recently revised upwards.
- 5 World Bank, 2017.
- 6 Adler et al., 2017; OECD, 2017a; WIPO, 2015; World Bank, 2017.
- 7 World Bank, 2017.
- 8 Adler et al., 2017; Cornell et al., 2016. Estimates indicate that worldwide productivity growth slowed down in 2015 and remained at the same modest rate of 1.5% in 2016 (Conference Board, 2016, 2017).
- 9 The Conference Board, Total Economy Database (adjusted version), May 2017 release, available at <http://www.conference-board.org/data/economydatabase/>.

- Swaziland, Sweden, Switzerland, Taiwan (China), Tajikistan, Thailand, The Former Yugoslav Republic of Macedonia, Timor-Leste, Togo, Tonga, Trinidad and Tobago, Tunisia, Turkey, Turkmenistan, Tuvalu, Uganda, Ukraine, United Arab Emirates, United Kingdom of Great Britain and Northern Ireland, United Republic of Tanzania, United States of America, Uruguay, Uzbekistan, Vanuatu, Venezuela (Bolivarian Republic of), Viet Nam, Yemen, Zambia, Zimbabwe.
- 19 The top three spenders relative to GDP are Israel, Korea, and Japan, with Israel overtaking Korea in 2015. Based on our estimates, China is the only emerging economy with R&D intensity above the global average. Other middle-income economies, such as Malaysia, Brazil, India, and South Africa, present lower R&D intensities, between 1.3% and 0.7%.
- 20 Cornell et al., 2016; OECD, 2017b.
- 21 Despite these aggregate figures, some surveys indicate that top world R&D companies raised their R&D expenditures in 2015 and 2016 (European Commission, 2016; Strategy&, 2016).
- 22 WIPO, 2016. At the same time, worldwide patent applications under WIPO's Patent Cooperation Treaty (PCT) saw a 1.4% increase in 2015; a significant fall in growth compared with previous years (WIPO, 2016).
- 23 OECD, 2009, 2017b; WIPO, 2015.
- 24 A recent IMF analysis shows that, if advanced economies increased private R&D by 40% on average, they could increase their GDP by 5% in the long term (IMF, 2016).
- 25 FAO, 2016.
- 26 FAO et al., 2015.
- 27 FAO et al., 2015.
- 28 Malnutrition manifests itself in various forms beyond undernutrition, such as micronutrient malnutrition, obesity, calorie deficiencies, anemia, or diabetes (IFPRI, 2016). See also Chapter 6.
- 29 Pingali, 2012.
- 30 It was estimated that in the absence of the green revolution, crop yields in developing countries would have decreased by 23.5%, with prices between 35% and 66% higher in 2000. Caloric intake would have fallen by 14.4%, and the percentage of malnourished children would have increased by 8% (Evenson and Gollin, 2003).
- 31 Juma, 2011, 2015; Juma and Gordon, 2015.
- 32 See Dutta et al., 2015.
- 33 See, for example, WIPO, 2011. See also the ongoing WIPO project on 'International Comparison of Knowledge Transfer Policies and Practices' in collaboration with the Chinese Ministry of Science and Technology (MOST); further details are available at [http://www.wipo.int/econ\\_stat/en/economics/studies/](http://www.wipo.int/econ_stat/en/economics/studies/).
- 34 On informal actors, see Kraemer-Mbula and Wunsch-Vincent, 2016.
- 35 Economies are grouped according to the World Bank classification (July 2016) gross national income (GNI) per capita, calculated using the World Bank Atlas method. The groups are: low income, US\$1,025 or less; lower-middle income, US\$1,026 to US\$4,035; upper-middle income, US\$4,036 to US\$12,475; and high income, US\$12,476 or more.
- 36 Since 2012, the regional groups have been based on the United Nations Classification: EUR = Europe; NAC = Northern America; LCN = Latin America and the Caribbean; CSA = Central and Southern Asia; SEA = South East Asia, East Asia, and Oceania; NAWA = Northern Africa and Western Asia; and SSF = Sub-Saharan Africa.
- 37 To address their inherent volatility (see previous GII editions) and thus reduce the swings in the ranking induced by FDI flows, this year the GII takes 3-year averages of FDI net inflows and outflows (see Annex 2).
- 38 Note that any assessment of how the UK's planned withdrawal from the European Union affected the country's GII rank would be speculative, at best. First, most of the data predate the actual related referendum. As is the case with other high-income countries, 37% of the UK's indicators are from 2016; the remaining 63% reflect 2015 and earlier years. Second, the causal relations between plans or the actual withdrawal from the EU and the 2016 GII indicators are complex and uncertain in size and direction.
- 39 See the Preface to this report by the Confederation of Indian Industry.
- 40 Government of India, Press Information Bureau, 2017.
- 41 See also Dutta et al., 2013; Hollanders, 2013; Primi, 2013.

## References and sources

- Adler, G. R. Duval, D. Furceri, S. Kiliç Çelik, K. Koloskova, and M. Poplawski-Ribeiro. 2017. 'Gone with the Headwinds: Global Productivity'. *IMF Staff Discussion Note 17/04*. Washington, DC: IMF.
- Andrews, D., C. Criscuolo, and P. Gal. 2015. 'Frontier firms, technology diffusion and public policy: micro evidence from OECD countries'. *OECD Productivity Working Papers* No. 2. Paris, OECD publishing.
- Conference Board. 2016. *Global Economic Outlook 2016: The Global Economy in a Holding Pattern*. November 2015. New York: The Conference Board.
- . 2017. *Global Economic Outlook 2017: Bucking the Trend—Overcoming Uncertainty, Shocks, and Disruption with Qualitative Growth*. November 2016. New York: The Conference Board.

- Cornell University, INSEAD, and WIPO. 2015. *The Global Innovation Index 2015: Effective Innovation Policies for Development*, eds. S. Dutta, B. Lanvin, and S. Wunsch-Vincent. Ithaca, Fontainebleau, and Geneva: Cornell, INSEAD, and WIPO.
- . 2016. *The Global Innovation Index 2016: Winning with Global Innovation*, eds. S. Dutta, B. Lanvin, and S. Wunsch-Vincent. Ithaca, Fontainebleau, and Geneva: Cornell, INSEAD, and WIPO.
- Decker, R., J. Haltiwanger, R.S. Jarmin, and J. Miranda. 2016. 'Where Has All the Skewness Gone? The Decline in High-Growth (Young) Firms in the U.S.', *European Economic Review* 86 (July): 4-23.
- Dutta, S., D. Benavente, B. Lanvin, and S. Wunsch-Vincent. 2013. 'The Global Innovation Index 2013: Local Dynamics Keep Innovation Strong in the Face of Crisis'. In *The Global Innovation Index 2013: The Local Dynamics of Innovation*, eds. S. Dutta and B. Lanvin. Ithaca and Fontainebleau: Cornell, INSEAD, 3-67.
- Dutta, S., R. Escalona Reynoso, A. Bernard, B. Lanvin, and S. Wunsch-Vincent. 2015. 'The Global Innovation Index 2015: Effective Innovation Policies for Development'. In *The Global Innovation Index 2015: Effective Innovation Policies for Development*, eds. S. Dutta, B. Lanvin, and S. Wunsch-Vincent. Geneva, Ithaca, and Fontainebleau: Cornell, INSEAD, and WIPO. 3-63.
- Escalona Reynoso, R., A. L. Bernard, M. Saisana, M. Schaaper, F. Guadagno, and S. Wunsch-Vincent. 2015. 'Benchmarking Innovation Performance at the Global and Country Levels'. In *The Global Innovation Index 2015: Effective Innovation Policies for Development*, eds. S. Dutta, B. Lanvin, and S. Wunsch-Vincent. Geneva, Ithaca, and Fontainebleau: Cornell, INSEAD, and WIPO. 65-80.
- European Commission. 2016. 'The 2016 EU Industrial R&D Investment Scoreboard'. Authors Héctor Hernández, Alexander Tübke, Fernando Hervás, Antonio Vezzani, Mafini Dosso, Sara Amoroso, and Nicola Grassano. Seville, Spain: European Commission, Joint Research Centre.
- Evenson, R. E., and D. Gollin. 2003. 'Assessing the Impact of the Green Revolution, 1960 to 2000'. *Science* 300: 758-62.
- FAO (Food and Agriculture Organization of the United Nations). 2016. *The State of Food and Agriculture 2016: Climate Change, Agriculture and Food Security*. Rome: FAO.
- FAO, IFAD, and WFP (Food and Agriculture Organization of the United Nations, International Fund for Agricultural Development, and World Food Programme). 2015. *The State of Food Insecurity in the World 2015. Meeting the 2015 International Hunger Targets: Taking Stock of Uneven Progress*. Rome: FAO.
- Fernald, J. 2014. 'Productivity and Potential Output before, during, and after the Great Recession'. *NBER Working Paper* 20248. Cambridge, MA: National Bureau of Economic Research.

- Government of India, Press Information Bureau. 2017. 'Amitabh Kant Launches India Innovation Index'. Press Information Bureau, Government of India, NITI Aayog. 2 February 2017. Available at <http://pib.nic.in/newsite/PrintRelease.aspx?relid=157941>.
- Haltiwanger, J. 2011. 'Firm Dynamics and Productivity Growth'. *EIB Papers* 16 (1): 116–36.
- Haltiwanger, J., I. Hathaway, and J. Miranda. 2014. 'Declining Business Dynamism in the U.S. High-Technology Sector'. The Kauffman Foundation. Available at [http://www.kauffman.org/~media/kauffman\\_org/research%20reports%20and%20covers/2014/02/declining\\_business\\_dynamism\\_in\\_us\\_high\\_tech\\_sector.pdf](http://www.kauffman.org/~media/kauffman_org/research%20reports%20and%20covers/2014/02/declining_business_dynamism_in_us_high_tech_sector.pdf).
- Hollanders, H. 2013. 'Measuring Regional Innovation: A European Perspective'. In *The Global Innovation Index 2013: The Local Dynamics of Innovation*, eds. S. Dutta and B. Lanvin. Ithaca and Fontainebleau: Cornell, INSEAD. 79–86.
- IFPRI (International Food Policy Research Institute). 2016. *Global Nutrition Report 2016: From Promise to Impact: Ending Malnutrition by 2030*. Washington, DC: IFPRI.
- IMF (International Monetary Fund). 2016. Fiscal Policies for Innovation and Growth'. In *Fiscal Monitor: Acting Now, Acting Together*. April 2016. Washington, DC: IMF. Chapter 2.
- . 2017. 'Global Prospects and Policies'. *World Economic Outlook (WEO): Gaining Momentum?* April 2017. Washington, DC: IMF.
- Juma, C. 2011. 'Preventing Hunger: Biotechnology Is Key'. *Nature* 479: 471–72.
- . 2015. *The New Harvest: Agricultural Innovation in Africa*. New York: Oxford University Press.
- Juma, C. and K. Gordon. 2015. 'Taking Root: Global Trends in Agricultural Biotechnology'. *Discussion Paper*, Belfer Center for Science and International Affairs.
- Kraemer-Mbula, E. and S. Wunsch-Vincent. 2016. *The Informal Economy in Developing Nations: Hidden Engine of Innovation?* New York: Cambridge University Press.
- Lee, K. 2016. *Economic Catch-Up and Technological Leapfrogging: The Path to Development and Macroeconomic Stability in Korea*. Cheltenham, UK: Edward Elgar Publishing.
- OECD (Organisation for Economic Co-operation and Development). 2009. *Policy Responses to the Economic Crisis: Investing in Innovation for Long-Term Growth*, eds. D. Guelllec and S. Wunsch-Vincent. Paris: OECD Publishing.
- . 2015. *The Future of Productivity*. Paris: OECD publishing.
- . 2017a. *OECD Interim Economic Outlook*. March 2017. Paris: OECD Publishing.
- . 2017b. Main Science and Technology Indicators (MSTI). Last update: MSTI 7 February 2017. Available at <http://www.oecd.org/science/inno/msti.htm>.
- Pingali, P. L. 2012. 'Green Revolution: Impacts, Limits, and the Path Ahead'. *Proceedings of the National Academy of Sciences of the United States of America* 109 (31): 12302–08.
- Primi, A. 2013. 'The Evolving Geography of Innovation: A Territorial Perspective'. In *The Global Innovation Index 2013: The Local Dynamics of Innovation*, eds. S. Dutta and B. Lanvin. Ithaca and Fontainebleau: Cornell, INSEAD. 69–78.
- Strategy&. 2016. '2016 Global Innovation 1000: Software-as-a-Catalyst. Fact Pack'. October 2016. PwC. Available at <https://www.strategyand.pwc.com/media/file/2016-Global-Innovation-1000-Fact-Pack.pdf>.
- UNCTAD (United Nation Conference on Trade and Development). 2016. *Global Investment Trends Monitor No. 24. October 2016*. Geneva and New York: UNCTAD. Available at [http://unctad.org/en/PublicationsLibrary/webdiaeia2016d3\\_en.pdf](http://unctad.org/en/PublicationsLibrary/webdiaeia2016d3_en.pdf).
- . 2017. *Global Investment Trends Monitor No. 25. February 2017*. Geneva and New York: UNCTAD. Available at [http://unctad.org/en/PublicationsLibrary/webdiaeia2017d1\\_en.pdf](http://unctad.org/en/PublicationsLibrary/webdiaeia2017d1_en.pdf).
- WIPO (World Intellectual Property Organization) 2011. 'Harnessing Public Research for Innovation: The Role of Intellectual Property'. In *World Intellectual Property Report 2011: The Changing Face of Innovation*. Geneva: WIPO. Chapter 4.
- . 2015. *World Intellectual Property Report: Breakthrough Innovation and Economic Growth*. Geneva: WIPO.
- . 2016. *World Intellectual Property Indicators 2016*. Geneva: WIPO.
- . 2017 (forthcoming). *World Intellectual Property Report: Intangible Assets and Global Value Chains*. Geneva: WIPO.
- World Bank. 2017. 'Global Outlook: Subdued Growth, Shifting Policies, Heightened Uncertainty'. *Global Economic Prospects 2017: Weak Investment in Uncertain Times*. Washington, DC: World Bank Group.
- WTO (World Trade Organization) 2017. 'Trade Recovery Expected in 2017 and 2018, Amid Policy Uncertainty'. World Trade Organization Press Release. PRESS/793. 12 April 2017. Geneva: WTO.





## The Global Innovation Index (GII) Conceptual Framework

### The rationale for the Global Innovation Index

The Global Innovation Index (GII) project was launched by Professor Dutta at INSEAD in 2007 with the simple goal of determining how to find metrics and approaches that better capture the richness of innovation in society and go beyond such traditional measures of innovation as the number of research articles and the level of research and development (R&D) expenditures.<sup>1</sup>

There were several motivations for setting this goal. First, innovation is important for driving economic progress and competitiveness—both for developed and developing economies. Many governments are putting innovation at the centre of their growth strategies. Second, the definition of innovation has broadened—it is no longer restricted to R&D laboratories and to published scientific papers. Innovation could be and is more general and horizontal in nature, and includes social innovations and business model innovations as well as technical ones. Last but not least, recognizing and celebrating innovation in emerging markets is seen as critical for inspiring people—especially the next generation of entrepreneurs and innovators.

Now in its 10th edition, the GII helps to create an environment in which innovation factors are under continual evaluation, and it provides a key tool for decision makers and a

rich database of detailed metrics for refining innovation policies.

The GII is not meant to be the ultimate and definitive ranking of economies with respect to innovation. Measuring innovation outputs and impacts remains difficult, hence great emphasis is placed on measuring the climate and infrastructure for innovation and on assessing related outcomes.

Although the end results take the shape of several rankings, the GII is more concerned with improving the ‘journey’ to better measure and understand innovation and with identifying targeted policies, good practices, and other levers that foster innovation. The rich metrics can be used—on the level of the index, the sub-indices, or the actual raw data of individual indicators—to monitor performance over time and to benchmark developments against countries in the same region or income classification.

Drawing on the expertise of the GII’s Knowledge Partners and its prominent Advisory Board, the GII model is continually updated to reflect the improved availability of statistics and our understanding of innovation. This year the model continues to evolve, although its mature state now requires only minor updates (refer to Annex 2).

### An inclusive perspective on innovation

The GII adopts a broad notion of innovation, originally elaborated

in the *Oslo Manual* developed by the European Communities and the Organisation for Economic Co-operation and Development (OECD):<sup>2</sup>

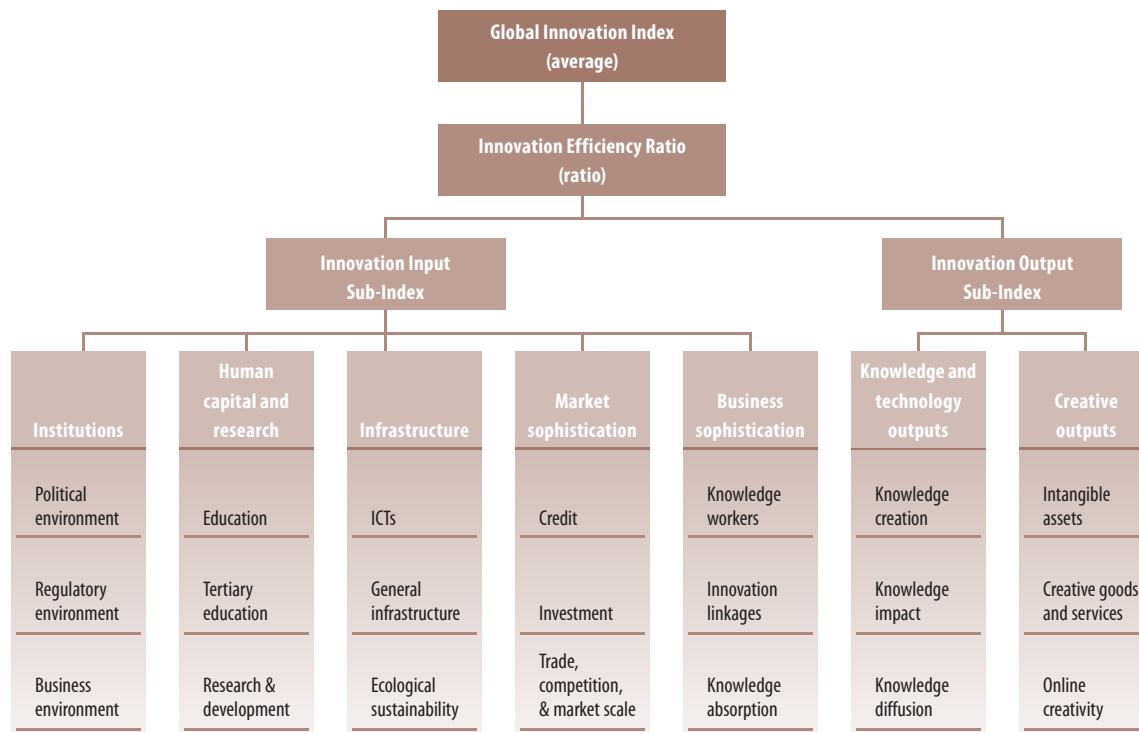
An innovation is the implementation of a new or significantly improved product (good or service), a new process, a new marketing method, or a new organizational method in business practices, workplace organization, or external relations.

This definition reflects the evolution of the way innovation has been perceived and understood over the last two decades.<sup>3</sup>

Economists and policy makers used to focus on R&D-based technological product innovation, largely produced in-house and mostly in manufacturing industries. This type of innovation was performed by a highly educated labour force in R&D-intensive companies. The process leading to such innovation was conceptualized as closed, internal, and localized. Technological breakthroughs were necessarily ‘radical’ and took place at the ‘global knowledge frontier’. This characterization implied the existence of leading and lagging countries, with low- or middle-income economies only catching up.

Today innovation capability is seen more as the ability to exploit new technological combinations; it embraces the notion of incremental innovation and ‘innovation without research’. Non-R&D innovative expenditure is an important

Figure 1: Framework of the Global Innovation Index 2017



component of reaping the rewards of technological innovation. Interest in understanding how innovation takes place in low- and middle-income countries is increasing, along with an awareness that incremental forms of innovation can impact development. Furthermore, the process of innovation itself has changed significantly. Investment in innovation-related activity has consistently intensified at the firm, country, and global levels, adding both new innovation actors from outside high-income economies and nonprofit actors. The structure of knowledge production activity is more complex and geographically dispersed than ever.

A key challenge is to find metrics that capture innovation as it actually happens in the world today.<sup>4</sup> Direct official measures that quantify innovation outputs remain extremely

scarce.<sup>5</sup> For example, there are no official statistics on the amount of innovative activity—defined as the number of new products, processes, or other innovations—for any given innovation actor, let alone for any given country (see Box 1, Annex 1 of Chapter 1 in the GII 2013). Most measures also struggle to appropriately capture the innovation outputs of a wider spectrum of innovation actors, such as the services sector or public entities.

The GII aims to move beyond the mere measurement of such simple innovation metrics. To do so will require the integration of new variables, with a trade-off between the quality of the variable on the one hand and achieving good country coverage on the other hand.

The timeliest possible indicators are used for the GII: 38.7% of data

obtained are from 2016, 38.1% are from 2015, 11.3% are from 2014, 5.7% from 2013, and the small remainder 6.3% from earlier years.<sup>6</sup>

### The GII conceptual framework

The GII is an evolving project that builds on its previous editions while incorporating newly available data and that is inspired by the latest research on the measurement of innovation. This year the GII model includes 127 countries/economies, which represent 92.5% of the world's population and 97.6% of the world's GDP (in current US dollars). The GII relies on two sub-indices—the Innovation Input Sub-Index and the Innovation Output Sub-Index—each built around pillars. Four measures are calculated (see Figure 1):



1. **Innovation Input Sub-Index:** Five input pillars capture elements of the national economy that enable innovative activities.
2. **Innovation Output Sub-Index:** Innovation outputs are the results of innovative activities within the economy. Although the Output Sub-Index includes only two pillars, it has the same weight in calculating the overall GII scores as the Input Sub-Index.
3. **The overall GII score** is the simple average of the Input and Output Sub-Indices.
4. **The Innovation Efficiency Ratio** is the ratio of the Output Sub-Index to the Input Sub-Index. It shows how much innovation output a given country is getting for its inputs.

Each pillar is divided into three sub-pillars, each of which is composed of individual indicators, for a total of 81 indicators this year. The GII pays special attention to presenting a scoreboard for each economy that includes strengths and weaknesses (Appendix I Country/Economy Profiles), making accessible the data series (Appendix II Data Tables), and providing data sources and definitions (Appendix III) and detailed technical notes (Appendix IV). Adjustments to the GII framework, including a detailed analysis of the factors influencing year-on-year changes, are detailed in Annex 2. In addition, since 2011 the GII has been submitted to an independent statistical audit performed by the Joint Research Centre of the European Union (results are detailed in Annex 3).

A table is included here for each pillar. That table provides a list of the pillar's indicators, specifying their type (composite indicators are

**Table 1a: Institutions pillar**

| Indicator   | Average value by income group |                     |                     |            | Mean  |
|---|-------------------------------|---------------------|---------------------|------------|-------|
|   | High income                   | Upper-middle income | Lower-middle income | Low income |       |
| <b>1 Institutions</b>   |                               |                     |                     |            |       |
| <b>1.1 Political environment</b>                              |                               |                     |                     |            |       |
| 1.1.1 Political stability and safety*                         | 0.69                          | -0.23               | -0.80               | -0.66      | -0.06 |
| 1.1.2 Government effectiveness*                               | 1.21                          | 0.04                | -0.50               | -0.78      | 0.26  |
| <b>1.2 Regulatory environment</b>                             |                               |                     |                     |            |       |
| 1.2.1 Regulatory quality <sup>a</sup>                         | 1.19                          | 0.03                | -0.45               | -0.63      | 0.28  |
| 1.2.2 Rule of law <sup>a</sup>                                | 1.19                          | -0.22               | -0.60               | -0.64      | 0.18  |
| 1.2.3 Cost of redundancy dismissal, salary weeks <sup>b</sup> | 14.60                         | 17.95               | 26.60               | 16.18      | 18.29 |
| <b>1.3 Business environment</b>                               |                               |                     |                     |            |       |
| 1.3.1 Ease of starting a business*                            | 90.29                         | 84.76               | 82.13               | 79.87      | 85.64 |
| 1.3.2 Ease of resolving insolvency*                           | 68.24                         | 51.63               | 39.85               | 38.80      | 53.69 |
| 1.3.3 Ease of paying taxes*                                   | 83.83                         | 69.51               | 59.52               | 57.51      | 71.19 |

Note: (\*) index, (†) survey question, (a) half weight, (b) higher values indicate worse outcomes.

identified with an asterisk “\*”, survey questions with a dagger “†”, and the remaining indicators are hard data); their weight in the index (indicators with half weight are identified with the letter ‘a’); and the direction of their effect (indicators for which higher values imply worse outcomes are identified with the letter ‘b’). The table then provides each indicator's average values (in their respective units) per income group (World Bank classification) and for the whole sample of 127 countries/economies retained in the final computation (Tables 1a through 1g).

### The Innovation Input Sub-Index

The first sub-index of the GII, the Innovation Input Sub-Index, has five enabler pillars: Institutions, Human capital and research, Infrastructure, Market sophistication, and Business sophistication. Enabler pillars define aspects of the environment conducive to innovation within an economy.

#### Pillar 1: Institutions

Nurturing an institutional framework that attracts business and fosters growth by providing good governance and the correct levels of protection and incentives is essential

to innovation. The Institutions pillar captures the institutional framework of a country (Table 1a).

The Political environment sub-pillar includes two indices: one that reflects perceptions of the likelihood that a government might be destabilized; and one that reflects the quality of public and civil services, policy formulation, and implementation.

The Regulatory environment sub-pillar draws on two indices aimed at capturing perceptions on the ability of the government to formulate and implement cohesive policies that promote the development of the private sector and at evaluating the extent to which the rule of law prevails (in aspects such as contract enforcement, property rights, the police, and the courts). The third indicator evaluates the cost of redundancy dismissal as the sum, in salary weeks, of the cost of advance notice requirements added to severance payments due when terminating a redundant worker.

The Business environment sub-pillar expands on three aspects that directly affect private entrepreneurial endeavours by using the World Bank indices on the ease of starting a business; the ease of resolving insolvency (based on the recovery rate recorded as the cents on the

**Table 1b: Human capital & research pillar**

| Indicator  | Average value by income group |                     |                     |            | Mean     |
|--|-------------------------------|---------------------|---------------------|------------|----------|
|  | High income                   | Upper-middle income | Lower-middle income | Low income |          |
| <b>2 Human capital and research</b>                        |                               |                     |                     |            |          |
| <b>2.1 Education</b>                                       |                               |                     |                     |            |          |
| 2.1.1 Expenditure on education, % GDP                      | 5.49                          | 4.56                | 4.21                | 4.75       | 4.75     |
| 2.1.2 Govt expend. on edu./pupil, secondary <sup>1</sup>   | 24.86                         | 17.65               | 17.97               | 25.17      | 21.17    |
| 2.1.3 School life expectancy, years                        | 16.56                         | 14.31               | 11.86               | 9.67       | 13.95    |
| 2.1.4 PISA scales in reading, maths & science <sup>a</sup> | 489.53                        | 416.63              | 405.24              | n/a        | 459.98   |
| 2.1.5 Pupil-teacher ratio, secondary <sup>a,b</sup>        | 11.25                         | 15.06               | 20.07               | 27.26      | 16.52    |
| <b>2.2 Tertiary education</b>                              |                               |                     |                     |            |          |
| 2.2.1 Tertiary enrolment, % gross <sup>a</sup>             | 66.29                         | 47.38               | 28.27               | 7.28       | 44.83    |
| 2.2.2 Graduates in science & engineering, %                | 22.76                         | 21.04               | 22.06               | 14.44      | 21.32    |
| 2.2.3 Tertiary inbound mobility, % <sup>a</sup>            | 9.96                          | 3.45                | 1.53                | 3.42       | 5.77     |
| <b>2.3 Research and development (R&amp;D)</b>              |                               |                     |                     |            |          |
| 2.3.1 Researchers, FTE/mn pop.                             | 3,680.04                      | 792.86              | 449.14              | 68.47      | 1,938.71 |
| 2.3.2 Gross expenditure on R&D, % GDP                      | 1.65                          | 0.55                | 0.34                | 0.36       | 0.96     |
| 2.3.3 Global R&D firms, avg. exp. top 3, mn \$US           | 1,332.33                      | 154.67              | 37.95               | 0.00       | 554.25   |
| 2.3.4 QS university ranking, average score top 3*          | 39.97                         | 18.48               | 6.93                | 0.18       | 21.70    |

Note: (\*) index, (†) survey question, (a) half weight, (b) higher values indicate worse outcomes. FTE = full-time equivalence.

<sup>1</sup> Scaled by percent of GDP per capita.

**Table 1c: Infrastructure pillar**

| Indicator   | Average value by income group |                     |                     |            | Mean     |
|---|-------------------------------|---------------------|---------------------|------------|----------|
|   | High income                   | Upper-middle income | Lower-middle income | Low income |          |
| <b>3 Infrastructure</b>   |                               |                     |                     |            |          |
| <b>3.1 Information and communication technologies (ICTs)</b>    |                               |                     |                     |            |          |
| 3.1.1 ICT access*   | 8.08                          | 5.98                | 4.41                | 2.68       | 6.01     |
| 3.1.2 ICT use*  | 6.86                          | 4.36                | 2.30                | 0.86       | 4.41     |
| 3.1.3 Governments online service*                               | 0.77                          | 0.57                | 0.46                | 0.28       | 0.58     |
| 3.1.4 E-participation*  | 0.75                          | 0.57                | 0.49                | 0.30       | 0.59     |
| <b>3.2 General infrastructure</b>                               |                               |                     |                     |            |          |
| 3.2.1 Electricity output, kWh/cap <sup>a</sup>                  | 9,396.97                      | 3,285.84            | 1,135.44            | 221.18     | 5,031.15 |
| 3.2.2 Logistics performance <sup>a,†</sup>                      | 3.60                          | 2.83                | 2.64                | 2.56       | 3.04     |
| 3.2.3 Gross capital formation, % GDP                            | 21.81                         | 25.33               | 22.27               | 24.49      | 23.22    |
| <b>3.3 Ecological sustainability</b>                            |                               |                     |                     |            |          |
| 3.3.1 GDP/unit of energy use, 2010 PPP\$/kg oil eq.             | 10.15                         | 9.73                | 8.84                | 4.36       | 9.29     |
| 3.3.2 Environmental performance*                                | 82.18                         | 74.11               | 65.77               | 47.86      | 72.08    |
| 3.3.3 ISO 14001 environ. certificates/bn PPP\$ GDP <sup>a</sup> | 4.45                          | 2.73                | 0.56                | 0.23       | 2.60     |

Note: (\*) index, (†) survey question, (a) half weight, (b) higher values indicate worse outcomes. kWh = kilowatt hours.

dollar recouped by creditors through reorganization, liquidation, or debt enforcement/foreclosure proceedings); and the ease of paying taxes.

### Pillar 2: Human capital and research

The level and standard of education and research activity in a country are prime determinants of the innovation capacity of a nation. This pillar tries to gauge the human capital of countries (Table 1b).

The first sub-pillar includes a mix of indicators aimed at capturing

achievements at the elementary and secondary education levels. Education expenditure and school life expectancy are good proxies for coverage. Government expenditure per pupil, secondary gives a sense of the level of priority given to secondary education by the state. The quality of education is measured through the results to the OECD Programme for International Student Assessment (PISA), which examines 15-year-old students' performances in reading,

mathematics, and science, as well as the pupil-teacher ratio.

Higher education is crucial for economies to move up the value chain beyond simple production processes and products. The sub-pillar on tertiary education aims at capturing coverage (tertiary enrolment); priority is given to the sectors traditionally associated with innovation (with a series on the percentage of tertiary graduates in science, engineering, manufacturing, and construction); and the inbound and mobility of tertiary students, which plays a crucial role in the exchange of ideas and skills necessary for innovation.

The last sub-pillar, on R&D, measures the level and quality of R&D activities, with indicators on researchers (full-time equivalence), gross expenditure, the R&D expenditures of top global R&D spenders, and the quality of scientific and research institutions as measured by the average score of the top three universities in the QS World University Ranking of 2016. The R&D expenditures of the top three firms in a given country looks at the average expenditure of these three firms that are part of the top 2,500 R&D spenders worldwide. The QS university rankings indicator gives the average scores of the country's top three universities that belong to the top 700 universities worldwide. These indicators are not aimed at assessing the average level of all institutions within a particular economy.

### Pillar 3: Infrastructure

The third pillar includes three sub-pillars: Information and communication technologies (ICTs), General infrastructure, and Ecological sustainability (Table 1c).

Good and ecologically friendly communication, transport, and energy infrastructures facilitate the

production and exchange of ideas, services, and goods and feed into the innovation system through increased productivity and efficiency, lower transaction costs, better access to markets, and sustainable growth.

The ICTs sub-pillar includes four indices developed by international organizations on ICT access, ICT use, online service by governments, and online participation of citizens.

The sub-pillar on general infrastructure includes the average of electricity output in kWh per capita; a composite indicator on logistics performance; and gross capital formation, which consists of outlays on additions to the fixed assets and net inventories of the economy, including land improvements (fences, ditches, drains); plant, machinery, and equipment purchases; and the construction of roads, railways, and the like, including schools, offices, hospitals, private residential dwellings, and commercial and industrial buildings.

The sub-pillar on ecological sustainability includes three indicators: GDP per unit of energy use (a measure of efficiency in the use of energy), the Environmental Performance Index of Yale and Columbia Universities, and the number of certificates of conformity with standard ISO 14001 on environmental management systems issued.

#### Pillar 4: Market sophistication

The availability of credit and an environment that supports investment, access to the international market, competition, and market scale are all critical for businesses to prosper and for innovation to occur. The Market sophistication pillar has three sub-pillars structured around market conditions and the total level of transactions (Table 1d).

**Table 1d: Market sophistication pillar**

| Indicator  | Average value by income group |                     |                     |            | Mean   |
|--|-------------------------------|---------------------|---------------------|------------|--------|
|  | High income                   | Upper-middle income | Lower-middle income | Low income |        |
| <b>4 Market sophistication</b>                             |                               |                     |                     |            |        |
| <b>4.1 Credit</b>  |                               |                     |                     |            |        |
| 4.1.1 Ease of getting credit*                              | 59.79                         | 60.29               | 55.74               | 36.76      | 55.98  |
| 4.1.2 Domestic credit to private sector, % GDP             | 99.09                         | 59.83               | 41.61               | 23.82      | 66.31  |
| 4.1.3 Microfinance gross loans, % GDP                      | 0.15                          | 0.95                | 3.63                | 0.98       | 1.79   |
| <b>4.2 Investment</b>                                      |                               |                     |                     |            |        |
| 4.2.1 Ease of protecting minority investors*               | 62.98                         | 58.86               | 53.33               | 43.63      | 57.20  |
| 4.2.2 Market capitalization, % GDP <sup>a</sup>            | 93.18                         | 41.80               | 28.10               | 21.82      | 60.25  |
| 4.2.3 Venture capital deals/bn PPP\$ GDP <sup>a</sup>      | 0.11                          | 0.02                | 0.02                | 0.03       | 0.06   |
| <b>4.3 Trade, competition, and market scale</b>            |                               |                     |                     |            |        |
| 4.3.1 Applied tariff rate, weighted mean, % <sup>a,b</sup> | 1.84                          | 3.79                | 5.35                | 8.99       | 4.08   |
| 4.3.2 Intensity of local competition <sup>†</sup>          | 5.42                          | 5.01                | 4.88                | 4.67       | 5.10   |
| 4.3.3 Domestic market scale, bn PPP\$                      | 1,120.76                      | 1,183.87            | 700.32              | 48.06      | 905.18 |

Note: (\*) index, (†) survey question, (a) half weight, (b) higher values indicate worse outcomes.

The Credit sub-pillar includes a measure on the ease of getting credit aimed at measuring the degree to which collateral and bankruptcy laws facilitate lending by protecting the rights of borrowers and lenders, as well as the rules and practices affecting the coverage, scope, and accessibility of credit information. Transactions are given by the total value of domestic credit and, in an attempt to make the model more applicable to emerging markets, by the gross loan portfolio of microfinance institutions.

The Investment sub-pillar includes the ease of protecting minority investors index as well as two indicators on the level of transactions. These two indicators look at whether market size is matched by market dynamism and provide a hard data metric on venture capital deals.

The last sub-pillar tackles trade, competition, and market scale. The market conditions for trade are given in the first indicator measuring the average tariff rate weighted by import shares. The second indicator is a survey question that reflects the intensity of competition in local markets. Efforts made at finding hard data on competition so far remain

unsuccessful. Domestic market scale, as measured by an economy's GDP, was incorporated in 2016, so the last sub-pillar takes into consideration the impact that the size of an economy has on its capacity to introduce and test innovations in the market place.

#### Pillar 5: Business sophistication

The last enabler pillar tries to capture the level of business sophistication to assess how conducive firms are to innovation activity (Table 1e). The Human capital and research pillar (pillar 2) made the case that the accumulation of human capital through education, particularly higher education and the prioritization of R&D activities, is an indispensable condition for innovation to take place. That logic is taken one step further here with the assertion that businesses foster their productivity, competitiveness, and innovation potential with the employment of highly qualified professionals and technicians.

The first sub-pillar includes four quantitative indicators on knowledge workers: employment in knowledge-intensive services; the availability of formal training at the firm level; R&D performed by

**Table 1e: Business sophistication pillar**

| Indicator   | Average value by income group |                     |                     |            | Mean  |
|---|-------------------------------|---------------------|---------------------|------------|-------|
|   | High income                   | Upper-middle income | Lower-middle income | Low income |       |
| <b>5 Business sophistication</b>  |                               |                     |                     |            |       |
| <b>5.1 Knowledge workers</b>  |                               |                     |                     |            |       |
| 5.1.1 Knowledge-intensive employment, %.....                              | 38.87                         | 23.03               | 17.99               | 3.73       | 27.37 |
| 5.1.2 Firms offering formal training, % firms.....                        | 40.37                         | 38.43               | 32.05               | 28.41      | 35.00 |
| 5.1.3 GERD performed by business, % GDP <sup>a</sup> .....                | 1.06                          | 0.28                | 0.10                | 0.04       | 0.63  |
| 5.1.4 GERD financed by business, % <sup>a</sup> .....                     | 43.84                         | 25.65               | 15.82               | 5.87       | 31.32 |
| 5.1.5 Females emp. w/adv. degrees, % tot. emp. <sup>a</sup> .....         | 18.81                         | 13.01               | 10.02               | 2.27       | 14.54 |
| <b>5.2 Innovation linkages</b>  |                               |                     |                     |            |       |
| 5.2.1 University/industry research collaboration <sup>†a</sup> .....      | 4.26                          | 3.40                | 3.21                | 3.13       | 3.66  |
| 5.2.2 State of cluster development <sup>†</sup> .....                     | 4.37                          | 3.64                | 3.48                | 3.29       | 3.85  |
| 5.2.3 GERD financed by abroad, %.....                                     | 14.14                         | 9.09                | 8.98                | 30.63      | 13.49 |
| 5.2.4 JV-strategic alliance deals/bn PPP\$ GDP <sup>a</sup> .....         | 0.07                          | 0.02                | 0.02                | 0.02       | 0.04  |
| 5.2.5 Patent families filed in 2+ offices/bn PPP\$ GDP <sup>a</sup> ..... | 3.38                          | 0.16                | 0.09                | 0.07       | 1.44  |
| <b>5.3 Knowledge absorption</b>   |                               |                     |                     |            |       |
| 5.3.1 Intellectual property payments, % total trade <sup>a</sup> .....    | 1.90                          | 0.69                | 0.44                | 0.13       | 1.00  |
| 5.3.2 High-tech imports less re-imports, % total trade.....               | 10.27                         | 9.81                | 7.98                | 7.91       | 9.36  |
| 5.3.3 ICT services imports, % total trade.....                            | 1.67                          | 0.93                | 0.86                | 1.71       | 1.30  |
| 5.3.4 FDI net inflows, % GDP.....   | 5.32                          | 3.94                | 3.18                | 5.32       | 4.49  |
| 5.3.5 Research talent, % in business enterprise.....                      | 42.75                         | 23.24               | 20.23               | 17.04      | 32.44 |

Note: (\*) index, (†) survey question, (a) half weight, (b) higher values indicate worse outcomes. GERD = gross domestic expenditure on R&D.

business enterprise (GERD) as a percentage of GDP (i.e., GERD over GDP); and the percentage of total gross expenditure of R&D that is financed by business enterprise. In addition, the sub-pillar includes an indicator related to the percentage of females employed with advanced degrees. This indicator, in addition to providing a glimpse into the gender labour distributions of nations, offers more information about the degree of sophistication of the local human capital currently employed.

Innovation linkages and public/private/academic partnerships are essential to innovation. In emerging markets, pockets of wealth have developed around industrial or technological clusters and networks, in sharp contrast to the poverty that may prevail in the rest of the territory. The Innovation linkages sub-pillar draws on both qualitative and quantitative data regarding business/university collaboration on R&D, the prevalence of well-developed and deep clusters, the level of gross R&D expenditure financed by

abroad, and the number of deals on joint ventures and strategic alliances. In addition, the total number of Patent Cooperation Treaty (PCT) and national office published patent family applications filed by residents in at least two offices proxies for international linkages.

In broad terms, pillar 4 on market sophistication makes the case that well-functioning markets contribute to the innovation environment through competitive pressure, efficiency gains, and economies of transaction and by allowing supply to meet demand. Markets that are open to foreign trade and investment have the additional effect of exposing domestic firms to best practices around the globe, which is critical to innovation through knowledge absorption and diffusion, which are considered in pillars 5 and 6. The rationale behind sub-pillars 5.3 on knowledge absorption (an enabler) and 6.3 on knowledge diffusion (a result)—two sub-pillars designed to be mirror images of each other—is precisely that together they will

reveal how good economies are at absorbing and diffusing knowledge.

Sub-pillar 5.3 includes five metrics that are linked to sectors with high-tech content or are key to innovation: intellectual property payments as a percentage of total trade; high-tech net imports as a percentage of total imports; imports of communication, computer and information services as a percentage of total trade; and net inflows of foreign direct investment (FDI) as a percentage of GDP (three-year average). To strengthen the sub-pillar, the percentage of research talent in business was added in 2016 to provide a measurement of professionals engaged in the conception or creation of new knowledge, products, processes, methods and systems, including business management.

### The Innovation Output Sub-Index

Innovation outputs are the results of innovative activities within the economy. Although the Output Sub-Index includes only two pillars, it has the same weight in calculating the overall GII scores as the Input Sub-Index. There are two output pillars: Knowledge and technology outputs and Creative outputs.

### Pillar 6: Knowledge and technology outputs

This pillar covers all those variables that are traditionally thought to be the fruits of inventions and/or innovations (Table 1f). The first sub-pillar refers to the creation of knowledge. It includes five indicators that are the result of inventive and innovative activities: patent applications filed by residents both at the national patent office and at the international level through the PCT; utility model applications filed by residents at the national office; scientific and technical published articles in peer-reviewed journals;

and an economy's number of articles (H) that have received at least H citations.

The second sub-pillar, on knowledge impact, includes statistics representing the impact of innovation activities at the micro- and macro-economic level or related proxies: increases in labour productivity, the entry density of new firms, spending on computer software, the number of certificates of conformity with standard ISO 9001 on quality management systems issued, and the measure of high- and medium-high-tech industrial output over total manufactures output.

The third sub-pillar, on knowledge diffusion, is the mirror image of the knowledge absorption sub-pillar of pillar 5, with the exception of indicator 5.3.5. It includes four statistics all linked to sectors with high-tech content or that are key to innovation: intellectual property receipts as a percentage of total trade; high-tech net exports as a percentage of total exports; exports of ICT services as a percentage of total trade; and net outflows of FDI as a percentage of GDP (three-year average).

### Pillar 7: Creative outputs

The role of creativity for innovation is still largely underappreciated in innovation measurement and policy debates. Since its inception, the GII has always emphasized measuring creativity as part of its Innovation Output Sub-Index. The last pillar, on creative outputs, has three sub-pillars (Table 1g).

The first sub-pillar on intangible assets includes statistics on trademark applications by residents at the national office; industrial designs included in applications at a regional or national office, and two survey questions regarding the use of ICTs in business and organizational

**Table 1f: Knowledge & technology outputs pillar**

| Indicator   | Average value by income group |                     |                     |            | Mean   |
|---|-------------------------------|---------------------|---------------------|------------|--------|
|   | High income                   | Upper-middle income | Lower-middle income | Low income |        |
| <b>6 Knowledge and technology outputs</b>                           |                               |                     |                     |            |        |
| <b>6.1 Knowledge creation</b>                                       |                               |                     |                     |            |        |
| 6.1.1 Patents by origin/bn PPP\$ GDP <sup>a</sup>                   | 7.65                          | 3.02                | 1.27                | 0.25       | 4.10   |
| 6.1.2 PCT patent applications/bn PPP\$ GDP <sup>a</sup>             | 2.50                          | 0.23                | 0.10                | 0.06       | 1.17   |
| 6.1.3 Utility models by origin/bn PPP\$ GDP                         | 1.26                          | 3.23                | 3.19                | 0.19       | 2.40   |
| 6.1.4 Scientific & technical articles/bn PPP\$ GDP <sup>a</sup>     | 30.01                         | 10.82               | 7.22                | 8.66       | 16.94  |
| 6.1.5 Citable documents H index <sup>*a</sup>                       | 422.21                        | 166.28              | 120.37              | 78.91      | 241.56 |
| <b>6.2 Knowledge impact</b>   |                               |                     |                     |            |        |
| 6.2.1 Growth rate of PPP\$ GDP/worker, %                            | 0.70                          | 0.69                | 1.19                | 2.32       | 0.97   |
| 6.2.2 New businesses/th pop. 15–64 <sup>a</sup>                     | 6.12                          | 3.28                | 1.00                | 0.45       | 3.64   |
| 6.2.3 Computer software spending, % GDP <sup>a</sup>                | 0.42                          | 0.21                | 0.19                | 0.07       | 0.26   |
| 6.2.4 ISO 9001 quality certificates/bn PPP\$ GDP <sup>a</sup>       | 14.69                         | 9.35                | 2.73                | 1.33       | 8.89   |
| 6.2.5 High- & medium-high-tech manufactures, % <sup>a</sup>         | 33.74                         | 21.97               | 15.83               | 8.68       | 25.05  |
| <b>6.3 Knowledge diffusion</b>                                      |                               |                     |                     |            |        |
| 6.3.1 Intellectual property receipts, % total trade <sup>a</sup>    | 1.20                          | 0.08                | 0.11                | 0.05       | 0.51   |
| 6.3.2 High-tech exports less re-exports, % total trade <sup>a</sup> | 6.87                          | 4.55                | 2.15                | 0.34       | 4.39   |
| 6.3.3 ICT services exports, % total trade <sup>a</sup>              | 2.99                          | 1.73                | 2.34                | 2.34       | 2.42   |
| 6.3.4 FDI net outflows, % GDP                                       | 3.59                          | 0.95                | 0.22                | 0.52       | 1.75   |

Note: (\*) index, (t) survey question, (a) half weight, (b) higher values indicate worse outcomes.

**Table 1g: Creative outputs pillar**

| Indicator  | Average value by income group |                     |                     |            | Mean  |
|--|-------------------------------|---------------------|---------------------|------------|-------|
|  | High income                   | Upper-middle income | Lower-middle income | Low income |       |
| <b>7 Creative outputs</b>  |                               |                     |                     |            |       |
| <b>7.1 Intangible assets</b>                                       |                               |                     |                     |            |       |
| 7.1.1 Trademarks by origin/bn PPP\$ GDP                            | 56.96                         | 56.80               | 45.97               | 16.72      | 49.60 |
| 7.1.2 Industrial designs by origin/bn PPP\$ GDP <sup>a</sup>       | 5.35                          | 3.09                | 4.48                | 1.26       | 4.10  |
| 7.1.3 ICTs & business model creation <sup>†</sup>                  | 5.28                          | 4.51                | 4.25                | 3.89       | 4.68  |
| 7.1.4 ICTs & organizational model creation <sup>†</sup>            | 4.93                          | 4.04                | 3.87                | 3.40       | 4.28  |
| <b>7.2 Creative goods and services</b>                             |                               |                     |                     |            |       |
| 7.2.1 Cultural & creative services exp, % total trade <sup>a</sup> | 0.85                          | 0.58                | 0.08                | 0.23       | 0.54  |
| 7.2.2 National feature films/mn pop. 15–69 <sup>a</sup>            | 9.35                          | 3.30                | 2.90                | 1.30       | 5.52  |
| 7.2.3 Global ent. & media market/th pop. 15–69 <sup>a</sup>        | 1.26                          | 0.19                | 0.05                | n/a        | 0.78  |
| 7.2.4 Printing & publishing manufactures, %                        | 2.21                          | 1.62                | 1.12                | 1.55       | 1.78  |
| 7.2.5 Creative goods exports, % total trade                        | 1.90                          | 1.70                | 0.86                | 0.07       | 1.39  |
| <b>7.3 Online creativity</b>                                       |                               |                     |                     |            |       |
| 7.3.1 Generic TLDs/th pop. 15–69                                   | 33.42                         | 5.79                | 1.37                | 0.32       | 14.56 |
| 7.3.2 Country-code TLDs/th pop. 15–69                              | 31.69                         | 6.52                | 0.91                | 0.77       | 14.07 |
| 7.3.3 Wikipedia yearly edits/mn pop. 15–69                         | 60.37                         | 46.09               | 33.69               | 9.93       | 44.01 |
| 7.3.4 Video uploads on YouTube/pop. 15–69                          | 48.20                         | 25.32               | 11.43               | 0.94       | 35.41 |

Note: (\*) index, (t) survey question, (a) half weight, (b) higher values indicate worse outcomes. Scores rather than values are presented for indicators 7.3.1, 7.3.2, 7.3.3, and 7.3.4. TLDs = top-level domains.

models, new areas that are increasingly linked to process innovations in the literature.

The second sub-pillar on creative goods and services includes proxies to get at creativity and the creative outputs of an economy. In 2014, in an attempt to include broader sectoral coverage, a global entertainment and media output

composite was added. In addition, the indicator on audio-visual and related services exports was renamed 'Cultural and creative services exports' and expanded to include information services, advertising, market research and public opinion polling, and other personal, cultural, and recreational services (as a percentage of total trade). These two



indicators complement the remainder of the sub-pillar, which measures national feature films produced in a given country (per capita count); printing and publishing output (as a percentage of total manufactures output); and creative goods exports (as a percentage of total trade), all of which are aimed at providing an overall sense of the international reach of creative activities in the country.

The third sub-pillar on online creativity includes four indicators, all scaled by population aged 15 through 69 years old: generic and country-code top level domains, average yearly edits to Wikipedia; and video uploads on YouTube. Attempts made to strengthen this sub-pillar with indicators in areas such as Internet and machine learning, blog posting, online gaming, and the development of applications have so far proved unsuccessful.

- INSEAD. 2011. *The Global Innovation Index 2011: Accelerating Growth and Development*, ed. S. Dutta. Fontainebleau: INSEAD.
- OECD (Organisation for Economic Co-operation and Development). 2010. *The OECD Innovation Strategy: Getting a Head Start on Tomorrow*. Paris: OECD.
- . 2011. *OECD Science, Technology and Industry Scoreboard 2011*. Paris: OECD.
- . 2013. *OECD Science, Technology and Industry Scoreboard 2013*. Paris: OECD.
- OECD and Eurostat (Organisation for Economic Co-operation and Development and Eurostat). 2005. *Oslo Manual: Guidelines for Collecting and Interpreting Innovation Data*, 3rd Edition. Paris: OECD Publishing.
- WIPO (World Intellectual Property Organization). 2011. 'The Changing Nature of Innovation and Intellectual Property'. In *World Intellectual Property Report 2011: The Changing Face of Innovation*, Chapter 1. Geneva: WIPO. Available at [http://www.wipo.int/econ\\_stat/en/economics/publications.html](http://www.wipo.int/econ_stat/en/economics/publications.html).

## Notes

- 1 For a fuller introduction to the Global Innovation Index, see the GII 2011.
- 2 OECD and Eurostat, 2005.
- 3 OECD, 2010; INSEAD, 2011; and WIPO, 2011.
- 4 INSEAD, 2011; OECD Scoreboard, 2013; WIPO, 2011.
- 5 INSEAD, 2011; OECD, 2011; WIPO, 2011.
- 6 For completeness, 2.0% of data points are from 2012, 1.2% from 2011, 1.3% from 2010, 0.7% from 2009, 0.7% from 2008, 0.3% from 2007, and 0.1% from 2006. In addition, the GII is calculated on the basis of 9,225 data points (compared to 10,287 with complete series), implying that 10.3% of data points are missing. The Data Tables (Appendix II) include the reference year for each data point and mark missing data as not available (n/a).

## References

- Cornell University, INSEAD, and WIPO (World Intellectual Property Organization). 2013. *The Global Innovation Index 2013: The Local Dynamics of Innovation*, eds. S. Dutta and B. Lanvin. Geneva, Ithaca, and Fontainebleau: Cornell, INSEAD, and WIPO.

## Adjustments to the Global Innovation Index Framework and Year-on-Year Comparability of Results

The Global Innovation Index (GII) is a cross-country performance assessment, compiled on an annual basis, which continuously seeks to update and improve the way innovation is measured. The GII report pays special attention to making accessible the statistics used in the Country/Economy Profiles and Data Tables, providing data sources and definitions, and detailing the computation methodology (Appendices I, II, III, and IV, respectively). This annex summarizes the changes made this year and provides an assessment of the impact of these changes on the comparability of rankings.

### Adjustments to the Global Innovation Index framework

The GII model is revised every year in a transparent exercise. This year, no change was made at either the pillar or the sub-pillar level.

Beyond the use of World Intellectual Property Organization (WIPO) data, we collaborate with both public international bodies such as the International Energy Agency; the United Nations Educational, Scientific and Cultural Organization (UNESCO); the United Nations Industrial Development Organization (UNIDO); the International Telecommunication Union (ITU); and the Joint Research Centre of the European Commission (JRC) as well as with private organizations such as

**Table 1: Changes to the Global Innovation Index framework**

| GII 2016 |  | Adjustment                   | GII 2017 |  |
|----------|--|------------------------------|----------|--|
| 4.2.3    | Total value of stocks traded, % GDP    | Removed                      |          |  |
| 4.2.4    | Venture capital deals/bn PPP\$ GDP     | Number changed               | 4.2.3    | Venture capital deals/bn PPP\$ GDP                   |
| 5.3.4    | Foreign direct investment net inflows  | Name and methodology changed | 5.3.4    | Foreign direct investment net inflows (3-year avg.)  |
| 6.3.4    | Foreign direct investment net outflows | Name and methodology changed | 6.3.4    | Foreign direct investment net outflows (3-year avg.) |
| 7.3.3    | Wikipedia monthly edits                | Name and methodology changed | 7.3.3    | Wikipedia yearly edits                               |

Note: Refer to Annex 1 and Appendix III for a detailed explanation of terminologies. Indicators whose name did not change but methodology at the source did are not part of this list. Refer to Appendix III for a detailed explanation of methodological changes at the source.

the International Organization for Standardization (ISO); IHS Global Insight; QS Quacquarelli Symonds Ltd; Bureau van Dijk (BvD); ZookNIC Inc; and Google to obtain the best available data on innovation measurement globally.

Table 1 provides a summary of adjustments to the GII 2017 framework for quick reference. A total of five indicators were modified this year: one indicator was removed, one indicator changed its number as a result, and three indicators underwent methodological and name changes. Indicators that retained the same name as last year but are derived from a source that changed

its methodology are not identified in Table 1.

The statistical audit performed by the JRC (see Annex 3) provides a confidence interval for each ranking following a robustness and uncertainty analysis of the modelling assumptions.

### Sources of changes in the rankings

The GII compares the performance of national innovation systems across economies, and it also presents changes in economy rankings over time.

Importantly, scores and rankings from one year to the next are not

directly comparable (see Annex 2 of the GII 2013 for a full explanation). Making inferences about absolute or relative performance on the basis of year-on-year differences in rankings can be misleading. Each ranking reflects the relative positioning of that particular country/economy on the basis of the conceptual framework, the data coverage, and the sample of economies—elements that change from one year to another.

A few particular factors influence the year-on-year ranking of a country/economy:

- the actual performance of the economy in question;
- adjustments made to the GII framework;
- data updates, the treatment of outliers, and missing values; and
- the inclusion or exclusion of countries/economies in the sample.

Additionally, the following characteristics complicate the time-series analysis based on simple GII scores or rankings:

- **Missing values.** The GII produces relative index scores, which means that a missing value for one economy affects the index score of other economies. Because the number of missing values decreases every year, this problem is reduced over time.
- **Reference year.** The data underlying the GII do not refer to a single year but to several years, depending on the latest available year for any given variable. In addition, the reference years for different variables are not the same for each economy. The motivation for this approach

is that it widens the set of data points for cross-economy comparability.

- **Normalization factor.** Most GII variables are normalized using either GDP or population. This approach is also intended to enable cross-economy comparability. Yet, again, year-on-year changes in individual variables may be driven either by the variable's numerator or by its denominator.
- **Consistent data collection.** Finally, measuring year-on-year performance changes relies on the consistent collection of data over time. Changes in the definition of variables or in the data collection process could create movements in the rankings that are unrelated to true performance.

A detailed economy study based on the GII database and the country/economy profile over time, coupled with analytical work on grounds that include innovation actors and decision makers, yields the best results in terms of grasping an economy's innovation performance over time as well as possible avenues for improvement.

#### Methodology and data

The revision of the computation methodology for certain individual indicators has caused shifts in the results for several countries.

For indicator 3.3.1, which measures energy use, the constant PPP\$ per kg of oil equivalent was updated from 2005 PPP\$ to 2010 PPP\$.

The methodology underpinning indicators 4.2.3 and 5.2.4 expanded to use datasets from previous years to improve data coverage.

For indicators 5.3.4 and 6.3.4, the net inflows and outflows of foreign

direct investment are now being measured as an average of the most recent three years to produce a more stable reflection of these indicators' datasets.

The underlying methodology for indicator 7.3.3 has also changed; it now measures edits within each economy by year rather than by month.

#### Missing values

Since its inception, the GII has had a positive influence on data availability, increasing awareness of the importance of submitting timely data. The number of data points submitted by economies to international data agencies has substantially increased in recent years. In the GII 2016, 12.8% of data points were missing; this year, in the GII 2017, coverage improved again, with only 10.3% of data points missing.

When it comes to country coverage, the objective is to include as many economies as possible. However, it is also important to maintain a good level of data coverage within each of these economies. Because the GII results are linked to data availability (see the JRC Statistical Audit presented in Annex 3 for more details), which affects the overall GII ranks, this year the minimum data coverage threshold rule was strengthened—on the recommendation of the JRC—to maintain the significance of both the GII results and the country sample. To be included in the GII 2017, an economy must have a minimum symmetric data coverage of 36 indicators in the Innovation Input Sub-Index (66%) and 18 indicators in the Innovation Output Sub-Index (66%), and it must have scores for at least two sub-pillars per pillar. Missing values are indicated with 'n/a' and are not considered in the sub-pillar score.

This adjustment derives from a sensitivity that is the result of the data availability, which is less satisfactory



**Table 2: GII economies with the most missing values**

| Economy             | Number of missing values | Economy           | Number of missing values |
|---------------------|--------------------------|-------------------|--------------------------|
| Trinidad and Tobago | 25                       | Brunei Darussalam | 21                       |
| Togo                | 23                       | Burkina Faso      | 20                       |
| Burundi             | 22                       | Guinea            | 20                       |
| Niger               | 22                       | Nepal             | 20                       |
| Benin               | 21                       |                   |                          |

**Table 3: GII economies with the fewest missing values**

| Economy            | Number of missing values | Economy                  | Number of missing values |
|--------------------|--------------------------|--------------------------|--------------------------|
| Colombia           | 0                        | Israel                   | 3                        |
| Hungary            | 0                        | Kazakhstan               | 3                        |
| Mexico             | 0                        | Netherlands              | 3                        |
| Romania            | 0                        | Serbia                   | 3                        |
| Bulgaria           | 1                        | Slovenia                 | 3                        |
| Chile              | 1                        | Spain                    | 3                        |
| Czech Republic     | 1                        | Sweden                   | 3                        |
| Malaysia           | 1                        | Argentina                | 4                        |
| Poland             | 1                        | Croatia                  | 4                        |
| Russian Federation | 1                        | Egypt                    | 4                        |
| Turkey             | 1                        | Latvia                   | 4                        |
| Austria            | 2                        | Lithuania                | 4                        |
| Brazil             | 2                        | Malta                    | 4                        |
| France             | 2                        | Morocco                  | 4                        |
| Italy              | 2                        | New Zealand              | 4                        |
| Japan              | 2                        | Norway                   | 4                        |
| Korea, Rep.        | 2                        | Philippines              | 4                        |
| Portugal           | 2                        | Switzerland              | 4                        |
| Slovakia           | 2                        | Tunisia                  | 4                        |
| South Africa       | 2                        | United Kingdom           | 4                        |
| Thailand           | 2                        | Cyprus                   | 5                        |
| Ukraine            | 2                        | Georgia                  | 5                        |
| Australia          | 3                        | Greece                   | 5                        |
| Belgium            | 3                        | India                    | 5                        |
| Costa Rica         | 3                        | Ireland                  | 5                        |
| Denmark            | 3                        | Luxembourg               | 5                        |
| Estonia            | 3                        | Moldova, Rep.            | 5                        |
| Finland            | 3                        | Panama                   | 5                        |
| Germany            | 3                        | Singapore                | 5                        |
| Indonesia          | 3                        | United States of America | 5                        |

in the case of the Output Sub-Index: four countries that were part of the GII 2016 have data coverage below the 66% threshold in the 27 variables in the Output Sub-Index. In contrast, data coverage is satisfactory in all of these cases in the Input Sub-Index (all of these economies have indicator coverage of more than 66% over the 54 input variables). As a result, the following countries included in the GII 2016 dropped out this year: Bhutan, Ghana, Nicaragua, and the Bolivarian Republic of Venezuela.<sup>1</sup> The rules on missing data and the minimum coverage necessary per sub-pillar will be progressively tightened, leading to the exclusion of countries that fail to meet the desired minimum coverage in any sub-pillar (see Appendix I for more details).

Despite requiring minimum levels of coverage, for several economies the number of missing data points remains very high. Table 2 lists the countries that have the highest number of missing data points (20 or more), ranking them according to how many data points are missing.

Conversely, Table 3 lists those economies with the best data coverage, ranking them according to the least number of missed data points. These economies are missing at most only five data points; some are missing none at all.

### Note

Conversely, Brunei Darussalam, Trinidad and Tobago, and Zimbabwe—which were not included in the GII 2016—enter the GII this year with the required coverage in both sub-indices and sufficient data availability per pillar.



## Joint Research Centre Statistical Audit of the 2017 Global Innovation Index

MICHAELA SAISANA, MARCOS DOMÍNGUEZ-TORREIRO, and DANIEL VERTESY, European Commission, Joint Research Centre (JRC), Ispra, Italy

Conceptual and practical challenges are inevitable when trying to understand and model the fundamentals of innovation at the national level worldwide. In its 10th edition, the 2017 Global Innovation Index (GII) considers these conceptual challenges in Chapter 1 and deals with practical challenges—related to data quality and methodological choices—by grouping country-level data over 127 countries and across 81 indicators into 21 sub-pillars, 7 pillars, 2 sub-indices and, finally, an overall index. This annex offers detailed insights into the practical issues related to the construction of the GII, analysing in depth the statistical soundness of the calculations and assumptions made to arrive at the final index rankings. Statistical soundness should be regarded as a necessary but not sufficient condition for a sound GII, since the correlations underpinning the majority of the statistical analyses carried out herein ‘need not necessarily represent the real influence of the individual indicators on the phenomenon being measured’.<sup>1</sup> Consequently, the development of the GII must be nurtured by a dynamic iterative dialogue between the principles of statistical and conceptual soundness or, to put it another way, between the theoretical understanding of innovation and the empirical observations of the data underlying the variables.

The European Commission’s Competence Centre on Composite

Indicators and Scoreboards at the Joint Research Centre (JRC) in Ispra has been invited for the seventh consecutive year to audit the GII. As in previous editions, the present JRC audit focuses on the statistical soundness of the multi-level structure of the index as well as on the impact of key modelling assumptions on the results.<sup>2</sup> The independent statistical assessment of the GII provided by the JRC guarantees the transparency and reliability of the index for both policy makers and other stakeholders, thus facilitating more accurate priority setting and policy formulation in this particular field.

As in past GII reports, the JRC analysis complements the country rankings with confidence intervals for the GII, the Innovation Input Sub-Index, and the Innovation Output Sub-Index in order to better appreciate the robustness of these ranks to the computation methodology. In addition, the JRC analysis includes an assessment of the added value of the GII and a measure of distance to the efficient frontier of innovation by using data envelopment analysis.

### Conceptual and statistical coherence in the GII framework

An earlier version of the GII model was assessed by the JRC in April–May 2017. Fine-tuning suggestions were taken into account in the final computation of the rankings in an iterative process with the JRC aimed

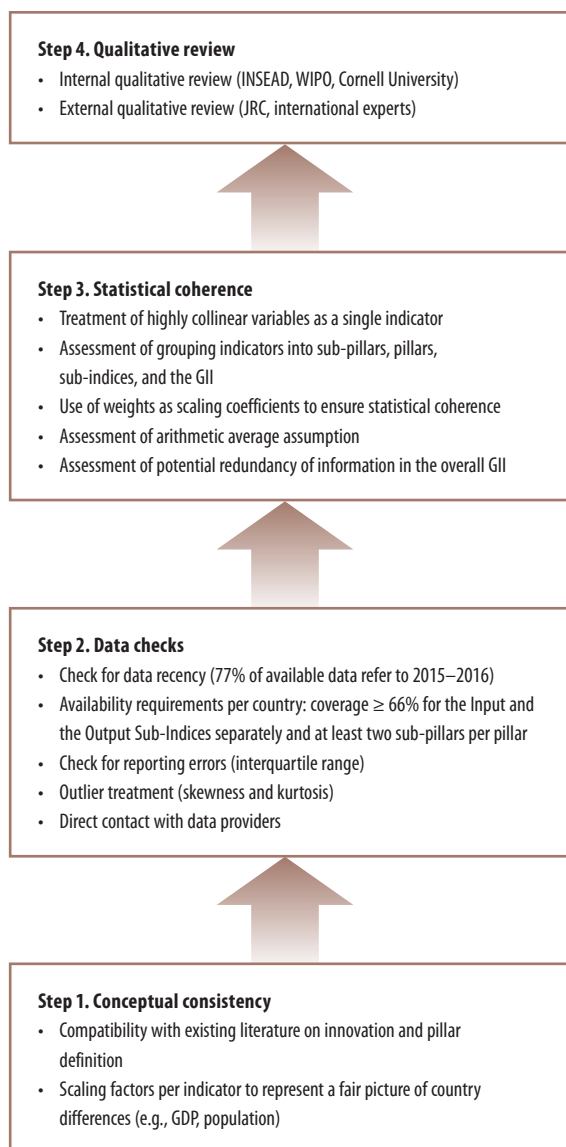
at setting the foundation for a balanced index. The entire process followed four steps (see Figure 1).

#### Step 1: Conceptual consistency

Eighty-one indicators were selected for their relevance to a specific innovation pillar on the basis of the literature review, expert opinion, country coverage, and timeliness. To represent a fair picture of country differences, indicators were scaled either at the source or by the GII team as appropriate and where needed.

#### Step 2: Data checks

The most recently released data within the period 2006–16 were used for each economy: 77% of the available data refer to 2015 or more recent years. In past editions, countries were included if data availability was at least 60% across all variables in the GII framework. A more stringent criterion was adopted this year, following the JRC recommendation of past GII audits. That is, countries were included if data availability was at least 66% within each of the two sub-indices (i.e., 36 out of 54 variables within the Input Sub-Index and 18 out of the 27 variables in the Output Sub-Index) and at least two of the three sub-pillars in each pillar could be computed. This more stringent criterion for a country’s inclusion in the GII was introduced this year in order to ensure that country scores for the GII and for the two Input and Output Sub-Indices are

**Figure 1: Conceptual and statistical coherence in the GII 2017 framework**

Source: European Commission Joint Research Centre, 2017.

not particularly sensitive to the missing values (as it was the case for the Output Sub-Index scores of several countries in past editions). In practice, data availability for all countries included in the GII 2017 is very good: 80% data availability for 84% (107 out of 127) of the countries. Potentially problematic indicators that could bias the overall results were identified on the basis of two measures related to the shape of the distributions:

skewness and kurtosis. In past editions since 2011, values were treated if the indicators had absolute skewness greater than 2.0 and kurtosis greater than 3.5.<sup>3</sup> These criteria were decided jointly with the JRC back in 2011. This year and after having analysed data in GII 2011–GII 2017, a less stringent criterion was adopted: an indicator was treated if the absolute skewness was greater than 2.25 and kurtosis greater than 3.5. These

indicators were treated either by winsorization or by taking the natural logarithm (in case of more than five outliers; see Appendix IV Technical Notes in this report for details).

### Step 3: Statistical Coherence

#### *Weights as scaling coefficients*

Weights of 0.5 or 1.0 were jointly decided between the JRC and the GII team in 2012 to be scaling coefficients and not importance coefficients, with the aim of arriving at sub-pillar and pillar scores that were balanced in their underlying components (i.e., that indicators and sub-pillars can explain a similar amount of variance in their respective sub-pillars/pillars). Becker et al. (2017) and Paruolo et al. (2013) show that, in weighted arithmetic averages, the ratio of two nominal weights gives the rate of substitutability between two indicators, and hence can be used to reveal the relative importance of individual indicators. This importance can then be compared with ex-post measures of variables' importance, such as the non-linear Pearson correlation ratio. As a result of this analysis, 35 out of 81 indicators and two sub-pillars—7.2 Creative goods and services and 7.3 Online creativity—were assigned half weight while all other indicators and sub-pillars were assigned a weight of 1.0. Nevertheless, for seven indicators with Pearson correlation coefficients less than 0.3 with the respective sub-pillars, some further reflection is needed because they seem to be non-influential (i.e., they behave as 'noise') at all aggregation levels in the GII 2017 framework, despite the fact that their inclusion was based on conceptual grounds or practical experience. This applies to 2.1.2 Government expenditure on education per pupil, secondary; 2.2.2 Graduates in science and engineering; 3.2.3 Gross capital formation; 5.2.3 GERD financed by abroad,

**Table 1: Statistical coherence in the GII: Correlations between sub-pillars and pillars**

| Sub-pillar  | Institutions | Human capital and research | Infrastructure | Market sophistication | Business sophistication | Knowledge and technology outputs | Creative outputs |
|---|--------------|----------------------------|----------------|-----------------------|-------------------------|----------------------------------|------------------|
| Political environment                             | 0.94         | 0.76                       | 0.85           | 0.69                  | 0.71                    | 0.68                             | 0.77             |
| Regulatory environment                            | 0.93         | 0.68                       | 0.71           | 0.60                  | 0.68                    | 0.60                             | 0.67             |
| Business environment                              | 0.89         | 0.73                       | 0.77           | 0.69                  | 0.66                    | 0.66                             | 0.71             |
| Education   | 0.57         | 0.78                       | 0.56           | 0.45                  | 0.50                    | 0.51                             | 0.55             |
| Tertiary education                                | 0.67         | 0.80                       | 0.73           | 0.58                  | 0.48                    | 0.54                             | 0.60             |
| Research and development (R&D)                    | 0.69         | 0.88                       | 0.76           | 0.74                  | 0.83                    | 0.85                             | 0.74             |
| Information and communication technologies (ICTs) | 0.80         | 0.85                       | 0.94           | 0.75                  | 0.68                    | 0.72                             | 0.82             |
| <b>INPUT</b>                                      |              |                            |                |                       |                         |                                  |                  |
| General infrastructure                            | 0.57         | 0.53                       | 0.69           | 0.47                  | 0.49                    | 0.56                             | 0.47             |
| Ecological sustainability                         | 0.65         | 0.59                       | 0.77           | 0.54                  | 0.55                    | 0.53                             | 0.67             |
| Credit  | 0.63         | 0.58                       | 0.58           | 0.87                  | 0.53                    | 0.56                             | 0.60             |
| Investment  | 0.53         | 0.47                       | 0.42           | 0.71                  | 0.52                    | 0.44                             | 0.42             |
| Trade, competition, & market scale                | 0.48         | 0.66                       | 0.73           | 0.71                  | 0.52                    | 0.62                             | 0.62             |
| Knowledge workers                                 | 0.69         | 0.79                       | 0.72           | 0.67                  | 0.86                    | 0.72                             | 0.67             |
| Innovation linkages                               | 0.52         | 0.42                       | 0.40           | 0.38                  | 0.74                    | 0.51                             | 0.45             |
| Knowledge absorption                              | 0.56         | 0.60                       | 0.58           | 0.55                  | 0.81                    | 0.77                             | 0.61             |
| Knowledge creation                                | 0.62         | 0.79                       | 0.64           | 0.65                  | 0.78                    | 0.89                             | 0.76             |
| Knowledge impact                                  | 0.50         | 0.55                       | 0.61           | 0.48                  | 0.54                    | 0.76                             | 0.62             |
| Knowledge diffusion                               | 0.59         | 0.60                       | 0.61           | 0.58                  | 0.69                    | 0.80                             | 0.59             |
| <b>OUTPUT</b>                                     |              |                            |                |                       |                         |                                  |                  |
| Intangible assets                                 | 0.61         | 0.63                       | 0.70           | 0.59                  | 0.55                    | 0.67                             | 0.91             |
| Creative goods and services                       | 0.69         | 0.66                       | 0.69           | 0.61                  | 0.68                    | 0.71                             | 0.85             |
| Online creativity                                 | 0.82         | 0.80                       | 0.82           | 0.71                  | 0.75                    | 0.79                             | 0.88             |

Source: European Commission Joint Research Centre, 2017.

5.3.4 Foreign direct investment net inflows; 6.2.1 Growth rate of GDP per person engaged; and 7.2.4 Printing and publishing output. For two out of the seven indicators listed above—2.1.2 and 7.2.4—this is the first time that they are found to be non-influential at all in the GII framework. Instead, the remaining five indicators were found to be non-influential also in the GII 2016. On the other hand, two indicators that were found to be non-influential last year—3.3.1 GDP per unit of energy use and 4.1.3 Microfinance institutions' gross loan portfolio—are instead found to be influential in this year's framework. It is suggested that the GII development team carefully assess how these variables behave in the coming releases of the index. If the 'noisy' behaviour persists, these variables could eventually be removed from the GII framework.

#### *Principal components analysis and reliability item analysis*

Principal component analysis (PCA) was used to assess to what extent the conceptual framework is confirmed by statistical approaches. PCA results confirm the presence of a single latent dimension in each of the seven pillars (one component with an eigenvalue greater than 1.0) that captures between close to 60% (pillar 4: Market sophistication) up to 85% (pillar 1: Institutions) of the total variance in the three underlying sub-pillars. These results reveal that the modest adjustments made to the 2017 GII framework have left unaffected the already good statistical coherence properties of the previous version. Furthermore, results confirm the expectation that the sub-pillars are more correlated to their own pillar than to any other pillar and that all

correlation coefficients are close to or greater than 0.70. (see Table 1).

The five input pillars share a single statistical dimension that summarizes 80% of the total variance, and the five loadings (correlation coefficients) of these pillars are very similar to each other (0.86–0.92). This similarity suggests that the five pillars make roughly equal contributions to the variation of the Innovation Input Sub-Index scores, as envisaged by the developing team. The reliability of the Input Sub-Index, measured by the Cronbach alpha value, is very high at 0.94—well above the 0.70 threshold for a reliable aggregate.<sup>4</sup>

The two output pillars—Knowledge and technology outputs and Creative outputs—are strongly correlated to each other (0.81); they are also both strongly correlated with the Innovation Output Sub-Index (0.95). This result suggests that the

**Table 2: Distribution of differences between pillar and GII rankings**

| Rank differences (positions)                 | Innovation Input Sub-Index |                                |                    |                           | Innovation Output Sub-Index |                                      |                      |
|--|----------------------------|--------------------------------|--------------------|---------------------------|-----------------------------|--------------------------------------|----------------------|
|  | Institutions (%)           | Human capital and research (%) | Infrastructure (%) | Market sophistication (%) | Business sophistication (%) | Knowledge and technology outputs (%) | Creative outputs (%) |
| More than 30                                 | 14.8%                      | 9.4%                           | 3.9%               | 21.9%                     | 17.2%                       | 9.4%                                 | 3.1%                 |
| 20–29  | 15.6%                      | 14.8%                          | 14.1%              | 10.2%                     | 12.5%                       | 11.7%                                | 8.6%                 |
| 10–19  | 23.4%                      | 21.9%                          | 28.1%              | 28.9%                     | 18.8%                       | 26.6%                                | 30.5%                |
| <b>10 or more*</b>                           | <b>53.9%</b>               | <b>46.1%</b>                   | <b>46.1%</b>       | <b>60.9%</b>              | <b>48.4%</b>                | <b>47.7%</b>                         | <b>42.2%</b>         |
| 5–9  | 21.1%                      | 23.4%                          | 25.8%              | 16.4%                     | 22.7%                       | 23.4%                                | 19.5%                |
| Less than 5                                  | 21.9%                      | 26.6%                          | 23.4%              | 18.8%                     | 25.0%                       | 25.8%                                | 32.0%                |
| Same rank                                    | 2.3%                       | 3.1%                           | 3.9%               | 3.1%                      | 3.1%                        | 2.3%                                 | 5.5%                 |
| <b>Total†</b>                                | <b>99.2%</b>               | <b>99.2%</b>                   | <b>99.2%</b>       | <b>99.2%</b>              | <b>99.2%</b>                | <b>99.2%</b>                         | <b>99.2%</b>         |
| Pearson correlation coefficient with the GII | 0.88                       | 0.90                           | 0.89               | 0.81                      | 0.86                        | 0.92                                 | 0.93                 |

Source: European Commission Joint Research Centre, 2017.

\* This column is the sum of the prior three rows.

† This column is the sum of all white rows.

Output Sub-Index is also well balanced in its two pillars. Furthermore, building the GII as the simple average of the Input Sub-Index and Output Sub-Index is also statistically justifiable because the Pearson correlation coefficient of either sub-index with the overall GII is 0.97; the two sub-indices have a correlation of 0.89.

Finally, an important part of the analysis relates to clarifying the importance of the Input and Output Sub-Indices with respect to the variation of the GII scores. The GII is built as the simple arithmetic average of the five Input sub-pillars and the two Output sub-pillars, which implies that the Input-related pillars have a weight of 5/7 versus a weight of 2/7 for the Output-related pillars. Yet this does not imply that the Input aspect is more important than the Output aspect in determining the variation of the GII scores. In fact, the Pearson correlation coefficient of either sub-index with the overall GII is 0.97 (and the two sub-indices have a correlation of 0.89), which suggests that the sub-indices are effectively placed on equal footing.

Overall, the tests so far show that the grouping of variables into sub-pillars, pillars, and an overall index is

statistically coherent in the GII 2017 framework, and that the GII has a balanced structure at each aggregation level.

The only recommendation for next year relates to a careful reflection of the seven indicators discussed above—2.1.2 Government expenditure on education per pupil, secondary; 2.2.2 Graduates in science and engineering; 3.2.3 Gross capital formation; 5.2.3 GERD financed by abroad; 5.3.4 Foreign direct investment net inflows; 6.2.1 Growth rate of GDP per person engaged; and 7.2.4 Printing and publishing output—because their information content is lost in the aggregation at the pillar level or higher (sub-index and overall GII). For five out of the seven indicators (2.2.2, 3.2.3, 5.2.3, 5.3.4, 6.2.1) this was also the case in last year's audit.

#### *Added value of the GII*

As already discussed, the Input and Output Sub-Indices correlate strongly with each other and with the overall GII. Furthermore, the five pillars in the Input Sub-Index have a very high statistical reliability. These results—the strong correlation between Input and Output Sub-Indices and the high

statistical reliability of the five input pillars—may be interpreted by some as a sign of redundancy of information in the GII. The tests conducted by the JRC confirm that this is not the case. In fact, for more than 42% (up to 61%) of the 127 economies included in the GII 2017, the GII ranking and any of the seven pillar rankings differ by 10 positions or more (see Table 2). This is a desired outcome because it demonstrates the added value of the GII ranking, which helps to highlight other aspects of innovation that do not emerge directly by looking into the seven pillars separately. At the same time, this result points to the value of duly taking into account the GII pillars, sub-pillars, and individual indicators on their own merit. By doing so, country-specific strengths and bottlenecks on innovation can be identified and serve as an input for evidence-based policy making.

#### **Step 4: Qualitative Review**

Finally, the GII results—including overall country classifications and relative performances in terms of the Innovation Input or Output Sub-Indices—were evaluated to verify that the overall results are, to a great extent, consistent with current

**Table 3: Uncertainty parameters: Missing values, aggregation, and weights**

|   |                                  | Reference                      | Alternative                                   |
|---|----------------------------------|--------------------------------|---|
| <b>I. Uncertainty in the treatment of missing values</b>          |                                  | No estimation of missing data  | Expectation Maximization (EM)                 |
| <b>II. Uncertainty in the aggregation formula at pillar level</b> |                                  | Arithmetic average             | Geometric average                             |
| <b>III. Uncertainty intervals for the GII pillar weights</b>      |                                  |                                |   |
| GII Sub-Index   | Pillar                           | Reference value for the weight | Distribution assigned for robustness analysis |
| <b>Innovation Input</b>   | Institutions                     | 0.2                            | U[0.1, 0.3]                                   |
|   | Human capital and research       | 0.2                            | U[0.1, 0.3]                                   |
|   | Infrastructure                   | 0.2                            | U[0.1, 0.3]                                   |
|   | Market sophistication            | 0.2                            | U[0.1, 0.3]                                   |
|   | Business sophistication          | 0.2                            | U[0.1, 0.3]                                   |
| <b>Innovation Output</b>  | Knowledge and technology outputs | 0.5                            | U[0.4, 0.6]                                   |
|   | Creative outputs                 | 0.5                            | U[0.4, 0.6]                                   |

Source: European Commission Joint Research Centre, 2017.

evidence, existing research, and prevailing theory. Notwithstanding these statistical tests and the positive outcomes on the statistical coherence of the GII structure, the GII model is and has to remain open for future improvements as better data, more comprehensive surveys and assessments, and new relevant research studies become available.

### The impact of modelling assumptions on the GII results

Modelling assumptions with a direct impact on the GII scores and rankings relate to:

- setting up an underlying structure for the index based on a battery of pillars,
- choosing the individual variables to be used as indicators,
- deciding whether (and how) or not to impute missing data,
- deciding whether (and how) or not to treat outliers,
- selecting the normalization approach to be applied,
- choosing the weights to be assigned, and
- deciding on the aggregation rule to be implemented.

The rationale for these choices is manifold. For instance, expert opinion coupled with statistical analysis is behind the selection of the individual indicators, common practice and ease of interpretation suggests the use of a min-max normalization approach in the [0–100] range, the treatment of outliers is driven by statistical analysis, and simplicity and parsimony criteria seem to advocate for not imputing missing data. The unavoidable uncertainty stemming from the above-mentioned modelling choices is accounted for in the robustness assessment carried out by the JRC. More precisely, the methodology applied herein allows for the joint and simultaneous analysis of the impact of such choices on the aggregate scores, resulting in error estimates and confidence intervals calculated for the GII 2017 individual country rankings.

As suggested in the relevant literature on composite indicators,<sup>5</sup> the robustness assessment was based on Monte Carlo simulation and multimodelling approaches, applied to ‘error-free’ data where potential outliers and eventual errors and typos have already been corrected in a preliminary stage. In particular, the

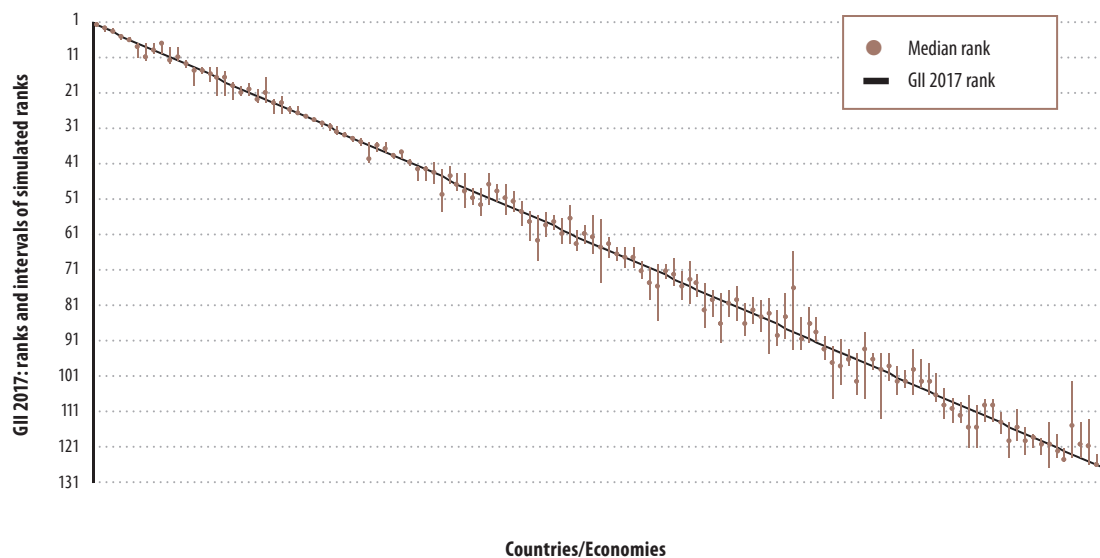
three key modelling issues considered in the assessment of the GII were the treatment of missing data, the pillar weights, and the aggregation formula used at the pillar level.

Monte Carlo simulation comprised 1,000 runs of different sets of weights for the seven pillars in the GII. The weights were assigned to the pillars based on uniform continuous distributions centred in the reference values. The ranges of simulated weights were defined by taking into account both the need for a wide enough interval to allow for meaningful robustness checks and the need to respect the underlying principle of the GII that the Input and the Output Sub-Indices should be placed on equal footings. As a result of these considerations, the limit values of uncertainty for the five input pillars are 10%–30%; the limit values for the two output pillars are 40%–60% (see Table 3).

The GII developing team, for transparency and replicability, has always opted not to estimate missing data. The ‘no imputation’ choice, which is common in similar contexts, might encourage economies not to report low data values. Yet this is not the case for the GII. After 10 editions of the GII, the index-developing



Figure 2a: Robustness analysis (GII rank vs. median rank, 90% confidence intervals)



Source: European Commission Joint Research Centre, 2017.

Notes: Median ranks and intervals are calculated over 4,000 simulated scenarios combining random weights, imputed versus missing values, and geometric versus arithmetic average at the pillar level. The Spearman rank correlation between the median rank and the GII 2017 rank is 0.997.

team has not encountered any intentional no-reporting strategy. The consequence of the ‘no imputation’ choice in an arithmetic average is that it is equivalent to replacing an indicator’s missing value for a given country with the respective sub-pillar score. Hence, the available data (indicators) in the incomplete pillar may dominate, sometimes biasing the ranks up or down. To test the impact of the ‘no imputation’ choice, the JRC estimated missing data using the Expectation Maximization (EM) algorithm.<sup>6</sup>

Regarding the aggregation formula, decision-theory practitioners challenge the use of simple arithmetic averages because of their fully compensatory nature, in which a comparative high advantage on a few indicators can compensate a comparative disadvantage on many indicators.<sup>7</sup> For example, one may

argue that the United Kingdom and Germany, despite their similar performance at the Innovation Output Sub-Index—both close to 53.5 points (rank 6th and 7th respectively)—are very different if one considers how these countries perform within the sub-index. Germany ranks 8th in Knowledge and technology outputs and 7th in Creative outputs, while the United Kingdom is much more diverse: the country ranks 13th position in Knowledge and technology outputs, but it notably improves its overall position in the Output Sub-Index thanks to its 4th rank in Creative outputs. To assess the impact of this compensability issue, the JRC relaxed the strong perfect substitutability assumption inherent in the arithmetic average and considered instead the geometric average, which is a partially compensatory approach that rewards economies with balanced

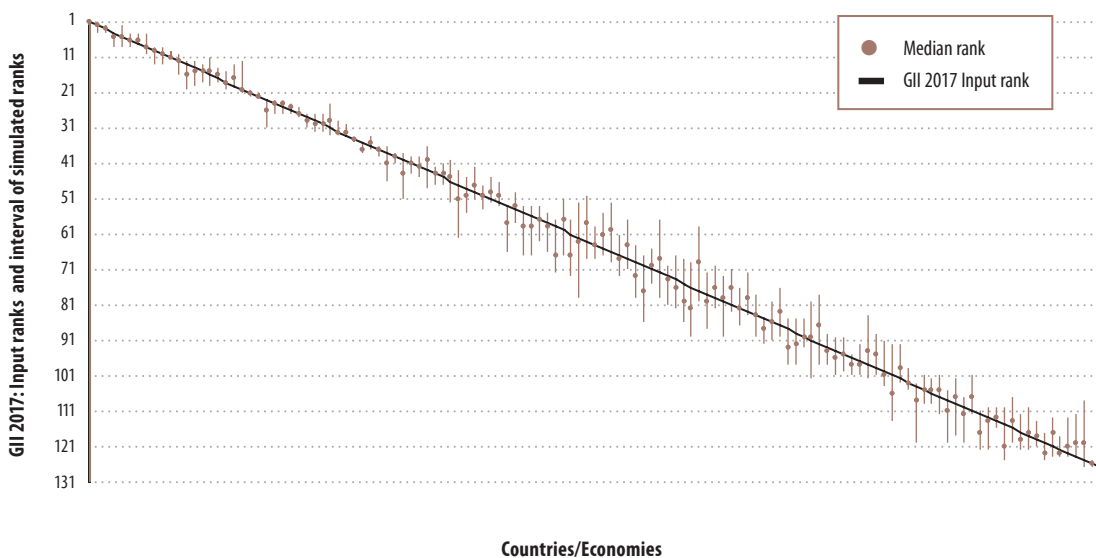
profiles and motivates economies to improve in the GII pillars in which they perform poorly, and not just in *any* GII pillar.<sup>8</sup>

Four models were tested based on the combination of no imputation versus EM imputation, and arithmetic versus geometric average, combined with 1,000 simulations per model (random weights versus fixed weights), for a total of 4,000 simulations for the GII and each of the two sub-indices (see Table 3 for a summary of the uncertainties considered).

#### Uncertainty analysis results

The main results of the robustness analysis are shown in Figure 2 with median ranks and 90% confidence intervals computed across the 4,000 Monte Carlo simulations for the GII and the two sub-indices. The figure orders economies from best to worst

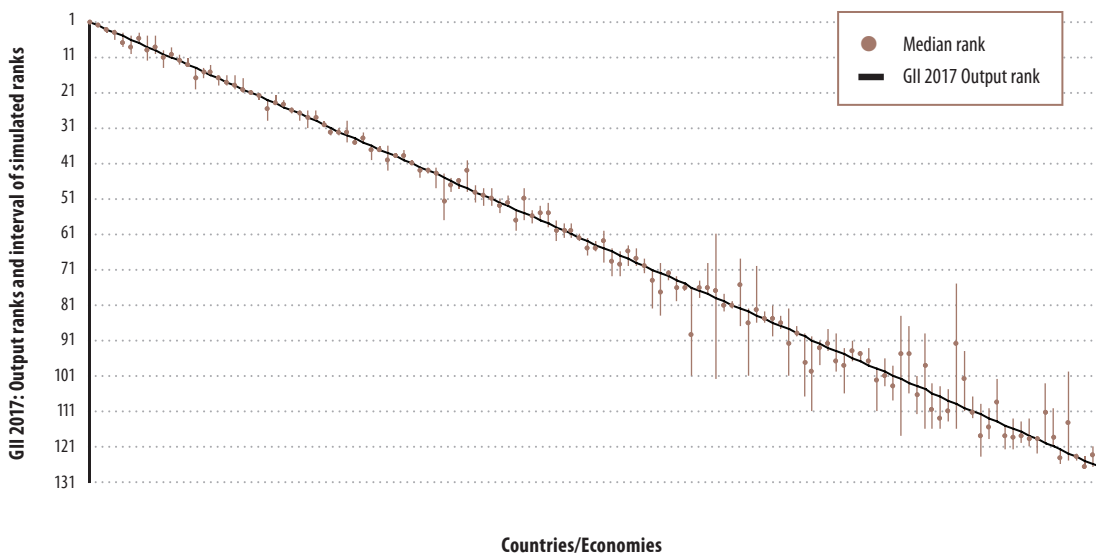
Figure 2b: Robustness analysis (Input rank vs. median rank, 90% confidence intervals)



Source: European Commission Joint Research Centre, 2017.

Notes: Median ranks and intervals are calculated over 4,000 simulated scenarios combining random weights, imputed versus missing values, and geometric versus arithmetic average at the pillar level. The Spearman rank correlation between the median rank and the Innovation Input 2017 rank is 0.997.

Figure 2c: Robustness analysis (Output rank vs. median rank, 90% confidence intervals)



Source: European Commission Joint Research Centre, 2017.

Notes: Median ranks and intervals are calculated over 4,000 simulated scenarios combining random weights, imputation versus no imputation of missing values, and geometric versus arithmetic average at the pillar level. The Spearman rank correlation between the median rank and the Innovation Output 2017 rank is 0.995.

Table 4: GII 2017 and Input/Output Sub-Indices: Ranks and 90% confidence intervals

| Country/Economy          | GII 2017 |          | Input Sub-Index |          | Output Sub-Index |          |
|--------------------------|----------|----------|-----------------|----------|------------------|----------|
|                          | Rank     | Interval | Rank            | Interval | Rank             | Interval |
| Switzerland              | 1        | [1, 1]   | 3               | [2, 4]   | 1                | [1, 1]   |
| Sweden                   | 2        | [2, 3]   | 2               | [1, 4]   | 3                | [3, 4]   |
| Netherlands              | 3        | [2, 3]   | 9               | [8, 13]  | 2                | [2, 2]   |
| United States of America | 4        | [4, 5]   | 5               | [2, 8]   | 5                | [4, 8]   |
| United Kingdom           | 5        | [4, 5]   | 7               | [4, 7]   | 6                | [5, 10]  |
| Denmark                  | 6        | [6, 10]  | 6               | [4, 8]   | 12               | [10, 13] |
| Singapore                | 7        | [6, 11]  | 1               | [1, 2]   | 17               | [16, 19] |
| Finland                  | 8        | [6, 9]   | 4               | [4, 8]   | 13               | [11, 13] |
| Germany                  | 9        | [6, 9]   | 17              | [14, 18] | 7                | [4, 7]   |
| Ireland                  | 10       | [7, 12]  | 19              | [13, 19] | 8                | [5, 12]  |
| Korea, Republic of       | 11       | [7, 11]  | 16              | [11, 19] | 9                | [5, 10]  |
| Luxembourg               | 12       | [11, 13] | 24              | [23, 27] | 4                | [3, 6]   |
| Iceland                  | 13       | [13, 18] | 21              | [20, 22] | 10               | [9, 14]  |
| Japan                    | 14       | [13, 15] | 11              | [9, 11]  | 20               | [17, 21] |
| France                   | 15       | [13, 17] | 15              | [13, 18] | 18               | [16, 19] |
| Hong Kong (China)        | 16       | [13, 21] | 8               | [4, 10]  | 25               | [23, 25] |
| Israel                   | 17       | [14, 21] | 20              | [12, 21] | 14               | [14, 20] |
| Canada                   | 18       | [17, 22] | 10              | [8, 13]  | 23               | [23, 29] |
| Norway                   | 19       | [18, 21] | 14              | [12, 19] | 22               | [22, 23] |
| Austria                  | 20       | [17, 21] | 18              | [15, 20] | 21               | [20, 21] |
| New Zealand              | 21       | [19, 23] | 13              | [12, 20] | 24               | [22, 24] |
| China                    | 22       | [16, 23] | 31              | [24, 33] | 11               | [8, 11]  |
| Australia                | 23       | [22, 26] | 12              | [10, 16] | 30               | [29, 30] |
| Czech Republic           | 24       | [21, 26] | 27              | [25, 28] | 16               | [13, 16] |
| Estonia                  | 25       | [24, 26] | 26              | [24, 27] | 19               | [16, 20] |
| Malta                    | 26       | [24, 26] | 28              | [27, 31] | 15               | [14, 17] |
| Belgium                  | 27       | [27, 27] | 22              | [21, 22] | 27               | [26, 29] |
| Spain                    | 28       | [28, 28] | 25              | [23, 27] | 26               | [25, 27] |
| Italy                    | 29       | [29, 30] | 29              | [27, 32] | 29               | [26, 29] |
| Cyprus                   | 30       | [29, 31] | 32              | [29, 33] | 28               | [26, 31] |
| Portugal                 | 31       | [30, 32] | 33              | [30, 33] | 31               | [31, 33] |
| Slovenia                 | 32       | [31, 32] | 30              | [27, 32] | 34               | [34, 35] |
| Latvia                   | 33       | [33, 34] | 35              | [35, 38] | 33               | [29, 35] |
| Slovakia                 | 34       | [33, 35] | 39              | [38, 41] | 35               | [32, 35] |
| United Arab Emirates     | 35       | [34, 40] | 23              | [23, 31] | 56               | [54, 58] |
| Bulgaria                 | 36       | [34, 37] | 45              | [41, 47] | 32               | [31, 33] |
| Malaysia                 | 37       | [34, 37] | 36              | [33, 37] | 39               | [38, 39] |
| Poland                   | 38       | [38, 39] | 37              | [36, 39] | 41               | [40, 41] |
| Hungary                  | 39       | [37, 39] | 41              | [39, 44] | 37               | [36, 37] |
| Lithuania                | 40       | [39, 41] | 34              | [34, 35] | 49               | [47, 52] |
| Croatia                  | 41       | [41, 45] | 44              | [42, 47] | 46               | [45, 49] |
| Romania                  | 42       | [41, 45] | 51              | [45, 52] | 44               | [42, 48] |
| Turkey                   | 43       | [40, 46] | 68              | [57, 71] | 36               | [36, 40] |
| Greece                   | 44       | [42, 54] | 38              | [36, 46] | 59               | [57, 63] |
| Russian Federation       | 45       | [41, 46] | 43              | [36, 48] | 51               | [48, 53] |
| Chile                    | 46       | [43, 48] | 42              | [39, 45] | 53               | [50, 53] |
| Viet Nam                 | 47       | [43, 53] | 71              | [65, 75] | 38               | [36, 43] |
| Montenegro               | 48       | [47, 52] | 50              | [47, 54] | 52               | [51, 55] |
| Qatar                    | 49       | [47, 55] | 48              | [45, 55] | 54               | [54, 60] |
| Ukraine                  | 50       | [43, 52] | 77              | [59, 80] | 40               | [37, 40] |
| Thailand                 | 51       | [46, 51] | 65              | [55, 67] | 43               | [42, 44] |
| Mongolia                 | 52       | [46, 55] | 67              | [61, 73] | 48               | [40, 49] |
| Costa Rica               | 53       | [48, 54] | 57              | [53, 63] | 50               | [48, 53] |
| Moldova, Republic of     | 54       | [51, 58] | 73              | [70, 81] | 42               | [42, 45] |
| Saudi Arabia             | 55       | [54, 62] | 46              | [40, 52] | 66               | [65, 73] |
| Kuwait                   | 56       | [55, 68] | 80              | [73, 90] | 45               | [44, 57] |
| South Africa             | 57       | [54, 61] | 49              | [42, 51] | 69               | [65, 70] |
| Mexico                   | 58       | [55, 59] | 54              | [49, 58] | 60               | [58, 62] |
| Armenia                  | 59       | [56, 63] | 82              | [76, 87] | 47               | [46, 48] |
| India                    | 60       | [52, 63] | 66              | [52, 69] | 58               | [52, 59] |
| TFYR of Macedonia        | 61       | [59, 65] | 53              | [53, 66] | 63               | [62, 67] |
| Serbia                   | 62       | [58, 63] | 58              | [55, 66] | 61               | [58, 62] |
| Panama                   | 63       | [55, 66] | 74              | [67, 82] | 55               | [48, 57] |
| Mauritius                | 64       | [56, 74] | 47              | [43, 62] | 82               | [68, 87] |

Table 4: GII 2017 and Input/Output Sub-Indices: Ranks and 90% confidence intervals (continued)

| Country/Economy                 | GII 2017 |            | Input Sub-Index |            | Output Sub-Index |            |
|---------------------------------|----------|------------|-----------------|------------|------------------|------------|
|                                 | Rank     | Interval   | Rank            | Interval   | Rank             | Interval   |
| Colombia                        | 65       | [61, 67]   | 52              | [46, 53]   | 75               | [75, 77]   |
| Bahrain                         | 66       | [64, 68]   | 55              | [53, 67]   | 67               | [66, 73]   |
| Uruguay                         | 67       | [64, 70]   | 61              | [57, 73]   | 64               | [63, 66]   |
| Georgia                         | 68       | [64, 70]   | 69              | [64, 79]   | 62               | [61, 63]   |
| Brazil                          | 69       | [68, 73]   | 60              | [51, 67]   | 80               | [78, 83]   |
| Peru                            | 70       | [70, 79]   | 56              | [53, 67]   | 85               | [83, 86]   |
| Brunei Darussalam               | 71       | [69, 85]   | 40              | [38, 51]   | 110              | [94, 111]  |
| Morocco                         | 72       | [69, 73]   | 79              | [70, 82]   | 68               | [64, 70]   |
| Philippines                     | 73       | [67, 75]   | 83              | [72, 84]   | 65               | [60, 69]   |
| Tunisia                         | 74       | [71, 79]   | 81              | [71, 83]   | 71               | [71, 82]   |
| Iran, Islamic Republic of       | 75       | [68, 80]   | 98              | [84, 102]  | 57               | [53, 57]   |
| Argentina                       | 76       | [72, 78]   | 72              | [57, 79]   | 81               | [80, 82]   |
| Oman                            | 77       | [74, 87]   | 62              | [52, 79]   | 90               | [89, 107]  |
| Kazakhstan                      | 78       | [76, 84]   | 64              | [59, 68]   | 93               | [88, 94]   |
| Dominican Republic              | 79       | [77, 91]   | 88              | [85, 98]   | 72               | [69, 84]   |
| Kenya                           | 80       | [76, 84]   | 91              | [80, 102]  | 70               | [68, 72]   |
| Lebanon                         | 81       | [75, 85]   | 87              | [76, 90]   | 78               | [69, 78]   |
| Azerbaijan                      | 82       | [80, 89]   | 78              | [72, 88]   | 89               | [87, 90]   |
| Jordan                          | 83       | [78, 86]   | 92              | [78, 98]   | 74               | [73, 80]   |
| Jamaica                         | 84       | [79, 88]   | 84              | [78, 90]   | 84               | [70, 86]   |
| Paraguay                        | 85       | [79, 94]   | 90              | [85, 93]   | 79               | [61, 102]  |
| Bosnia and Herzegovina          | 86       | [82, 92]   | 75              | [68, 86]   | 96               | [91, 97]   |
| Indonesia                       | 87       | [77, 90]   | 99              | [89, 101]  | 73               | [71, 74]   |
| Belarus                         | 88       | [65, 93]   | 63              | [50, 68]   | 109              | [75, 116]  |
| Botswana                        | 89       | [84, 93]   | 59              | [57, 72]   | 111              | [107, 113] |
| Sri Lanka                       | 90       | [81, 91]   | 94              | [90, 101]  | 77               | [74, 79]   |
| Trinidad and Tobago             | 91       | [84, 91]   | 85              | [85, 92]   | 86               | [81, 90]   |
| Ecuador                         | 92       | [89, 96]   | 95              | [90, 100]  | 83               | [82, 101]  |
| Albania                         | 93       | [92, 107]  | 70              | [67, 86]   | 115              | [115, 122] |
| Tajikistan                      | 94       | [90, 103]  | 100             | [91, 104]  | 88               | [82, 101]  |
| Kyrgyzstan                      | 95       | [93, 98]   | 86              | [80, 91]   | 104              | [101, 112] |
| Tanzania, United Republic of    | 96       | [94, 106]  | 109             | [102, 118] | 76               | [76, 101]  |
| Namibia                         | 97       | [88, 107]  | 89              | [85, 98]   | 102              | [84, 118]  |
| Guatemala                       | 98       | [94, 99]   | 97              | [92, 101]  | 92               | [91, 98]   |
| Rwanda                          | 99       | [94, 113]  | 76              | [69, 90]   | 121              | [110, 121] |
| Senegal                         | 100      | [94, 102]  | 102             | [92, 103]  | 98               | [93, 98]   |
| Cambodia                        | 101      | [98, 106]  | 104             | [103, 120] | 87               | [84, 88]   |
| Uganda                          | 102      | [99, 104]  | 93              | [89, 98]   | 106              | [103, 116] |
| El Salvador                     | 103      | [93, 106]  | 96              | [95, 101]  | 105              | [89, 116]  |
| Honduras                        | 104      | [96, 104]  | 103             | [99, 105]  | 103              | [87, 106]  |
| Egypt                           | 105      | [97, 106]  | 106             | [102, 109] | 97               | [94, 97]   |
| Bolivia, Plurinational State of | 106      | [100, 108] | 107             | [101, 112] | 99               | [99, 111]  |
| Mozambique                      | 107      | [104, 113] | 114             | [110, 116] | 100              | [96, 104]  |
| Algeria                         | 108      | [107, 114] | 105             | [101, 109] | 117              | [114, 120] |
| Nepal                           | 109      | [108, 114] | 108             | [105, 120] | 114              | [102, 114] |
| Ethiopia                        | 110      | [106, 121] | 122             | [118, 124] | 91               | [90, 111]  |
| Madagascar                      | 111      | [109, 121] | 120             | [117, 125] | 95               | [93, 106]  |
| Côte d'Ivoire                   | 112      | [107, 114] | 121             | [113, 124] | 94               | [89, 100]  |
| Pakistan                        | 113      | [107, 114] | 116             | [107, 120] | 101              | [98, 108]  |
| Bangladesh                      | 114      | [111, 117] | 113             | [110, 122] | 108              | [105, 114] |
| Malawi                          | 115      | [114, 124] | 112             | [111, 122] | 112              | [109, 124] |
| Benin                           | 116      | [110, 119] | 110             | [107, 120] | 120              | [103, 120] |
| Cameroon                        | 117      | [115, 123] | 117             | [112, 122] | 113              | [110, 119] |
| Mali                            | 118      | [117, 121] | 123             | [113, 124] | 107              | [104, 116] |
| Nigeria                         | 119      | [118, 123] | 118             | [110, 122] | 119              | [118, 123] |
| Burkina Faso                    | 120      | [114, 127] | 101             | [92, 114]  | 126              | [121, 127] |
| Zimbabwe                        | 121      | [117, 124] | 124             | [112, 124] | 116              | [113, 122] |
| Burundi                         | 122      | [121, 125] | 115             | [110, 125] | 122              | [122, 126] |
| Niger                           | 123      | [102, 124] | 111             | [101, 112] | 123              | [100, 125] |
| Zambia                          | 124      | [114, 124] | 125             | [108, 127] | 118              | [113, 121] |
| Togo                            | 125      | [113, 126] | 119             | [114, 121] | 127              | [106, 127] |
| Guinea                          | 126      | [123, 126] | 126             | [125, 127] | 124              | [123, 125] |
| Yemen                           | 127      | [125, 127] | 127             | [125, 127] | 125              | [124, 127] |

Source: European Commission Joint Research Centre, 2017.

**Table 5: Sensitivity analysis: Impact of modelling choices on economies with most sensitive ranks**

| Index or Sub-Index      | Uncertainty tested (pillar level only)  | Number of economies that <i>improve</i> |                             | Number of economies that <i>deteriorate</i> |                             |
|-------------------------|---|---|-----------------------------|---|-----------------------------|
|                         |   | by 20 or more positions                 | between 10 and 19 positions | by 20 or more positions                     | between 10 and 19 positions |
| <b>GII</b>              | Geometric vs. arithmetic average  | 0                                       | 1                           | 0   | 3                           |
|                         | EM imputation vs. no imputation of missing data                               | 0                                       | 3                           | 0   | 3                           |
|                         | Geometric average and EM imputation vs. arithmetic average and missing values | 1 (Belarus)                             | 3                           | 0   | 3                           |
| <b>Input Sub-Index</b>  | Geometric vs. arithmetic average  | 0                                       | 0                           | 0   | 1                           |
|                         | EM imputation vs. no imputation of missing data                               | 0                                       | 2                           | 0   | 2                           |
|                         | Geometric average and EM imputation vs. arithmetic average and missing values | 0                                       | 5                           | 0   | 7                           |
| <b>Output Sub-Index</b> | Geometric vs. arithmetic average  | 0                                       | 0                           | 0   | 3                           |
|                         | EM imputation vs. no imputation of missing data                               | 1 (Belarus)                             | 10                          | 1 (Tanzania, U. Rep.)                       | 7                           |
|                         | Geometric average and EM imputation vs. arithmetic average and missing values | 1 (Belarus)                             | 9                           | 1 (Tanzania, U. Rep.)                       | 7                           |

Source: European Commission Joint Research Centre, 2017.

according to their reference rank (black line), the dot being the median rank over the simulations.

All published GII 2017 ranks lay within the simulated 90% confidence intervals, and for most economies these intervals are narrow enough for meaningful inferences to be drawn: there is a shift of fewer than 10 positions for 105 of the 127 economies. However, it is also true that merely two country ranks vary significantly with changes in weights and aggregation formula and because of the estimation of missing data. These two countries—Niger and Belarus—have 90% confidence interval widths of 22 and 28, respectively; hence their GII ranks should be interpreted cautiously and certainly not taken at face value. This is a remarkable improvement compared to the GII 2015, where confidence interval widths for 32 economies lay between 20 and 29, for another 7 economies between 30 and 39, and for 2 economies the widths were 40 or greater. This improvement in the confidence one can attach to the GII 2017 ranks is the direct result of the developers' choice since 2016 to adopt a more stringent criterion for an economy's inclusion, which requires at least 62%

data availability within each of the two sub-indices. Some caution is also warranted in the Input Sub-Index for 7 economies—Ukraine, Argentina, Oman, Kenya, Jordan, Rwanda, and Burkina Faso—that have 90% confidence interval widths over 20 (up to 27 for Oman). The Output Sub-Index is slightly more sensitive to the methodological choices: 8 countries—Paraguay, Belarus, the United Republic of Tanzania, Namibia, El Salvador, Ethiopia, Niger, and Togo—have 90% confidence interval widths over 20 (up to 41 for Paraguay and Belarus). This sensitivity is mostly the consequence of the estimation of missing data and the fact that there are only two pillars: this means that changes to the imputation method, weights, or aggregation formula have a more notable impact on the country ranks in the Innovation Output.

Although a few economy ranks, in the GII 2017 overall or in the two sub-indices, appear to be sensitive to the methodological choices, the published rankings for the vast majority can be considered as representative of the plurality of scenarios simulated herein. Taking the median rank as the yardstick for an economy's

expected rank in the realm of the GII's unavoidable methodological uncertainties, 75% of the economies are found to shift fewer than three positions with respect to the median rank in the GII, or in the Input and Output Sub-Index.

For full transparency and information, Table 4 reports the GII 2017 Index and Input and Output Sub-Indices economy ranks together with the simulated 90% confidence intervals in order to better appreciate the robustness of the results to the choice of weights, of the aggregation formula and the impact of estimating missing data (where applicable).

### Sensitivity analysis results

Complementary to the uncertainty analysis, sensitivity analysis has been used to identify which of the modelling assumptions have the highest impact on certain country ranks. Table 5 summarizes the impact of changes of the EM imputation method and/or the geometric aggregation formula, with fixed weights at their reference values (as in the original GII). Similar to last year's results, this year neither the GII nor the Input or Output Sub-Index are found to be heavily influenced by

**Table 6: Pie shares (absolute terms) and efficiency scores for the top 25 economies in the GII 2017**

| Country/Economy          | Input pillars |                            |                |                       |                         | Output pillars                   |                  | Efficient frontier rank (DEA) | GII rank | Difference | Efficiency ratio rank | Difference from GII rank |
|--------------------------|---------------|----------------------------|----------------|-----------------------|-------------------------|----------------------------------|------------------|-------------------------------|----------|------------|-----------------------|--------------------------|
|                          | Institutions  | Human capital and research | Infrastructure | Market sophistication | Business sophistication | Knowledge and technology outputs | Creative outputs |                               |          |            |                       |                          |
| Switzerland              | 0.09          | 0.17                       | 0.08           | 0.09                  | 0.19                    | 0.19                             | 0.19             | 1                             | 1        | 0          | 2                     | -1                       |
| Sweden                   | 0.20          | 0.20                       | 0.20           | 0.10                  | 0.20                    | 0.05                             | 0.05             | 2                             | 2        | 0          | 12                    | -10                      |
| Netherlands              | 0.20          | 0.05                       | 0.20           | 0.05                  | 0.20                    | 0.10                             | 0.20             | 5                             | 3        | -2         | 4                     | -1                       |
| United States of America | 0.20          | 0.20                       | 0.20           | 0.20                  | 0.10                    | 0.05                             | 0.05             | 5                             | 4        | -1         | 21                    | -17                      |
| United Kingdom           | 0.20          | 0.20                       | 0.20           | 0.20                  | 0.05                    | 0.05                             | 0.10             | 4                             | 5        | 1          | 20                    | -15                      |
| Denmark                  | 0.20          | 0.20                       | 0.20           | 0.20                  | 0.05                    | 0.05                             | 0.10             | 5                             | 6        | 1          | 34                    | -28                      |
| Singapore                | 0.20          | 0.20                       | 0.20           | 0.20                  | 0.10                    | 0.05                             | 0.05             | 2                             | 7        | 5          | 63                    | -56                      |
| Finland                  | 0.20          | 0.20                       | 0.20           | 0.10                  | 0.20                    | 0.05                             | 0.05             | 5                             | 8        | 3          | 37                    | -29                      |
| Germany                  | 0.20          | 0.20                       | 0.20           | 0.10                  | 0.05                    | 0.05                             | 0.20             | 9                             | 9        | 0          | 7                     | 2                        |
| Ireland                  | 0.20          | 0.20                       | 0.20           | 0.10                  | 0.20                    | 0.05                             | 0.05             | 14                            | 10       | -4         | 6                     | 4                        |
| Korea, Republic of       | 0.20          | 0.20                       | 0.20           | 0.20                  | 0.10                    | 0.05                             | 0.05             | 11                            | 11       | 0          | 14                    | -3                       |
| Luxembourg               | 0.20          | 0.05                       | 0.20           | 0.20                  | 0.10                    | 0.05                             | 0.20             | 16                            | 12       | -4         | 1                     | 11                       |
| Iceland                  | 0.20          | 0.10                       | 0.20           | 0.05                  | 0.20                    | 0.05                             | 0.20             | 19                            | 13       | -6         | 5                     | 8                        |
| Japan                    | 0.20          | 0.20                       | 0.20           | 0.20                  | 0.10                    | 0.05                             | 0.05             | 9                             | 14       | 5          | 49                    | -35                      |
| France                   | 0.20          | 0.20                       | 0.20           | 0.20                  | 0.05                    | 0.05                             | 0.10             | 14                            | 15       | 1          | 35                    | -20                      |
| Hong Kong (China)        | 0.20          | 0.10                       | 0.20           | 0.20                  | 0.20                    | 0.05                             | 0.05             | 11                            | 16       | 5          | 73                    | -57                      |
| Israel                   | 0.10          | 0.20                       | 0.20           | 0.20                  | 0.20                    | 0.05                             | 0.05             | 19                            | 17       | -2         | 23                    | -6                       |
| Canada                   | 0.20          | 0.20                       | 0.20           | 0.20                  | 0.10                    | 0.05                             | 0.05             | 11                            | 18       | 7          | 59                    | -41                      |
| Norway                   | 0.20          | 0.20                       | 0.20           | 0.20                  | 0.10                    | 0.05                             | 0.05             | 19                            | 19       | 0          | 51                    | -32                      |
| Austria                  | 0.20          | 0.20                       | 0.20           | 0.10                  | 0.20                    | 0.05                             | 0.05             | 19                            | 20       | 1          | 41                    | -21                      |
| New Zealand              | 0.20          | 0.20                       | 0.20           | 0.20                  | 0.05                    | 0.05                             | 0.10             | 16                            | 21       | 5          | 56                    | -35                      |
| China                    | 0.05          | 0.10                       | 0.20           | 0.20                  | 0.20                    | 0.20                             | 0.05             | 23                            | 22       | -1         | 3                     | 19                       |
| Australia                | 0.20          | 0.20                       | 0.20           | 0.20                  | 0.05                    | 0.05                             | 0.10             | 16                            | 23       | 7          | 76                    | -53                      |
| Czech Republic           | 0.20          | 0.20                       | 0.20           | 0.10                  | 0.05                    | 0.05                             | 0.20             | 28                            | 24       | -4         | 13                    | 11                       |
| Estonia                  | 0.20          | 0.05                       | 0.20           | 0.20                  | 0.10                    | 0.05                             | 0.20             | 23                            | 25       | 2          | 19                    | 6                        |

Source: European Commission Joint Research Centre, 2017.

Notes: Pie shares are in absolute terms, bounded by 0.05 and 0.20. In the GII 2017, however, the five input pillars each have a fixed weight of 0.10; the two output pillars each have a fixed weight of 0.25.

the imputation of missing data or the aggregation formula. Depending on the combination of the choices made, only Belarus or the United Republic of Tanzania can change rank by 20 positions or more.

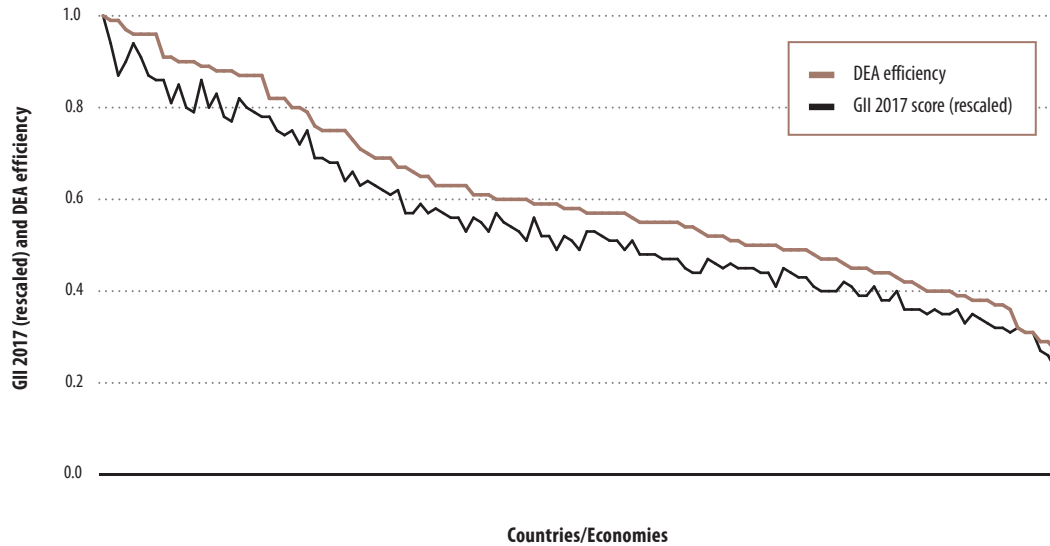
All in all, the published GII 2017 ranks are reliable and for the vast majority of countries the simulated 90% confidence intervals are narrow enough for meaningful inferences to be drawn. Nevertheless, the readers of the GII 2017 report should consider country ranks in the GII 2017 and in the Input and Output Sub-Indices not only at face value but also within the 90% confidence intervals

in order to better appreciate to what degree a country's rank depends on the modelling choices. Since 2016, following the JRC recommendation in past GII audits, the developers' choice to apply the 66% indicator coverage threshold separately to the Input and Output Sub-Indices in the GII 2017 has led to a net increase in the reliability of country ranks for the GII and the two sub-indices. Furthermore, the adoption of less stringent criterion for the skewness and kurtosis (greater than 2.25 in absolute value and greater than 3.5, respectively) has not introduced any bias in the estimates.

### Efficiency frontier in the GII by Data Envelopment Analysis

*Is there a way to benchmark countries' multi-dimensional performance on innovation without imposing a fixed and common set of weights that may not be fair to a particular country?*

Several innovation-related policy issues at the national level entail an intricate balance between global priorities and country-specific strategies. Comparing the multi-dimensional performance on innovation by subjecting countries to a fixed and common set of weights may prevent acceptance of an innovation index on grounds that a given

**Figure 3: GII 2017 scores and DEA 'distance to the efficient frontier' scores**

Source: European Commission Joint Research Centre, 2017.

Note: For comparison purposes, we have rescaled the GII scores by dividing them with the best performer in the overall GII 2017.

weighting scheme might not be fair to a particular country. An appealing feature of the Data Envelopment Analysis (DEA) literature applied in real decision-making settings is to determine endogenous weights that maximize the overall score of each decision-making unit given a set of other observations.

In this section, the assumption of fixed pillar weights common to all countries is relaxed once more; this time country-specific weights that maximize a country's score are determined endogenously by DEA.<sup>9</sup> In theory, each country is free to decide on the relative contribution of each pillar to its score, so as to achieve the best possible score in a computation that reflects its innovation strategy. In practice, the DEA method assigns a higher (lower) contribution to those pillars in which a country is relatively strong (weak). Reasonable constraints on the weights are applied to

preclude the possibility of a country achieving a perfect score by assigning a zero weight to weak pillars: for each country, the share of each pillar score (i.e., the pillar score multiplied by the DEA weight over the total score) has upper and lower bounds of 5% and 20% respectively. The DEA score is then measured as the weighted average of all seven pillar scores, where the weights are the country-specific DEA weights, compared to the best performance among all other countries with those same weights. The DEA score can be interpreted as a measure of the 'distance to the efficient frontier'.

Table 6 presents the pie shares and DEA scores for the top 25 countries in the GII 2017, next to the GII 2017 ranks and efficiency ratio ranks. All pie shares are in accordance with the starting point of granting leeway to each country when assigning shares, while not violating the (relative)

upper and lower bounds. The pie shares are quite diverse, reflecting the different national innovation strategies. These pie shares can also be seen to reflect countries' comparative advantage in certain GII pillars vis-à-vis all other countries and all pillars. For example, Switzerland is the only country this year that obtains a perfect DEA score of 1 by assigning 19% of its DEA score to Business sophistication, Knowledge and technology outputs, and Creative outputs, while merely 8% to 9% of its DEA score comes from Institutions, Infrastructure, and Market sophistication. Instead, countries including the United States of America, the United Kingdom, Denmark, and Singapore would assign 20% of their DEA scores to Market sophistication. Only Switzerland reaches a perfect DEA score of 1, closely followed by Sweden, the Netherlands, the United States of America, the United



Kingdom, Denmark, Singapore, and Finland, which score between 0.96 (Finland) and 0.99 (Sweden) in terms of efficiency. Figure 3 shows how close the DEA scores and the GII 2017 scores are for all 127 economies (correlation of 0.99).<sup>10</sup> Note that by construction, the version of DEA used herein is closer to the GII than to the efficiency ratio calculated as the Output Sub-Index score divided by the Input Sub-Index score (with a correlation of 0.63).

### Conclusion

The JRC analysis suggests that the conceptualized multi-level structure of the GII 2017—with its 81 indicators, 21 sub-pillars, 7 pillars, 2 sub-indices, up to an overall index—is statistically sound and balanced: that is, each sub-pillar makes a similar contribution to the variation of its respective pillar. Nevertheless, a careful reflection by the GII team is needed for seven out of the 81 indicators because their capacity to distinguish countries' performance is lost in the aggregation at the pillar level or higher. Five indicators related to the inputs of innovation—2.1.2 Government expenditure on education per pupil, secondary; 2.2.2 Graduates in science and engineering; 3.2.3 Gross capital formation; 5.2.3 GERD financed by abroad; 5.3.4 Foreign direct investment net inflows—and two indicators related to the outputs of innovation, 6.2.1 Growth rate of GDP per person engaged and 7.2.4 Printing and publishing output, need to be reviewed because their statistical relevance to the GII framework is very weak, unlike their strong conceptual relevance. The no-imputation choice for not treating missing values, common in relevant contexts and justified on grounds of transparency and replicability, can at times have an

undesirable impact on some country scores, with the additional negative side-effect that it may encourage countries not to report low data values. The adoption, since 2016, by the GII team of a more stringent data coverage threshold (at least 66% for the input- and output-related indicators, separately) has notably improved the confidence in the country ranks for the GII and the two sub-indices. Additionally, the choice of the GII team, which was made in 2012, to use weights as scaling coefficients during the development of the index constitutes a significant departure from the traditional, yet erroneous, vision of weights as a reflection of indicators' importance in a weighted average. It is hoped that such a consideration will be made also by other developers of composite indicators to avoid situations where bias sneaks in when least expected.

The strong correlations between the GII components are proven not to be a sign of redundancy of information in the GII. For more than 42.2% (up to 60.9%) of the 127 economies included in the GII 2017, the GII ranking and the rankings of any of the seven pillars differ by 10 positions or more. This demonstrates the added value of the GII ranking, which helps to highlight other components of innovation that do not emerge directly by looking into the seven pillars separately. At the same time, this finding points to the value of duly taking into account the GII pillars, sub-pillars, and individual indicators on their own merit. By doing so, country-specific strengths and bottlenecks in innovation can be identified and serve as an input for evidence-based policy making.

All published GII 2017 ranks lie within the simulated 90% confidence intervals that take into account the unavoidable uncertainties in the estimation of missing data, the

weights (fixed vs. simulated), and the aggregation formula (arithmetic vs. geometric average) at the pillar level. For the vast majority of countries these intervals are narrow enough for meaningful inferences to be drawn: the intervals comprise fewer than 10 positions for 83% (105 out of 127) of the economies. Some caution is needed mainly for two countries—Belarus and Niger—with ranks that are highly sensitive to the methodological choices. The Input and the Output Sub-Indices have the same modest degree of sensitivity to the methodological choices related to the imputation method, weights, or aggregation formula. Country ranks, either in the GII 2017 or in the two sub-indices, can be considered representative of the many possible scenarios: 75% of the countries shift fewer than three positions with respect to the median rank in the GII or either of the Input and Output Sub-Indices.

All things considered, the present JRC audit findings confirm that the GII 2017 meets international quality standards for statistical soundness, which indicates that the GII index is a reliable benchmarking tool for innovation practices at the country level around the world.

Finally, the 'distance to the efficient frontier' measure calculated with Data Envelopment Analysis could complement the Innovation Efficiency Ratio as a measure of efficiency, even if it is conceptually closer to the GII score than to the efficiency ratio.

The GII should not be seen as the ultimate and definitive ranking of countries with respect to innovation. On the contrary, the GII best represents an ongoing attempt by Cornell University, the business school INSEAD, and the World Intellectual Property Organization to find metrics and approaches that better capture the richness of

innovation, continuously adapting the GII framework to reflect the improved availability of statistics and the theoretical advances in the field. In any case, the GII should be regarded as a sound attempt to pave the way for better and more informed innovation policies worldwide.

## Notes

- 1 OECD/EC JRC, 2008, p. 26.
- 2 The JRC analysis was based on the recommendations of the OECD/EC JRC (2008) *Handbook on Composite Indicators* and on more recent research from the JRC. The JRC audits on composite indicators are conducted upon request of the index developers and are available at <https://ec.europa.eu/jrc/en/coin>.
- 3 Groeneveld and Meeden (1984) set the criteria for absolute skewness above 1 and kurtosis above 3.5. The skewness criterion was relaxed to account for the small sample (127 economies).
- 4 Nunnally, 1978.
- 5 Saisana et al., 2005; Saisana et al., 2011.
- 6 The Expectation-Maximization (EM) algorithm (Little and Rubin, 2002; Schneider, 2001) is an iterative procedure that finds the maximum likelihood estimates of the parameter vector by repeating two steps: (1) The expectation E-step: Given a set of parameter estimates, such as a mean vector and covariance matrix for a multivariate normal distribution, the E-step calculates the conditional expectation of the complete-data log likelihood given the observed data and the parameter estimates. (2) The maximization M-step: Given a complete-data log likelihood, the M-step finds the parameter estimates to maximize the complete-data log likelihood from the E-step. The two steps are iterated until the iterations converge.
- 7 Munda, 2008.
- 8 In the geometric average, pillars are multiplied as opposed to summed in the arithmetic average. Pillar weights appear as exponents in the multiplication. All pillar scores were greater than zero, hence there was no reason to rescale them to avoid zero values that would have led to zero geometric averages.

- 9 A question that arises from the GII approach is whether there is a way to benchmark countries' multi-dimensional performance on innovation without imposing a fixed and common set of weights that may not be fair to a particular country. The original question in the DEA literature was how to measure each unit's relative efficiency in production compared to a sample of peers, given observations on input and output quantities and, often, no reliable information on prices (Charnes and Cooper, 1985). A notable difference between the original DEA question and the one applied here is that no differentiation between inputs and outputs is made (Cherchye et al., 2008; Melyn and Moesen, 1991). To estimate DEA-based distance to the efficient frontier scores, we consider the  $m = 7$  pillars in the GII 2017 for  $n = 127$  countries, with  $y_{ij}$  the value of pillar  $j$  in country  $i$ . The objective is to combine the pillar scores per country into a single number, calculated as the weighted average of the  $m$  pillars, where  $w_i$  represents the weight of the  $i$ -th pillar. In absence of reliable information about the true weights, the weights that maximize the DEA-based scores are endogenously determined. This gives the following linear programming problem for each country  $j$ :

$$Y_j = \max_{w_j} \frac{\sum_{i=1}^n y_{ij} w_{ij}}{\max_{Y_i \in \text{score}=1} \sum_{i=1}^n y_{ij} w_{ij}} \quad (\text{bounding constraint})$$

$$\text{subject to } w_{ij} \geq 0, \quad (\text{non-negativity constraint})$$

$$\text{where } j = 1, \dots, 7, \\ i = 1, \dots, 127$$

In this basic programming problem, the weights are non-negative and a country's score is between 0 (worst) and 1 (best).

- 10 Instead, only Switzerland achieved a 1.0 score in the Innovation Efficiency Ratio, calculated as the ratio of the Output Sub-Index over the Input Sub-Index. The Efficiency Ratio and the DEA score embed very different concepts of efficiency, leading to completely different results and insights. A high score in the Innovation Efficiency Ratio is obtained by scoring more on the Output Sub-Index than on the Input Sub-Index, irrespective of the actual scores in these two sub-indices. Instead, a high score in the DEA score can be obtained by having comparative advantages on several GII pillars (irrespective of these being input or output pillars). The DEA scores are therefore closer to the GII scores than to the Innovation Efficiency Ratio.

## References and related reading

- Barbosa, N. and A. P. Faria. 2011. 'Innovation across Europe: How important are institutional differences'. *Research Policy* 40: 1157–69.
- Becker, W., M. Saisana, P. Paruolo, and I. Vandecasteele. 2017. 'Weights and Importance in Composite Indicators: Closing the Gap'. *Ecological Indicators* 80: 12–22.
- Charnes, A. and W. W. Cooper. 1985. 'Preface to Topics in Data Envelopment Analysis'. *Annals of Operations Research* 2: 59–94.
- Cherchye, L., W. Moesen, N. Rogge, T. Van Puyenbroeck, M. Saisana, A. Saltelli, R. Liska, and S. Tarantola. 2008. 'Creating Composite Indicators with DEA and Robustness Analysis: The Case of the Technology Achievement Index'. *Journal of Operational Research Society* 59: 239–51.
- Groeneveld, R. A. and G. Meeden. 1984. 'Measuring Skewness and Kurtosis'. *The Statistician* 33: 391–99.
- Little, R. J. A. and D. B. Rubin. 2002. *Statistical Analysis with Missing Data*. 2nd edition. Hoboken, NJ: John Wiley & Sons, Inc.
- Melyn, W. and W. Moesen. 1991. 'Towards a Synthetic Indicator of Macroeconomic Performance: Unequal Weighting when Limited Information Is Available'. *Public Economics Research Paper* 17. Leuven: Centre for Economic Studies.
- Munda, G. 2008. *Social Multi-Criteria Evaluation for a Sustainable Economy*. Berlin Heidelberg: Springer-Verlag.
- Nunnally, J. 1978. *Psychometric Theory*. New York: McGraw-Hill.
- OECD/EC JRC (Organisation for Economic Co-operation and Development/European Commission, Joint Research Centre). 2008. *Handbook on Constructing Composite Indicators: Methodology and User Guide*. Paris: OECD.
- Paruolo, P., M. Saisana, and A. Saltelli. 2013. 'Ratings and Rankings: Voodoo or Science?' *Journal of the Royal Statistical Society A* 176 (3): 609–34.
- Saisana, M., B. D'Hombres, and A. Saltelli. 2011. 'Ricky Numbers: Volatility of University Rankings and Policy Implications'. *Research Policy* 40: 165–77.
- Saisana, M., A. Saltelli, and S. Tarantola. 2005. 'Uncertainty and Sensitivity Analysis Techniques as Tools for the Analysis and Validation of Composite Indicators'. *Journal of the Royal Statistical Society A* 168 (2): 307–23.
- Saltelli, A., M. Ratto, T. Andres, F. Campolongo, J. Cariboni, D. Gatelli, M. Saisana, and S. Tarantola. 2008. *Global Sensitivity Analysis: The Primer*. Chichester, England: John Wiley & Sons.
- Schneider, T. 2001. 'Analysis of incomplete climate data: Estimation of mean values and covariance matrices and imputation of missing values'. *Journal of Climate* 14, 853–871.

## Measuring Innovation in Agriculture and Food Systems

Agriculture and food innovation systems are complex and constantly evolving. Today robotics and biotechnological and digital technologies are applied in agriculture and food systems. New actors enter the systems and traditional actors, such as farmers and food companies, grow into commercial farmers, bio/organic producers, and so on.

Agriculture and food systems also vary greatly across countries, reflecting each country's level of development as well as the role that agriculture and food sectors play.

Measuring agricultural innovation is challenging for several reasons:

First, agriculture and food systems span many different sectors, products, and service groups that are not easily grasped and that go far beyond the agriculture sector or agricultural farms alone. As Chapter 1 and the other substantive chapters of this report show, innovations occur along the value chain and involve (1) agricultural inputs such as fertilizers and seeds, at times coming from the chemical or the biotechnology sector; (2) product innovations coming from the capital goods sector; and (3) process or organizational innovations in the fields of payments, logistics, and distribution services coming from the banking, transport, and retail sectors.

Second, key innovation data sources such as the innovation surveys based on the *Oslo Manual* focus on the manufacturing and services sectors, thus excluding agriculture for

the most part.<sup>1</sup> Although the agriculture sector is likely to be included in future revisions of the *Oslo Manual*, it is currently unclear whether the coverage of the business sector alone will satisfy the innovation data requirements of the agriculture sector.

Third, in developing countries, agricultural activities and related innovations often take place at the farm or household level (especially in case of subsistence farming), not in private-sector firms as captured by most data collections. Statistically, however, capturing activity in the informal sector or at the grassroots level is challenging.<sup>2</sup>

Clearly, the work of the African Union–New Partnership for Africa's Development (AU-NEPAD) on the African Innovation Outlook,<sup>3</sup> and application of innovation surveys, for example, is ongoing.<sup>4</sup> Yet the focus is currently not on the informal or the agriculture sector.

As a result of the complexities outlined above, and because of a lack of robust metrics (see Chapter 2), measuring innovation in agriculture and food systems is a difficult endeavour. This annex maps agriculture and food systems based on the GII framework.

Although incomplete, this mapping illustrates the above challenge and provides guidance to researchers and policy makers interested in benchmarking their agriculture and food systems. It also shows how the GII framework could be adapted to

measuring innovation in specific systems and sectors, thereby laying the foundations for interesting future work.

---

### Potential indicators to benchmark innovation in agriculture and food systems

Table 1 shows how the GII framework could be used to measure the characteristics of agriculture and food innovation systems. The table includes only the indicators that are relevant to measuring innovation in agriculture and food systems and that are available for a large number of economies.<sup>5</sup> The next sections look into some of these indicators and provide snapshots of top performing economies in each selected indicator.

---

### Human capital and research

Education and research and development (R&D) investment are key to boosting productivity; they are also key for advancing the agriculture and food sector.<sup>6,7</sup> Various studies demonstrate that better-educated farmers have the skills to run their farms more efficiently and are more prone to embracing innovation.<sup>8</sup> Education has also proven to spill over, affecting the productivity of family members and neighbours.<sup>9</sup>

In spite of its role in agriculture and food systems, data on farmers' education are limited. This has led researchers to use other proxies, such

**Table 1: Adapting the GII framework to agriculture and food systems**

| GII pillar                              | GII indicator                               | Are indicators available for agri-food? | Corresponding indicator in agri-food               | Additional indicators                |
|---|---|---|--|--------------------------------------|
| <b>Human capital and research</b>       | Expenditure on education                    | For only a few economies                | —  | —                                    |
|   | Tertiary enrolment                          | Yes                                     | Tertiary students in agriculture programmes        | —                                    |
|   | Graduates in science & engineering          | Yes                                     | ODA for agricultural education/training            | —                                    |
|   | Researchers                                 | Yes                                     | Agricultural researchers                           | —                                    |
|   | Gross expenditures on R&D                   | Yes                                     | Agricultural R&D expenditures                      | ODA for agricultural research        |
|   | Global R&D companies, average expenditure   | No                                      | —  | —                                    |
|   | QS university rankings                      | No                                      | —  | —                                    |
| <b>Market sophistication</b>            | Ease of getting credit                      | For only a few economies                | —  | —                                    |
|   | Domestic credit to private sector           | Yes                                     | Credit to agriculture                              | —                                    |
|   | Microfinance gross loans                    | For only a few economies                | —  | —                                    |
|   | Venture capital deals                       | No                                      | —  | —                                    |
|   | Applied tariff rate                         | Yes                                     | Applied tariff rate for agriculture and food items | —                                    |
|   | Intensity of local competition              | No                                      | —  | —                                    |
| <b>Business sophistication</b>          | Knowledge-intensive employment              | —                                       | —  | —                                    |
|   | Firms offering formal training              | Yes                                     | Firms offering formal training in food-processing  | —                                    |
|   | GERD performed by business                  | For only a few economies                | —  | —                                    |
|   | GERD financed by business                   | No                                      | —  | —                                    |
|   | Females employed w/ advanced degrees        | No                                      | —  | —                                    |
|   | University/industry research collaborations | No                                      | —  | —                                    |
|   | State of cluster development                | No                                      | —  | —                                    |
|   | GERD financed by abroad                     | No                                      | —  | —                                    |
|   | JV-strategic alliance deals                 | No                                      | —  | —                                    |
|   | Patent families in 2+ offices               | Yes                                     | Agri-food patent families in 2+ offices            | —                                    |
|   | IP payments                                 | No                                      | —  | —                                    |
|   | High-tech imports                           | Yes                                     | High-tech imports for agri-food sector             | Use of fertilizers; Machinery in use |
|   | FDI net inflows                             | Yes                                     | Agri-food FDI inflows                              | —                                    |
| <b>Knowledge and technology outputs</b> | Patents by origin                           | Yes                                     | Agri-food patents by origin                        | Plant varieties registered           |
|   | PCT patent applications                     | Yes                                     | Agri-food PCT patent applications                  | —                                    |
|   | Utility models by origin                    | Yes                                     | Agri-food utility models by origin                 | —                                    |
|   | Scientific and technical articles           | Yes                                     | Scientific and technical articles in agri-food     | —                                    |
|   | Citable documents H index                   | Yes                                     | Citable documents in agri-food                     | —                                    |
|   | Growth rate of PPP\$ GDP/worker             | Yes                                     | Agriculture labour productivity growth             | —                                    |
|   | New businesses                              | No                                      | —  | —                                    |
|   | ISO 9001 quality certificates               | No                                      | —  | —                                    |
|   | IP receipts                                 | No                                      | —  | —                                    |
|   | High-tech exports                           | Yes                                     | Agri-food exports                                  | —                                    |
|   | FDI net outflows                            | Yes                                     | Agri-food FDI outflows                             | —                                    |
| <b>Creative outputs</b>                 | Trademarks                                  | Yes                                     | Agri-food trademarks                               | Geographic indications registered    |
|   | Industrial designs                          | Yes                                     | Agri-food industrial designs                       | —                                    |
|   | ICTs & business model creation              | No                                      | —  | —                                    |
|   | ICTs & organizational model creation        | No                                      | —  | —                                    |

Notes: The GII pillars Institutions and Infrastructure are not included in this table because the metrics in those pillars already capture the role of institutions and infrastructure in agriculture and food systems. ODA = official development assistance; — = data currently under review.

**Table 2: Official development assistance for education and training: Top five economies**

| Economy     | ODA in US\$, millions |
|-------------|-----------------------|
| Afghanistan | 8.2                   |
| Ethiopia    | 4.6                   |
| China       | 4.3                   |
| Indonesia   | 4.1                   |
| Uganda      | 3.4                   |

Data source: FAOstats, February 2017. Available at <http://www.fao.org/faostat/en/>.

Note: Data refer to total disbursements from bilateral and multilateral donors for 2014.

as official development assistance (ODA) for education and training (see Table 2). According to available data, Afghanistan, Ethiopia, China, Indonesia, and Uganda receive the highest amounts of aid in agricultural education and training. Other top recipients include Malawi, Myanmar, and Sierra Leone.

Lagging R&D expenditures in high-, middle-, and low-income economies affect productivity growth and innovation in agriculture. According to the data available, only about 6% of the world’s R&D investments and researchers are devoted to agricultural sciences (see Figure 1).<sup>10</sup> Although advanced economies have historically been the leaders in agricultural R&D, research capacity has also reached high standards in several emerging economies—such as China, India, Brazil, Argentina, and South Africa.<sup>11</sup> In agriculture, R&D affects output with a long lag, but the impact lasts for a long time.<sup>12</sup> R&D spillovers tend to be geographically bounded because innovations produced in one part of the world require adaptations to work well in local soil and climate conditions. This makes indigenous R&D efforts essential. Developing countries, especially in Sub-Saharan Africa, have traditionally underspent in agricultural R&D (see Chapter 2). When they undertake R&D, poor (or lacking) extension services generally

**Table 3: Agricultural R&D expenditures: Top five economies**

| Economy     | US\$, thousands | Economy             | Share of agriculture value added |
|-------------|-----------------|---------------------|----------------------------------|
| India       | 3,857           | Singapore           | 1.48                             |
| Korea, Rep. | 1,521           | Qatar               | 0.11                             |
| China       | 1,149           | Netherlands         | 0.10                             |
| Netherlands | 1,145           | Trinidad and Tobago | 0.10                             |
| Australia   | 842             | Denmark             | 0.06                             |

Data source: UNESCO-UIS Science & Technology Data Center, February 2017. Available at <http://data.uis.unesco.org/>.

Notes: Where data are not available, data from previous years are used. R&D expenditures are in 2005 PPP\$. Data are available for 73 economies. Many Organisation for Economic Co-operation and Development (OECD) economies, including the United States of America (USA), as well as other large economies such as Argentina and Brazil, are excluded because of a lack of data.

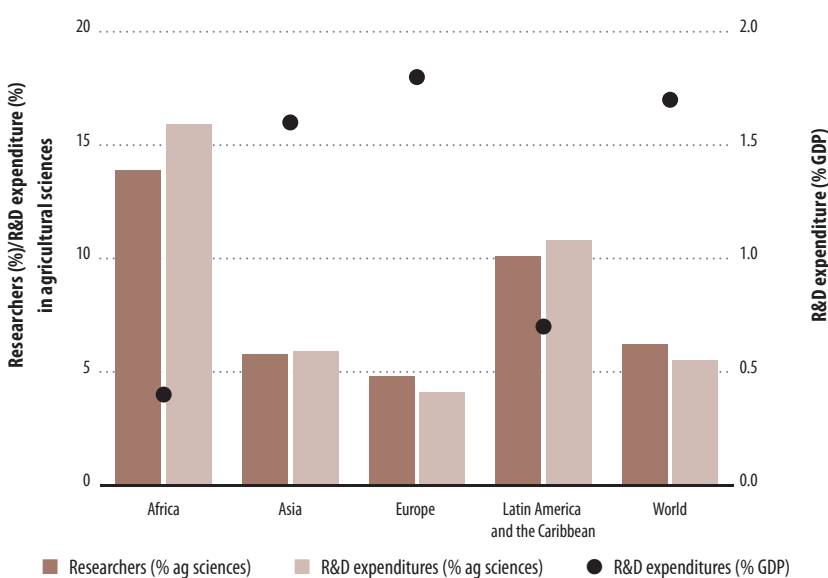
delay the adoption of innovation.<sup>13</sup> Indeed, research demonstrates that developing countries that invested the most in R&D while simultaneously investing in extension have had the strongest productivity leap.<sup>14</sup>

Overall, the top agricultural R&D spenders are India, the Republic of Korea (Korea), China, the Netherlands, and Australia (see Table 3), with India spending more than double than Korea. Singapore spends the most in relation to the size

of its agriculture sector (as measured by value added), investing roughly 150% of its output in R&D. Qatar, the Netherlands, and Trinidad and Tobago follow, with roughly 10% of their agricultural output spent in R&D. Denmark spends 6% of its agricultural output in R&D.

Another way to look at R&D is through ODA disbursements to agricultural research. Nigeria, Argentina, India, Uganda, and Ethiopia are the largest recipients of ODA in this

**Figure 1: Researchers and R&D expenditure in agriculture sciences**



Data source: UNESCO-UIS Science & Technology Data Center, February 2017. Available at <http://data.uis.unesco.org/>.

Notes: Data on researchers in agricultural sciences are based on headcount (HC) measurement. Because of a lack of data, Northern America is missing. Data refer to 2014.

**Table 4: ODA to agricultural research: Top five economies**

| Economy   | ODA (US\$, millions) |
|-----------|----------------------|
| Nigeria   | 30.3                 |
| Argentina | 28.2                 |
| India     | 24.0                 |
| Uganda    | 16.9                 |
| Ethiopia  | 16.9                 |

Data source: FAOstats, February 2017. Available at <http://www.fao.org/faostat/en/>.

Note: Data refer to total disbursements from bilateral and multilateral donors for 2014.

**Table 5: Tertiary students in agricultural studies: Top five economies**

| Economy    | Share of tertiary students (%) |
|------------|--------------------------------|
| Ethiopia   | 8.0                            |
| Uzbekistan | 7.5                            |
| Cambodia   | 6.8                            |
| Viet Nam   | 6.4                            |
| Albania    | 6.3                            |

Data source: UNESCO-UIS Science & Technology Data Center, February 2017. Available at <http://data.uis.unesco.org/>.

Notes: When data for 2014 were not available, data points up to 2008 were used.

**Table 6: Agricultural credit markets: Top five economies**

| Economy                  | US\$, millions | Economy                   | Share of total credit (%) |
|--------------------------|----------------|---------------------------|---------------------------|
| United States of America | 74,951         | New Zealand               | 26                        |
| Germany                  | 57,983         | Uruguay                   | 17                        |
| Australia                | 54,968         | Kyrgyzstan                | 12                        |
| France                   | 54,812         | Tajikistan                | 12                        |
| New Zealand              | 44,903         | Bolivia, Plurinational St | 11                        |

Data source: FAOstats, February 2017. Available at <http://www.fao.org/faostat/en/>.

Note: Data for 2014, available for 69 economies.

area. Argentina is the only top ODA recipient among upper-middle-income economies, while the others are mostly low- and lower-middle-income economies. Among the top 10 recipients are Kenya, the United Republic of Tanzania, and Indonesia, which each received more than US\$10 million. Finally, ODA to agricultural research reaches much higher values than ODA to agricultural education and training (see Table 4).

Data on the share of tertiary students enrolled in agricultural studies indicate that agricultural studies are particularly relevant in the developing world. The top five highest shares of agricultural students in tertiary students are in Ethiopia, Uzbekistan, Cambodia, Viet Nam, and Albania (see Table 5). Other countries with high shares of agricultural students in total graduates include Malawi, Sierra Leone, Eritrea, and Kenya.

### Market sophistication

Financial markets are important components of any innovation system. In agriculture, credit is essential to modernize farms and access high-quality inputs such as seeds and fertilizers. Given the size and nature of most farms, credit constraints can be often severe.<sup>15</sup> According to available data, the countries with the largest credit markets for agriculture are the USA, Germany, Australia, France, and New Zealand (see Table 6). It is worth recalling that these economies have very large credit markets. Indeed, in the GII, New Zealand, the USA, and Australia rank among the top five economies in the Credit sub-pillar. Still, New Zealand is the country that allocated the highest portion of its credit to agriculture (26%). Uruguay, Kyrgyzstan, Tajikistan, and the Plurinational State of Bolivia are the other top economies.

### Business sophistication

The adoption of synthetic fertilizers, together with high-yield crop varieties, has been at the basis of the green revolution. Today, despite the growing demand for organic food, less than 1% of agricultural land is farmed using organic methods.<sup>16</sup> Although organic farming has a number of advantages, synthetic fertilizers are still widely used.<sup>17</sup>

Limited access to high-quality fertilizers is still an issue in many countries, most notably in Sub-Saharan Africa (see for example the case of Uganda, described in Chapter 11). Estimates indicate that, from 2009 to 2015, global demand for fertilizers grew by roughly 15%, and will grow at least 1.6% annually from 2015 to 2020. Sub-Saharan Africa will be responsible for most of this growth, reaching an average annual growth rate of 4.4%.<sup>18</sup>

Data on current fertilizer consumption show that global consumption is highly concentrated, with one single economy—China—consuming 31% of total world fertilizers (see Table 7). Although the gap in fertilizer consumption between China and other economies is considerable, according to available data, other top fertilizer consumers are India, the USA, Brazil, and Indonesia. By contrast, Sub-Saharan African countries together account for only 3% of total world consumption. Considered in relation to arable land, Qatar, Malaysia, Hong Kong (China), New Zealand, and Bahrain are the five top consumers; other important consumers include Singapore, Costa Rica, the United Arab Emirates, and Colombia.

Mechanization of agriculture has also contributed greatly to productivity growth in agriculture. Estimates indicate that the economies with the highest number of machines in their agricultural lands



**Table 7: Fertilizer consumption: Top five economies**

| Economy                  | Share of world consumption (%) | Economy           | Tonnes of nutrients per hectare of arable land |
|--------------------------|--------------------------------|-------------------|--|
| China                    | 30.9                           | Qatar             | 12,111   |
| India                    | 13.4                           | Malaysia          | 2,064  |
| United States of America | 11.0                           | Hong Kong (China) | 1,966  |
| Brazil                   | 7.3                            | New Zealand       | 1,491  |
| Indonesia                | 2.6                            | Bahrain           | 1,319  |

Data source: FAOstats, February 2017. Available at <http://www.fao.org/faostat/en/>.

Notes: Data refer to 2014. Fertilizers include nitrogen, phosphate, and potash.

**Table 8: Machinery in use: Top five economies**

| Economy                  | Machinery in use (number) |
|--------------------------|---------------------------|
| China                    | 10,802,121                |
| India                    | 5,960,636                 |
| United States of America | 4,351,616                 |
| Japan                    | 2,112,822                 |
| Poland                   | 1,539,059                 |

Data source: U.S. Department of Agriculture (USDA), International Agricultural Productivity Data, February 2017. Available at <https://www.ers.usda.gov/data-products/international-agricultural-productivity/>.

**Table 9: Agriculture and food FDI net inflows: Top five economies**

| Economy        | Agri-food FDI (US\$, millions) | Economy            | Agriculture FDI (US\$, millions) | Economy        | Food FDI (US\$, millions) |
|----------------|--------------------------------|--------------------|----------------------------------|----------------|---------------------------|
| United Kingdom | 19,186.1                       | China              | 1,112.1                          | United Kingdom | 19,093.4                  |
| Italy          | 5,728.7                        | Brazil             | 426.7                            | Italy          | 5,746.7                   |
| Brazil         | 3,211.4                        | Ghana              | 348.8                            | Brazil         | 2,784.7                   |
| China          | 2,371.0                        | Argentina          | 259.4                            | Sweden         | 1,962.9                   |
| Sweden         | 1,962.9                        | Russian Federation | 215.8                            | Turkey         | 1,700.5                   |

Data source: FAOstats, February 2017. Available at <http://www.fao.org/faostat/en/>.

Notes: 'Agriculture' includes agriculture, forestry, and fishing. 'Food' includes food, beverages, and tobacco. Data refer to 2012; where data are missing, they refer to 2011, 2010, or 2009. FDI values are expressed in US\$, 2005 prices.

are China, India, the USA, Japan, and Poland, with China and India respectively accounting for 25% and 14% of all world agricultural machinery in use (see Table 8). Italy, Thailand, France, Turkey, and Brazil also stand out in the use of machinery in agriculture.

Although these statistics are extremely interesting, in the future, metrics on the use of drones and other autonomous vehicles might also be useful in assessing the innovativeness of agriculture and food innovation systems. According to recent estimates, the market for drone-powered solutions in agriculture is US\$32.4 billion—25% of the total drone application market.<sup>19</sup> Drones and robots can be integrated at every stage of the production cycle: they can be used for soil analysis, seed planting, spraying,

and weed removal. They are more accurate and efficient than previous technologies such as satellite imagery and traditional tractors, allowing for productivity gains and cost savings.

The last indicator on business sophistication reviewed in this annex is foreign direct investment (FDI) net inflows. Some agricultural and food innovation systems prove to be well integrated in international knowledge networks, receiving considerable FDI. The United Kingdom, Italy, Brazil, China, and Sweden are the top five recipients of FDI inflows in food and agriculture, driven by FDI in food processing (except for China). Ghana, Argentina, and the Russian Federation are among the top five FDI recipients in the agriculture sector, while Turkey is the fifth FDI recipient in food processing (see Table 9).

### Knowledge and technology outputs

This section looks at agricultural labour productivity growth, agriculture and food exports, and patents in technological fields related to agriculture and food.<sup>20</sup>

The top five economies in terms of agricultural labour productivity growth are Slovenia, Bahrain, Luxembourg, Armenia, and Belgium (see Table 10). Others that stand out include Bosnia and Herzegovina, Senegal, and Morocco.

Data on agricultural exports are widely available through the UN Comtrade database, which covers almost all economies in the world and allows for a highly disaggregated analysis. According to these data, a mix of high- and middle-income economies are among the top five exporters of agricultural and food products. The USA leads this ranking,



**Table 10: Agricultural labour productivity growth: Top five economies**

| Economy    | Growth rate of agriculture value added per worker |
|------------|---|
| Slovenia   | 34.6  |
| Bahrain    | 29.2  |
| Luxembourg | 19.9  |
| Armenia    | 16.6  |
| Belgium    | 15.8  |

Data source: World Bank's World Development Indicators, February 2017, available at <http://data.worldbank.org/data-catalog/world-development-indicators>.

Note: Data refer to agriculture value added per worker (constant 2010 US\$).

**Table 12: PCT applications in agriculture and food: Top five economies**

| Economy                  | Total applications |
|--------------------------|--------------------|
| United States of America | 4,821              |
| Japan                    | 2,142              |
| China                    | 1,418              |
| Germany                  | 948                |
| Korea, Rep.              | 798                |

Data source: WIPO Statistics Database, May 2017.

Note: Data refer to 2016.

accounting for 10% of total world agri-food exports. The Netherlands, Germany, Brazil, and China follow with shares of between 6% and 5% (see Table 11). Other European economies—namely France, Spain, Italy, and Belgium—follow. Among emerging economies, Argentina, India, and Indonesia stand out.

The top five economies in agri-food patent applications by origin are the USA, Japan, China, Germany, and Korea (see Table 12). Other important players in agri-food PCT patenting are Switzerland, the Netherlands, the United Kingdom, France, and Italy.

Early high-yielding varieties of wheat and rice led to the most significant improvements in crop yields in the 20th century (see Chapters 3 and 10). The green revolution enabled

**Table 11: Agriculture and food exports: Top five economies**

| Economy                  | Share of agriculture and food exports (%) |
|--------------------------|---|
| United States of America | 10.2                                      |
| Netherlands              | 6.4                                       |
| Germany                  | 5.8                                       |
| Brazil                   | 5.4                                       |
| China                    | 5.0                                       |

Data source: UN Comtrade Database, February 2017. Available at <https://comtrade.un.org/>.

Note: Data refer to 2-digit commodities codes, and include commodities from 01 to 24.

**Table 13: Plant variety applications: Top five economies**

| Economy                  | Total applications |
|--------------------------|--------------------|
| Netherlands              | 2,720              |
| China                    | 2,100              |
| United States of America | 2,027              |
| France                   | 1,038              |
| Germany                  | 942                |

Data source: WIPO, 2016.

developing economies to import cheaper grains and grow high-yield seed varieties, which were responsive to fertilizers and resistant to diseases and insects. Productivity gains from high-yield varieties are not over. First, new innovations—for example, in genome-editing technologies—are expected to drive the development of ground-breaking crop varieties that could not be obtained by traditional breeding (see Chapter 8). Second, the diffusion of seeds and new plant varieties can still bring considerable advantages, as demonstrated in the case of Bt cotton cultivation in India (see Chapter 5), or in the case of soybeans, corn, and cotton in Latin America and the Caribbean (see Chapter 10).

Yet research shows that the knowledge accumulated in the

development of new plant varieties is often tacit and difficult to appropriate.<sup>21</sup> Innovation in plant varieties tends to be cumulative, meaning that prior knowledge is needed to come up with new innovations. The adoption of new plant varieties also depends on the efforts to adapt innovation developed elsewhere to breed locally suitable varieties.<sup>22</sup> These characteristics may make intellectual property protection of new plant varieties a critical issue. The legislation on plant variety protection is increasingly being adopted in low-, middle-, and high-income countries.<sup>23</sup> WIPO data show that, since the early 2000s, plant variety application filings grew rapidly, with middle-income economies—especially in Asia—contributing to global figures more and more frequently.<sup>24</sup>

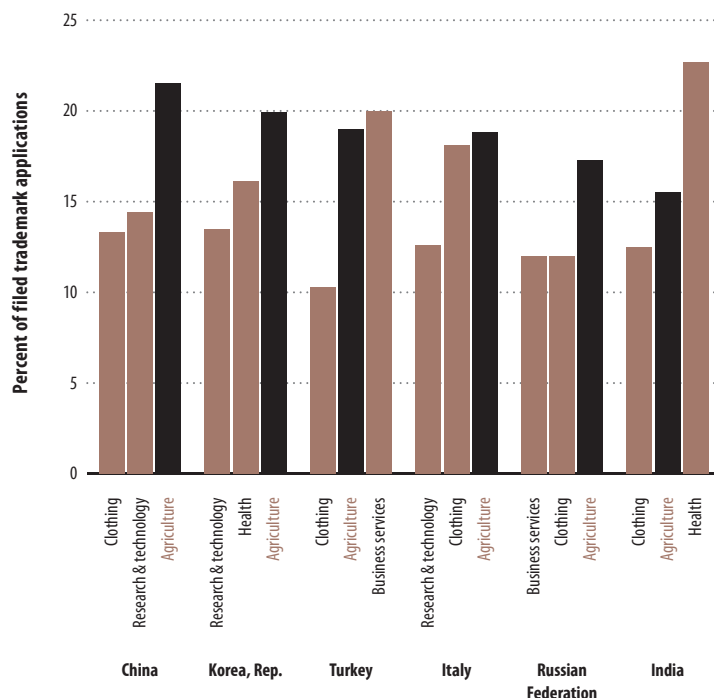
Top filers of plant variety applications are the Netherlands, China, and the USA, followed by France and Germany (see Table 13). Other important applicants are Japan, Korea, the Russian Federation, Ukraine, and Australia.

### Creative outputs

The creative outputs of agriculture and food systems can be measured through trademarks and geographic indications.

Looking at trademarks, Nice classes 29, 30, 31, 32, 33, and 43 are typically associated with the agri-food sector.<sup>25</sup> Still, identifying the Nice classes that capture agriculture and food is a complex task because various other Nice classes can potentially contain agriculture- and food-relevant trademarks. For example, Nice class 1 includes genes of seeds for agricultural production and agricultural chemicals; Nice class 7 includes agricultural elevators and machines; and Nice class 44 includes

**Figure 2: Trademark applications: Top three sectors by country origin**



Data source: WIPO, 2016.

Notes: Data refer to 2015. The top three sectors and top origins were selected based on their 2015 totals.

agriculture, horticulture, and forestry services.

Data on trademark applications indicate that Nice class 30—which collects trademarks in coffee, tea, cocoa, rice, and other food products—is the 6th largest Nice class, comprising 4.6% of all trademark applications filed in 2015. Services for providing food and drink (Nice class 43) ranks 8th, with 3.8%. Finally, Nice class 29 (foodstuffs of animal origin and vegetables) ranks 10th, with 3.7% of all trademark applications. Overall, Nice classes 29, 30, 31, 32, 33, and 43 account for 17.3% of all trademark applications.<sup>26</sup> In China, Korea, Turkey, Italy, the Russian Federation, and India, the agriculture sector is in the top three sectors for trademark applications (see Figure 2).

## Notes

- 1 OECD and Eurostat, 2005.
- 2 Charmes et al., 2016.
- 3 AU-NEPAD, 2010; NPCA, 2014.
- 4 For example, NEPAD's African Science Technology and Innovation Indicators (ASTII) contribute to the development and use of science, technology, and innovation indicators in African countries.
- 5 Agriculture and food innovation systems rely on nation-wide regulations, infrastructures, and education systems that are common for the economy and are therefore captured by the GI. These indicators are not reported in Table 1.
- 6 This section has benefited from contributions from our colleagues from the UNESCO Institute for Statistics (UIS) Martin Schaaper, Rohan Pathirage, and Luciana Marins.
- 7 Alston et al., 2000; Alston, 2010; Hayami and Ruttan, 1970; Kawagoe et al., 1985; Lau and Yotopoulos, 1989; Reimers and Klasen, 2013.
- 8 Adrian et al., 2005; Knight et al., 2003; Wheeler, 2008.
- 9 Knight et al., 2003; Weir and Knight, 2004.

- 10 Africa stands out as the region with the highest proportion of resources committed to agricultural sciences (16% of the region's total R&D expenditure). This is followed by Latin America and the Caribbean (11%), ahead of Asia (6%) and Europe (4%), indicating that middle- and low-income economies allocate more resources to agricultural sciences, whereas high-income economies focus more on other fields—notably natural sciences and engineering. These figures, however, should be taken with caution because of numerous data gaps.
- 11 Ruttan, 2002.
- 12 Alston, 2010.
- 13 Alston, 2010.
- 14 Fuglie, 2012. In developing countries, the public sector is still the main source of extension services, although they are plagued by limited funding, insufficient technologies and skills, weak links with research institutes, and limited farmer participation (World Bank, 2005).
- 15 FAO, 2016.
- 16 Data from FAOstats, available at <http://www.fao.org/faostat/en/>.
- 17 Moreover, modern technologies are optimizing their usage, thus reducing their environmental consequences (see Chapter 4).
- 18 FAO, 2016.
- 19 PwC, 2016.
- 20 Technological fields are selected following Lippoldt (2015).
- 21 Olmstead and Rhode, 2008.
- 22 Evenson and Gollin, 2003.
- 23 Campi and Nuvolari, 2015.
- 24 WIPO, 2016. See also FAO et al., 2009. On plant variety protection, see <http://www.upov.int>.
- 25 WIPO, 2016. The Nice Classification, established by the Nice Agreement (1957), is an international classification of goods and services applied for the registration of trademarks.
- 26 WIPO, 2016.

## References

- Adrian, A. M., S. H. Norwood, and P. L. Mask. 2005. 'Producers' Perceptions and Attitudes Toward Precision Agriculture Technologies'. *Computers and Electronics in Agriculture* 48 (3): 256–71.
- Alston, J. M. 2010. 'The Benefits from Agricultural Research and Development, Innovation, and Productivity Growth'. *OECD Food, Agriculture and Fisheries Working Paper* No. 31. Paris: OECD Publishing.

- Alston, J. M., C. Chang-Kang, M. C. Marra, P. G. Pardey, and T. J. Wyatt. 2000. *A Meta Analysis of Rates of Return to Agricultural R&D: Ex Pede Herculem?* IFPRI Research Report No. 113 Washington, DC: IFPRI.
- AU-NEPAD (African Union–New Partnership for Africa’s Development). 2010. *African Innovation Outlook 2010*. Pretoria: AU–NEPAD.
- Campi, M. and A. Nuvolari. 2015. ‘Intellectual Property Protection in Plant Varieties. A Worldwide Index (1961–2011)’. *Research Policy* 44 (4): 951–64.
- Charmes, J., F. Gault, and S. Wunsch-Vincent. 2016. ‘Formulating an Agenda for the Measurement of Innovation in the Informal Economy’. In *The Informal Economy in Developing Nations: Hidden Engine of Innovation?* eds. E. Kraemer-Mbula and S. Wunsch-Vincent. Cambridge: Cambridge University Press. 336–66.
- Evenson, R. E. and D. Gollin. 2003. ‘Assessing the Impact of the Green Revolution, 1960 to 2000’. *Science* 300: 758–62.
- FAO (Food and Agriculture Organization of the United Nations). 2016. *World Fertilizer Trends and Outlook to 2019*. Rome: FAO.
- FAO, OECD, UPOV, ISF, and ISTA (Food and Agriculture Organization of the United Nations, Organisation for Economic Co-operation and Development, International Union for the Protection of New Varieties of Plants, International Seed Federation, and International Seed Testing Association). 2009. *Responding to the Challenges of a Changing World: The Role of New Plant Varieties and High Quality Seed in Agriculture*. Proceedings of the Second World Seed Conference, FAO Headquarters, Rome, 8–10 September 2009.
- Fuglie, K. O. 2012. ‘Productivity Growth and Technology Capital in the Global Agricultural Economy’. In *Productivity Growth in Agriculture: An International Perspective*, eds. Fuglie, K. O., Wang, S. L., Ball, V. E., & C.A.B. International. Wallingford Oxfordshire, UK: CABI.
- Hayami, Y. and V. W. Ruttan. 1970. ‘Agricultural Productivity Differences among Countries’. *The American Economic Review* 60 (5): 895–911.
- Kawagoe, T., Y. Hayami, and V. W. Ruttan. 1985. ‘The Intercountry Agricultural Production Function and Productivity Differences among Countries’. *Journal of Development Economics* 19 (1–2): 113–32.
- Knight, J., S. Weir, and T. Woldehanna. 2003. ‘The Role of Education in Facilitating Risk-Taking and Innovation in Agriculture’. *The Journal of Development Studies* 39 (6): 1–22.
- Lau, L. J. and P. A. Yotopoulos. 1989. ‘The Meta-Production Function Approach to Technological Change in World Agriculture’. *Journal of Development Economics* 31 (2): 241–69.
- Lippoldt, D. 2015. ‘Innovation and the Experience with Agricultural Patents Since 1990: Food for Thought’. *OECD Food, Agriculture and Fisheries Papers* No. 73. Paris: OECD Publishing.
- NPCA (NEPAD Planning and Coordinating Agency). 2014. *African Innovation Outlook 2014*. Pretoria: NPCA.
- OECD and Eurostat (Organisation for Economic Co-operation and Development and Eurostat). 2005. *Oslo Manual: Guidelines for Collecting and Interpreting Innovation Data*, 3rd Edition. Paris: OECD Publishing.
- Olmstead, A. L. and P. W. Rhode. 2008. *Creating Abundance: Biological Innovation and American Agricultural Development*. Cambridge: Cambridge University Press.
- PwC (PricewaterhouseCoopers). 2016. *Clarity from above. PwC Global Report on the Commercial Applications of Drone Technology*. May 2016. PricewaterhouseCoopers & Strategy. Available at <https://www.pwc.pl/en/publikacje/2016/clarity-from-above.html>.
- Reimers, M. and S. Klasen. 2013. ‘Revisiting the Role of Education for Agricultural Productivity’. *American Journal of Agricultural Economics* 95 (1): 131–52.
- Ruttan, V. W. 2002. ‘Productivity Growth in World Agriculture: Sources and Constraints’. *Journal of Economic Perspectives* 16 (4): 161–84.
- Weir, S. and J. Knight. 2004. ‘Externality Effects of Education: Dynamics of the Adoption and Diffusion of an Innovation in Rural Ethiopia’. *Economic Development and Cultural Change* 53 (1): 93–113.
- Wheeler, S. A. 2008. ‘What Influences Agricultural Professionals’ Views towards Organic Agriculture?’ *Ecological Economics* 65 (1): 145–54.
- WIPO (World Intellectual Property Organization). 2016. *World Intellectual Property Indicators 2016*. Geneva: WIPO.
- World Bank. 2005. *Agriculture Investment Sourcebook, Economic and Sector Work*. Washington, DC: World Bank.

## The Potential of a Global Diagnostic Tool for Agricultural Innovation Systems

CHRISTIAN GROVERMANN, SAMY GAJI, KARIN NICHTERLEIN, ABDOULAYE SALEY MOUSSA, SÓNIA DIAS, ANDREA SONNINO, and DELGERMAA CHULUUNBAATAR,

Food and Agriculture Organization of the United Nations (FAO)

Eradicating hunger and malnutrition, improving rural livelihoods, and protecting the environment in the context of the global trends and challenges (e.g., population growth, climate change, land degradation) that shape agriculture and food systems worldwide will require creative solutions. Innovative responses to complex issues are needed to accelerate progress towards achieving the UN Sustainable Development Goals (SDGs). Innovation, be it technological, institutional, or social, emerges from collective thinking, iterative learning, and action. It is a process by which multiple actors and stakeholders collectively put knowledge to use.<sup>1</sup> Innovation outcomes—such as poverty reduction, increases in agricultural productivity, and resource use efficiency—are determined by the properties and capacities of the system in which organizations or individuals operate and engage with each other. Effective and dynamic systems are likely to generate more effective and relevant innovation outcomes. In addition to enhanced investments, policies, and technologies, a balanced strategy for sustainable agricultural productivity growth in developing countries involves strengthening agricultural innovation systems (AIS).<sup>2</sup>

### Agricultural innovation systems

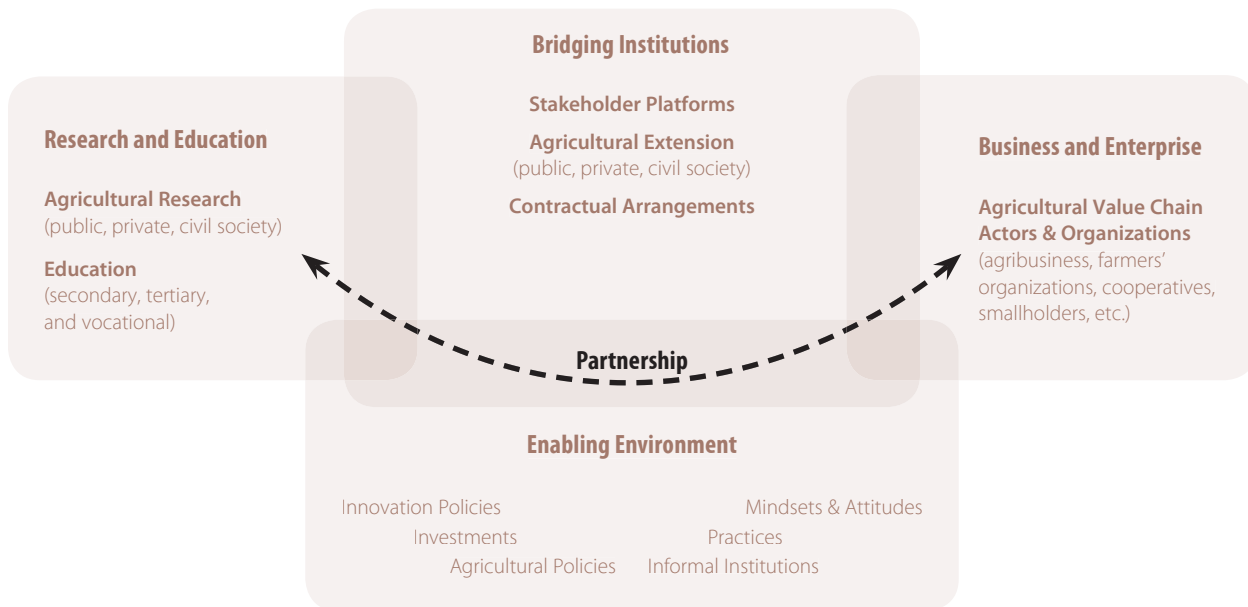
AIS can be understood as a network of actors (organizations and individuals), together with supporting institutions (formal and informal) and policies in the agricultural and related sectors that brings existing or new products, processes, and forms of organization into social and economic use.<sup>3</sup> System thinking is firmly established in the agriculture and rural development disciplines, and the AIS concept is widely recognized among researchers.<sup>4</sup> Adopting an AIS perspective for agricultural development issues is also becoming more commonplace beyond academia in international agencies and fora, donor organizations, and government outfits.<sup>5</sup>

Based on a conceptual model proposed by Arnold and Bell (2001) and further refined by Spielman and Birner (2008) and Spielman and Kelemework (2009), four primary AIS domains comprising public, civil society, and private-sector actors are proposed: (1) research and education, involving research institutes, universities, and vocational training centres; (2) business and enterprise, involving various value chain actors, agribusiness, producers, and consumers; (3) bridging institutions, involving stakeholder platforms, contractual arrangements, and various types of

rural advisory services; and (4) an enabling environment, involving governance and policies as well as behaviours, mindsets, and attitudes (Figure 1). The actors in the system engage in collective action at various levels, from local to global, and with various objectives, be it a product, process, or any other type of innovation.

### Requirements for a robust AIS assessment

Assessing agricultural innovation system properties and performance is not a straightforward exercise. Whereas much emphasis has been put on analysing and assessing the overall role of agricultural research and of extension and rural advisory services, relatively little attention has been paid to the system-wide analysis (e.g., understanding AIS actors' linkages and relationships and how these shape AIS performance), or to developing a broader diagnostic tool for assessing national agricultural innovation systems. AIS assessment has the potential to inform decision-makers about strengths, gaps, and opportunities in capacity development and investment. It can also be instrumental in meeting monitoring and evaluation requirements. A transition towards

**Figure 1: Representation of the agricultural innovation system**

Source: Adapted from TAP, 2016, with permission from CAB International 2016.

sustainable growth in the food and agriculture sectors needs evidence on what works and what does not.<sup>6</sup>

In recent years, countries have started to recognize the critical role that innovation plays and will continue to play in achieving the SDGs. During the 25th Session of the Committee on Agriculture (COAG) of the Food and Agriculture Organization of the United Nations (FAO),<sup>7</sup> countries explicitly requested support for the assessment of their innovation systems, in particular through the development of a diagnostic tool.

Data related to different aspects of AIS are available from a wide range of sources. These include FAO, the International Food Policy Research Institute (IFPRI), the Organisation for Economic Co-operation and Development (OECD), the World Bank, the World Economic Forum (WEF), and the World Intellectual Property Organization (WIPO). Existing datasets include information,

for example, on public spending and foreign aid for agricultural research and extension, ease of access to loans, and costs associated with agricultural policies. For a more comprehensive assessment, macro-level indicators measuring rather static properties and performance can be complemented by indicators that capture systems dynamics.<sup>8</sup> These can help to understand how far a system is integrated, heterogeneous, and demand-driven.

The AIS concept puts great emphasis on understanding the nature of relationships and interactions between actors and the knowledge, attitudes, and practices that shape these relationships. However, such information is not readily available.

This chapter explores the potential for a diagnostic tool to assess national agricultural innovation systems. Such a diagnostic tool needs to be geared towards identifying enabling and hindering factors that affect the performance of the system, with the aim of improving its overall

performance to respond to the needs of its actors and stakeholders. More specifically, the chapter provides insights into data availability and discusses options for additional data gathering and validation.

### Data considerations

Underpinning all these elements is the availability of good and up-to-date data. Good data are both essential and difficult to identify.

### Overview of available information

The complexity of the AIS concept poses challenges in terms of methods and data. The literature on innovation systems in agriculture has been making valuable contributions to the understanding of the role of AIS, mostly through the use of descriptive and case study methods,<sup>9</sup> while usually avoiding the use of more formal models and macro-level analysis.

More systematic assessment approaches are, however, gaining

traction.<sup>10</sup> A quantitative diagnostic of AIS at the country level or across a set of countries has been proposed by Spielman and Kelemework (2009) and Mekonnen et al. (2015). For their study of the determinants of technical efficiency in agriculture, Mekonnen et al. (2015) collected a dataset on innovation system properties covering 85 low- and middle-income countries from 2004 to 2011. The results illustrate how a global analysis of AIS can contribute to a better understanding of key agricultural development challenges. At the same time, the study shed light on some of the difficulties related to obtaining meaningful and comprehensive aggregate data on agriculture-specific innovation system properties. In terms of the explained variable, Mekonnen et al. decided to resort to technical efficiency. They point out that the innovation system properties selected for their study are expected to have a positive influence on the efficiency of agricultural production. The quality of institutions and legal systems as well as factors enabling business and enterprise influence the nature and performance of public- and private-sector innovation processes.

Table 1 on page 84 compiles available information that is of potential use for global AIS analysis. These are indicators that have already been used in the literature. As shown in the bottom part of the table, a range of AIS outcome indicators other than technical efficiency are available—for example, eco-efficiency and total factor productivity (TFP)—or simpler metrics, such as the value of agricultural production or agricultural exports. This wide range of indicators demonstrates the need to draw on records from a variety of sources to create a comprehensive database. The compilation reveals that several indicators pertain to innovation

at large and are not specific to the agricultural sector. In the absence of more accurate data, these are considered proxies for AIS characteristics. At the same time, they represent spillovers from what shapes innovation in general to the agricultural innovation system, which are important to take into account. Several of the indicators shown in Table 1 have been used in the studies by Spielman and Kelemework (2009) and Mekonnen et al. (2015), while other variables—such as public spending on extension and research-extension collaboration—were not considered previously but have been added here, as deemed relevant. The IFPRI/ASTI database records numbers of researchers and public spending on research in agriculture but falls short of providing any indicators on the relevance and demand-orientation of agricultural research.<sup>11</sup>

Three criteria were applied for selecting variables: (1) the indicator must be a potential parameter to assess innovation processes in agriculture; (2) the data must be openly accessible; (3) the level of data coverage across countries and years must be high (for most countries less than 20% of data are missing between 2000 and 2014). For any assessment of AIS on the basis of the data presented here, it is crucial to take into account issues regarding the quality and informative value of the data. Rather than focusing the analysis on single years or averages, data trends as well as variability, especially in the case of financial flows, should be at the core of an innovation system diagnostic.

#### **AIS properties**

Although a range of useful indicators has been identified, it becomes clear that many gaps exist—for example, gaps in data on rural advisory services and farmer organizations. Some indicators capture generic innovation system properties but lack precision

in the context of analysing AIS. In Table 2 on page 85, additional indicators are proposed that would be desirable for a more accurate and in-depth diagnosis of AIS. The indicators listed here by no means present an exhaustive list but serve to draw attention to how some important gaps could potentially be filled. Data on these indicators exist but are available only for a limited number of countries. Furthermore, data from national sources or surveys exist for selected countries but require considerable effort to make them comparable cross-country.

In Tables 1 and 2, the AIS properties variables were attributed to one of the four AIS domains to reflect how they capture the education and research levels, business and enterprise development, bridging institutions, and enabling environment aspects of the assessment. This categorization, however, falls short of making an important distinction that is of great relevance for any AIS analysis. Indicators can represent either more actor-oriented and static AIS characteristics or more system- and action-oriented properties. In addition, a distinction can be made in terms of specificity. While some indicators can be considered more generic, applying to innovation systems in general, others are more specific to innovation systems in the agricultural sector.

The following indicators can be classified as representing mostly static and generic properties: health expenditures, foreign aid received, total tax rate, patent applications, scientific and technical journal articles, domestic credit to the private sector, and the credit information index.

A range of indicators can be classified as representing mostly static but fairly agriculture-specific properties: farmer organization membership, extension service providers, extension



**Table 1: Selected easily accessible variables of relevance for global AIS analysis**

| AIS PROPERTIES                 |   |                    |  |  |
|--------------------------------|---|--------------------|--|--|
| Domain                         | Indicators                                      | Analytical focus   | Unit                                       | Sources  |
| <b>Research and education</b>  | Quality of the education system                 | Trend              | 1 (low) to 7 (high)                        | WEF, GCR data                                  |
|                                | Foreign aid for agricultural education/training | Trend, variability | % of agriculture GDP                       | OECD, DAC data                                 |
|                                | Quality of scientific research institutions     | Trend              | 1 (low) to 7 (high)                        | WEF, GCR data                                  |
|                                | Agricultural researchers                        | Trend              | FTEs per 100,000 farmers                   | IFPRI, ASTI data                               |
|                                | Agricultural research spending                  | Trend, variability | % of agriculture GDP                       | IFPRI, ASTI data                               |
|                                | Foreign aid for agricultural research           | Trend, variability | % of agriculture GDP                       | OECD, DAC data                                 |
|                                | Patent applications                             | Trend              | Number per 1,000,000 people                | WIPO data                                      |
|                                | Scientific and technical journal articles       | Trend, variability | Number per 100 researchers                 | WB, WDI data                                   |
| <b>Bridging institutions</b>   | University-industry collaboration in R&D        | Trend, variability | 1 (minimal) to 7 (intensive)               | WEF, GCR data                                  |
|                                | Foreign aid for extension                       | Trend, variability | % of agriculture GDP                       | OECD, DAC data                                 |
| <b>Business and enterprise</b> | Start-up procedures to register a business      | Trend              | Number                                     | WB, WDI data                                   |
|                                | Time required to start a business               | Trend              | Days                                       | WB, WDI data                                   |
|                                | Total tax rate                                  | Trend              | % of commercial profits                    | WB, WDI data                                   |
|                                | Ease of accessing loans                         | Trend              | 1 (low) to 7 (high)                        | WEF, GCR data                                  |
|                                | Domestic credit to private sectors              | Trend, variability | % of GDP                                   | WB, WDI data                                   |
| <b>Enabling environment</b>    | Credit information index                        | Trend              | 0 (low) to 8 (high)                        | WB, WDI data                                   |
|                                | Credit to agriculture                           | Trend, variability | % of total credit                          | FAOSTAT data                                   |
|                                | Government expenditure on agriculture           | Trend, variability | % of total outlays                         | FAOSTAT data                                   |
|                                | Agricultural policy costs                       | Trend              | 1 (low) to 7 (high)                        | WEF, GCR data                                  |
|                                | Foreign aid received                            | Trend, variability | Current international US\$ per capita      | OECD, DAC data                                 |
|                                | Foreign aid for agriculture                     | Trend, variability | % of agriculture GDP                       | OECD, DAC data                                 |
|                                | Gross capital formation                         | Trend              | % of GDP                                   | WB, WDI data                                   |
|                                | Health expenditures                             | Trend, variability | % of GDP                                   | WB, WDI data                                   |
| AIS OUTCOMES                   |   |                    |  |  |
| Domain                         | Indicators                                      | Analytical focus   | Unit                                       | Sources  |
| <b>Results</b>                 | Agricultural output                             | Level, growth      | Tons per hectare / %                       | FAOSTAT data                                   |
|                                | Value of agricultural output                    | Level, growth      | Current international US\$ per hectare / % | FAOSTAT data                                   |
|                                | Value of agricultural exports                   | Level, growth      | % of agricultural output                   | FAOSTAT data                                   |
|                                | Total factor productivity <sup>a</sup>          | Growth             | Index                                      | FAOSTAT data (calculation required); USDA, ERS |
|                                | Eco-efficiency                                  | Level, growth      | 0 (low) to (1 high) / %                    | FAOSTAT data (calculation required)            |
|                                | Rural poverty                                   | Trend              | % of rural population                      | WB, WDI data                                   |

Note: FAOSTAT data = FAO Statistical Databases, available at <http://www.fao.org/faostat/en/#home>; IFPRI, ASTI data = International Food Policy Research Institute, Agriculture Science and Technology Indicators, available at <https://www.asti.cgiar.org/>; OECD, DAC data = Organisation for Economic Co-operation and Development, Development Assistance Committee, available at <http://www.oecd.org/development/stats/idsonline.htm>; USDA, ERS = United States Department of Agriculture, Economic Research Service, available at <https://www.ers.usda.gov/data-products/international-agricultural-productivity/>; WB, WDI data = World Bank, World Development Indicators, available at <http://data.worldbank.org/data-catalog/world-development-indicators>; WEF, GCR = World Economic Forum, Global Competitiveness Report 2016–2017, available at <https://www.weforum.org/reports/the-global-competitiveness-report-2016-2017-1>; and World Intellectual Property Organization (WIPO), Global Brand Database, available at <http://www.wipo.int/branddb/en/>.

<sup>a</sup> Environmentally adjusted total factor productivity has been suggested as an alternative measure by the OECD.



**Table 2: Proposed indicators for in-depth diagnosis of AIS**

| AIS PROPERTIES                 |  |                    |                                 |                  |
|--------------------------------|--|--------------------|---------------------------------|------------------|
| Domain                         | Indicators                                     | Analytical focus   | Unit                            | Possible sources |
| <b>Research and education</b>  | Vocational training graduates                  | Trend              | Number per 100,000 farmers      | National data    |
|                                | Quality of university education in agriculture | Trend              | 1 (low) to 10 (high)            | Survey data      |
|                                | Quality of vocational training in agriculture  | Trend              | 1 (low) to 10 (high)            | Survey data      |
|                                | Demand-orientation of agricultural Research    | Trend              | 1 (low) to 10 (high)            | Survey data      |
|                                | Research-extension collaborations              |                    | 1 (low) to 10 (high)            | Survey data      |
| <b>Bridging institutions</b>   | Extension service providers                    | Trend              | Number                          | National data    |
|                                | Extension agents                               | Trend              | Number per 100,000 farmers      | National data    |
|                                | Public spending on extension                   | Trend, variability | % of agriculture GDP            | National data    |
|                                | Demand-orientation of extension                | Trend              | 1 (low) to 10 (high)            | Survey data      |
| <b>Business and enterprise</b> | Farmer organization membership                 | Trend              | % of total farmers              | National data    |
|                                | Adoption of certification standards            | Trend              | 1 (low) to 10 (high)            | Survey data      |
|                                | Seed regulation                                | Trend              | 0 (poor) to 100 (good practice) | WB, EBA data     |
|                                | Fertiliser regulation                          | Trend              | 0 (poor) to 100 (good practice) | WB, EBA data     |
|                                | Access to finance in agriculture               | Trend              | 0 (poor) to 100 (good practice) | WB, EBA data     |
| <b>Enabling environment</b>    | Market regulation in agriculture               | Trend              | 0 (poor) to 100 (good practice) | WB, EBA data     |
|                                | Transport regulation in agriculture            | Trend              | 0 (poor) to 100 (good practice) | WB, EBA data     |
|                                | Research-policy collaborations                 | Trend              | 1 (low) to 10 (high)            | Survey data      |

Note: WB, EBA data = World Bank, Enabling the Business of Agriculture, available at <http://eba.worldbank.org/>; national data = national government statistical data; survey data = data collected through key informant/expert opinion interviews.

agents, agricultural researchers, credit to agriculture, government expenditure on agriculture, public spending on agricultural research, public spending on extension, foreign aid for agriculture, foreign aid for agricultural education/training, foreign aid for extension, and foreign aid for agricultural research.

Several of the indicators can be classified as representing mostly dynamic and generic properties: quality of the education system, quality of scientific research institutions, university-industry collaboration in R&D, start-up procedures to register a business, time required to start a business, ease of accessing loans, and gross capital formation.

The remaining indicators can be classified as representing mostly dynamic and agriculture-specific

properties: quality of university education in agriculture, quality of vocational training in agriculture, demand-orientation of agricultural research, research-extension collaborations, demand-orientation of extension, research-policy collaborations, agricultural policy costs, adoption of certification standards, seed regulation, fertilizer regulation, access to finance in agriculture, market regulation in agriculture, and transport regulation in agriculture.

It should be noted that the above classification is not conceived of as a clear-cut typology, but rather an aid for reflection.

#### **AIS outcomes**

For the AIS outcome indicators shown at the bottom of Table 1, data on agricultural output for all major

crops and the value of agricultural production are readily available through FAOSTAT. Outcomes measured through TFP growth or eco-efficiency entail calculations that can be performed using existing FAOSTAT data but require knowledge of appropriate methods.

TFP denotes the ratio between total outputs and total inputs. It has been used to broaden the focus on land or labour productivity, improving understanding of technical change in agriculture. Growth in TFP is interpreted as increased efficiency of input use.<sup>12</sup> Fuglie (2015) explains the use of growth accounting to construct TFP indices for agriculture worldwide.<sup>13</sup> Using FAO data and the growth accounting methodology, internationally consistent and comparable agricultural TFP growth rates

can be computed, for which a complete dataset is accessible through the USDA website.<sup>14</sup> TFP rarely accounts for quality improvements in inputs or changes in natural resource stocks.

‘Eco-efficiency’ is defined as the ratio between economic value added and a composite variable of environmental pressures.<sup>15</sup> It must be stressed that measures used for computing eco-efficiency scores do not attempt to represent the environmental impact of agricultural production but rather the environmental pressures associated with it. Following the eco-efficiency definition, a country can be considered eco-efficient if it is impossible to decrease any environmental pressure without simultaneously increasing another pressure or decreasing the economic value added. For calculation purposes, data envelopment analysis is commonly used,<sup>16</sup> solving linear programming problems to trace a global eco-efficiency frontier and determine the distance of countries from that frontier. Data on environmental pressures from agriculture are available through FAOSTAT to a steadily increasing extent.

### Conclusions

The precise representation of AIS properties constitutes the most important constraint in any attempt of a diagnostic and/or assessment, where agriculture-specific data are by and large missing. As this chapter shows, some key data for characterizing and assessing national AIS covering a wide range of countries and periods are available and accessible from various sources. These include *inter-alia* data from FAO, IFPRI, the International Fund for Agricultural Development (IFAD), World Bank, OECD, WEF, WIPO, and so on. However, other crucial data are missing or are not readily available. These

include data on extension and civil society (non-governmental organizations and farmers’ organizations), public spending on extension services, the responsiveness of research to the needs of producers, and regulatory procedures in agriculture. A lack of structured data at the country level is particularly apparent for extension and other institutional arrangements that fulfil the bridging function between education and research actors and value chain actors. For these reasons, any AIS diagnostic tool remains exploratory rather than one that allows for precise analysis and definite answers. Despite limitations arising from the nature and scope of the data used, interesting results can emerge from AIS measurements and assessments. The information and knowledge generated can provide pointers to policy and investment gaps and innovation opportunities.

There is potential for a comprehensive diagnostic tool for AIS assessment, but data availability and accessibility at the county level remain a daunting challenge. For a thorough analysis of national AIS, it is important to identify available and accessible data and then fill gaps through additional data gathering. Equally important is to focus on trends and to rely on additional qualitative data sources and validation to interpret results. A sizeable set of indicators has been presented in Table 2. Selecting key indicators characterizing actors and actions/interactions, linkages, and relationships in the AIS will allow for a meaningful analysis of the system in terms of strengths and weaknesses. A multi-criteria AIS diagnosis can thus generate the sound evidence required to formulate global, regional, and national agricultural innovation strategies. In order to draw meaningful results from the diagnosis, it is of paramount importance to define

upstream its purpose and the information expected to be generated through the analysis of the diagnostic outputs. This requires the definition of information and knowledge needs by national actors and stakeholders that will guide data collection processes and the diagnostic process. Once the specific context is known, the selection of core indicators from the original set can then facilitate the data collection. The involvement of key AIS actors and stakeholders from the outset is therefore critical to ensure that the diagnosis responds to their information and knowledge requirements and needs.

### Notes

- 1 TAP, 2016.
- 2 World Bank, 2012; FAO, 2014.
- 3 TAP, 2016.
- 4 Klerkx et al., 2012.
- 5 OECD, 2010; OECD, 2012; World Bank, 2012; FAO, 2014.
- 6 OECD, 2011.
- 7 FAO, 2016.
- 8 For example, public researchers per \$100 million of agricultural GDP (ASTI indicator); university-industry research collaboration (WEF indicator); and external assistance to agriculture (FAO indicator). See Spielman and Kelemework, 2009.
- 9 For example, Hall and Clark, 1995; Klerkx et al., 2010.
- 10 Schut et al., 2015.
- 11 IFPRI, 2015.
- 12 Fuglie and Wang, 2012.
- 13 Fuglie, 2015.
- 14 USDA, 2016.
- 15 Kuosmanen and Kortelainen, 2005.
- 16 Kuosmanen and Kortelainen, 2005.

### References

- Arnold, E. and M. Bell. 2001. *Some New Ideas about Research and Development*. Copenhagen: Science and Technology Policy Research/Technopolis.

- FAO (Food and Agriculture Organization of the United Nations). 2014. *The State of Food and Agriculture: Innovation in Family Farming*. Rome: FAO.
- . 2016. Conference, Rome, 3–8 July 2017. Executive Summary of the 25th Session of the Committee on Agriculture (COAG) of the Food and Agriculture Organization of the United Nations. Available at <http://www.fao.org/3/a-mr949e.pdf>.
- FAOSTAT. 2016. United Nations Food and Agriculture Organization Statistical Database. FAO, Rome. Available at <http://www.fao.org/faostat/en/#home>.
- Fuglie, K. 2015. 'Accounting for Growth in Global Agriculture'. *Bio-based and Applied Economics* 4 (3): 201–34.
- Fuglie, K. and S. L. Wang. 2012. 'Productivity Growth in Global Agriculture Shifting to Developing Countries'. *Choices*. Quarter 4. Available at <http://www.choicesmagazine.org/choices-magazine/submitted-articles/productivity-growth-in-global-agriculture-shifting-to-developing-countries>.
- Hall, A. and N. Clark. 1995. 'Coping with Change, Complexity and Diversity in Agriculture: The Case of Rhizobium Inoculants in Thailand'. *World Development* 23 (9): 1601–14.
- IFPRI (International Food Policy Research Institute). 2015. Agricultural Science and Technology Indicators (ASTI) Database. IFPRI, Washington, DC. Available at <https://www.asti.cgiar.org/data>.
- Klerkx, L., N. Aarts, and C. Leeuwis. 2010. 'Adaptive Management in Agricultural Innovation Systems: The Interactions between Innovation Networks and Their Environment'. *Agricultural Systems* 103: 390–400.
- Klerkx, L., B. van Mierlo, and C. Leeuwis. 2012. 'Evolution of Systems Approaches to Agricultural Innovation: Concepts, Analysis and Interventions'. In *Farming Systems Research into the 21st Century: The New Dynamic*, eds. I. Darnhofer, D. Gibbon, and B. Dedieu. Dordrecht: Springer. 457–48.
- Kuosmanen, T. and M. Kortelainen. 2005. 'Measuring Eco-Efficiency of Production with Data Envelopment Analysis'. *Journal of Industrial Ecology* 9: 59–72.
- Mekonnen, D. K., D. Spielman, and E. G. Fonsah. 2015. 'Innovation Systems and Technical Efficiency in Developing-Country Agriculture'. *Agricultural Economics* 46: 689–702.
- OECD (Organisation for Economic Co-operation and Development). 2010. *Agricultural Innovation Systems: A Framework for Analyzing the Role of Government*. Paris: OECD.
- . 2011. *A Green Growth Strategy for Food and Agriculture*. Paris: OECD.
- . 2012. *Sustainable Agricultural Productivity Growth and Bridging the Gap for Small Family Farms. Interagency Report to the Mexican G20 Presidency*. Paris: OECD.
- Schut, M., L. Klerkx, J. Rodenburg, J. Kayeke, C. Raboanarielina, L. C. Hinnou, P. Y. Adegbola, A. van Ast, and L. Bastiaans. 2015. 'RAAIS: Rapid Appraisal of Agricultural Innovation Systems (Part I). A Diagnostic Tool for Integrated Analysis of Complex Problems and Innovation Capacity'. *Agricultural Systems* 132: 1–11.
- Spielman, J.D. and R. Birner. 2008. 'How Innovative Is Your Agriculture? Using Innovation Indicators and Benchmarks to Strengthen National Agricultural Innovation Systems. Agriculture and Rural Development'. *Discussion Paper No. 41*. Washington, DC: World Bank.
- Spielman, D. and D. Kelemework. 2009. 'Measuring Agricultural Innovation System Properties and Performance: Illustrations from Ethiopia and Vietnam'. *IFPRI Discussion Paper 00851*. Washington, DC: IFPRI.
- TAP (Tropical Agriculture Platform). 2016. *Common Framework on Capacity Development for Agricultural Innovation Systems: Conceptual Background*. Wallingford and Boston: CAB International. Available at <http://www.cabi.org/Uploads/CABI/about-us/4.8.5-other-business-policies-and-strategies/tap-conceptual-background.pdf>.
- USDA (United States Department of Agriculture). 2016. International Agricultural Productivity Data. United States Department of Agriculture: Economic Research Service. Available at <http://www.ers.usda.gov/data-products/international-agricultural-productivity/>.
- WEF (World Economic Forum). 2016. *The Global Competitiveness Report 2016–2017*. Geneva: World Economic Forum.
- WIPO (World Intellectual Property Organization). 2016. Statistical Data on intellectual property (IP) activity worldwide. Geneva: WIPO. Available at <http://ipstats.wipo.int/ipstatv2/>.
- World Bank. 2012. *Agricultural Innovation Systems: An Investment Sourcebook*. Washington, DC: World Bank.
- . 2016a. World Development Indicators. Washington, DC: World Bank. Available at <http://data.worldbank.org/data-catalog/world-development-indicators>.
- . 2016b. *Enabling the Business of Agriculture 2016: Comparing Regulatory Good Practices*. Washington, DC: World Bank.



## The Role of Private-Sector R&D in Agricultural Innovation: Improving Yields, Equipment Productivity, and Sustainability

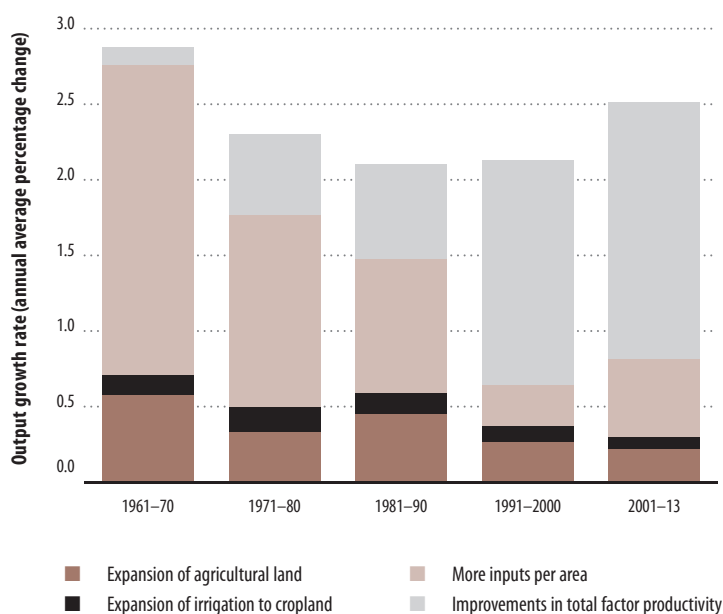
BARRY JARUZELSKI and VOLKER STAACK, PwC's Strategy&

TOM JOHNSON, PwC

By 2050, according to the United Nations, the world's population is estimated to reach 9.7 billion.<sup>1</sup> This presents the global agriculture sector with a daunting challenge, especially when combined with the effects of climate change and resource scarcity. The stage has been set for a potential global food crisis if policy makers and other stakeholders fail to act: Ensuring adequate supplies of food will require a 70% increase in agricultural production over the next 30 years.<sup>2</sup>

The pace of agricultural innovation has increased over the last 10 to 15 years, with advances in genomics, software, communications, logistics, and technology. The public sector has traditionally been the driving force behind these advances and represented the lion's share of agricultural research and development (R&D) expenditures, with global public-sector R&D accounting for 55% of the US\$69 billion total in 2011 (the most recent year for which global data are available).<sup>3</sup> But more recently, constrained fiscal policies in many countries have slowed public-sector R&D growth. The private sector has increasingly filled the gap: Private investment in agricultural innovation has resulted in new technologies and production techniques with significant promise to boost productivity.

Figure 1: Sources of growth in global agricultural output, 1961–2013



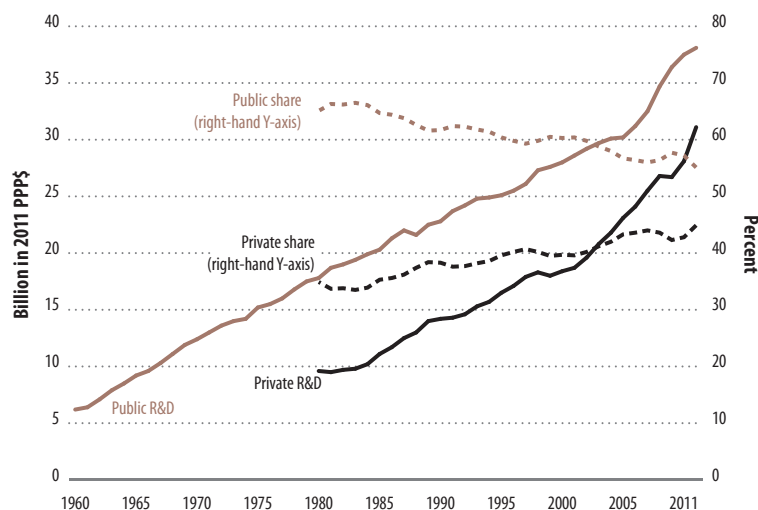
Source: USDA Economic Research Service, 2017.

### Output and productivity

Before 1970, the expansion of land under cultivation and other inputs—such as labour and capital per acre—accounted for the vast majority of the growth in global agricultural output. Since 1990, however, the rate of growth in land, labour, capital, and other material inputs has dramatically slowed, and increasing total factor productivity (TFP)—which measures the efficiency with which

all agricultural inputs are transformed into outputs—has become the main driver of agricultural productivity growth. From 2001 to 2013, TFP accounted for more than two-thirds of the overall growth in output (see Figure 1).<sup>4</sup>

However, the 2016 *Global Agricultural Productivity Report*, a benchmark that analyses agricultural productivity growth (compiled by the private-sector group Global Harvest

**Figure 2: Public and private agricultural R&D**

Source: Pardey et al. (University of Minnesota, InStEP International Innovation Accounts, 2016).

Initiative), has found that global TFP is not growing fast enough to meet projected population-driven increases in food demand by 2050. This inadequate growth is mostly the result of lagging TFP growth in low-income countries, where the current average growth rate is 25% lower than the global average.<sup>5</sup> In these countries, the bulk of output growth still comes from increasing agricultural inputs and land under cultivation—creating even greater need for productivity gains.

Driving further growth in TFP rates demands greater investment in agricultural R&D. Unfortunately, the growth of public-sector investment has slowed in many high-income countries, including those of Western Europe, and has declined sharply in the United States of America (USA) in recent years (falling more than 20% in real terms from 2008 to 2013). R&D spending in low-income countries is also lagging, particularly when measured on a per capita basis. In 2011, high-income countries spent US\$17.73 per person, compared to US\$1.51 in low-income countries.<sup>6</sup>

At the same time, public-sector spending has been increasing in middle-income countries, including Brazil, India, and especially China; the last-mentioned has accounted for a majority of the net growth in global public-sector agricultural R&D in recent years. From 2008 to 2013, China increased its spending nearly 70%.<sup>7</sup>

Private-sector R&D spending, meanwhile, has been growing robustly in recent years, especially in high-income countries (see Figure 2).<sup>8</sup> In the USA, private- and public-sector spending were roughly equal in the 1980s and 1990s; in 2000, for example, each sector contributed 50%. But by 2013, the public share had declined and private investment had risen; the private sector now accounts for 75% of total US R&D.

Such growth can be traced to advances in genetic engineering in the mid-1980s, which gave rise to a wave of technological innovation that boosted returns on private investment, and to the increasing marketization of the agricultural supply chain in many regions. Over

the past 10 years, investment in agricultural innovation has been fuelled by an unprecedented convergence of advances in biology, agronomy, plant and animal science, digitization, and robotics. These technologies—often referred to collectively as ‘digital agriculture’,<sup>9</sup> precision farming, or ‘smart farming’—are creating the foundation for a new, more productive and sustainable future of agriculture. Farm ownership patterns are also changing, creating a multiplier effect because farmers who automate are able to manage larger fields and greater numbers of animals.

Much of this new wave of innovation is enabled by the shift in corporate R&D towards software, advanced hardware, and service offerings. The integration of embedded software and sensors in farm equipment, in the soil, and on the animals—as well as the ability to reliably and inexpensively connect and network agricultural producers, suppliers, products, and customers using cloud-based systems and shared analytics—has significant potential to increase output.<sup>10</sup> Such innovations are enabling major gains in yields, asset productivity, and sustainability that will be key factors in meeting the escalating demand for food (see Figure 3).

### Increasing yields

The development and widespread adoption of hybrid seeds led to the most significant improvements in crop yields in the 20th century. For example, the adoption of hybrid corn (maize) in the USA—aided by improvements in tillage practices, herbicides, and equipment—increased yields by a factor of five from the 1940s to the present.<sup>11</sup> In the 1990s, genetically modified crops (GMCs) launched a new wave

of major yield improvements; today more than 90% of the planted area of soybeans, cotton, and corn in the USA are genetically modified varieties. These hybrids are also in wide use in South America and Asia—most notably in China and in India. Adoption of GMCs has been controversial, however, and health fears have limited their penetration in Europe.<sup>12</sup>

The latest advances in genomics promise to increase crop yields while avoiding some of the features that have caused concern about GMCs. A technology under development known as CRISPR (which stands for ‘clustered regularly interspaced short palindromic repeats’) for example, which is now being adapted for crop and animal science, uses the immune system of bacteria to edit specific genes in organisms. Unlike processes used for traditional GMCs, CRISPR does not introduce genes from other organisms into plants but instead edits the genome of the plant itself. Scientists believe the CRISPR outcomes could improve the natural characteristics of crops to make them more resistant to drought, pests, and weeds, and could boost their photosynthetic efficiency to make them grow faster. Companies are already developing applications of the technology to improve drought resistance for crops and to improve livestock resistance to diseases, such as African swine fever.<sup>13</sup>

R&D in sensor technology, geo-positioning, and big data will also enable significant increases in crop and livestock yields. The Climate Corporation, a subsidiary of Monsanto, launched its Climate FieldView platform in 2015. This platform, backed by a powerful data science engine and an extensive field research network, uses sensors and satellite imagery to provide farmers with real-time data to maximize

**Figure 3: Three imperatives driving future investments across agribusiness markets**

| INCREASING YIELDS                 | IMPROVING ASSET PRODUCTIVITY                            | ENHANCING SUSTAINABILITY         |
|-----------------------------------|---|----------------------------------|
| Precision agriculture solutions   | Enterprise resource planning (ERP) systems for the farm | Land use mapping                 |
| Integrated equipment              | Telematics  | Managing water                   |
| Data collection and data entry    | Autonomous equipment                                    | Energy management                |
| Image management                  | Drones  | Waste tracking                   |
| Consultative support              | Sensory networks  | Input traceability               |
| Access to season trends and facts | Services enablement                                     | Farm/field performance reporting |
|                                   | Predictive analytics                                    | Harvest tractability             |

Source: PwC, 2016b.

Note: Farmers who deliver profitability across all three objectives will likely expand their acreage and become enterprise agribusiness leaders in their markets.

crop yields. It enables precision application of fertilizers and can also identify and prevent disease vulnerability. FieldView is already in operation on more than 100 million acres in the USA and Brazil. The Climate Corporation has recently expanded into the European market, and plans to also offer the platform in South Africa, Australia, and Argentina over the next few years.<sup>14</sup> More and more big-data solutions of this nature are expected both from start-ups and from legacy agribusiness organizations that serve growers around the world.

Another example of the implementation of new technology is happening at My Dairy Dashboard, a joint venture of Virtus Nutrition and Dairy.com in the USA, announced in May 2017. Virtus had previously acquired Farmeron, a Croatian startup that developed a cloud-based software platform for data management and agricultural production performance optimized for dairy farmers. My Dairy Dashboard will provide data aggregation for the dairy farm industry, to help

enhance production and streamline operations.<sup>15</sup>

Innovations in drone technology will also enable increases in yields. Companies are adapting drones to produce precise three-dimensional maps for soil analysis and to optimize irrigation and nitrogen-level management. Start-ups are developing drone systems for planting that shoot pods with seeds and nutrients into the soil. Drones are also being developed to spray crops far more precisely and efficiently than current tractor-based technologies. Drones with thermal sensors are well suited for monitoring crop health and growth.<sup>16</sup>

Some African countries are pursuing R&D in aquaculture to develop inland fish farming as a potentially large future source of protein. In the United Republic of Tanzania, the National Aquaculture Development Centre is working with a consortium of local and global educational and nonprofit organizations to identify and optimize the best species of native tilapia for farming, and to adopt best practices from aquaculture experience around



the world. The Tanzanian government aims to triple the contribution of aquaculture to the nation's GDP from its current 1.4% to 4.2% by 2025.<sup>17</sup>

Not all promising innovations for raising yields rely on cutting-edge science; some leverage older technologies. AgroStar, a start-up based in Pune, India, has developed a mobile-commerce platform that helps small farmers access raw materials, seed, fertilizer, and other agricultural inputs in rural areas that are often plagued by product unavailability, unfair prices, substandard quality, and limited information. AgroStar enables its customers to order using a mobile app or via the 'missed call' technique (dialling a number and disconnecting before the call is picked up, thus signalling the recipient that the caller wants to order or communicate while avoiding cell-phone usage charges). The company, which launched in 2012, has partnered with more than 150 brands, including multinationals such as Syngenta, and has served 7 million farmers in the states of Maharashtra, Gujarat, and Rajasthan.<sup>18</sup>

### Improving asset productivity

One of the most notable innovations in improving asset productivity was the invention of the cotton gin in 1793. The new machine could process 1,000 pounds of cotton in the time it took an individual to process five pounds by hand.<sup>19</sup> Over the past decade, major agricultural equipment manufacturers have been attempting another dramatic transformation by building increasingly sophisticated digital features into farm equipment to boost productivity.

The latest models of tractors, planters, harvesters, and other equipment from companies such as Case

IH, John Deere, and Kubota feature monitors, sensors, and software that optimize farming processes and generate detailed computerized data—enabling farmers to maximize their productivity and increase their yields while gaining a wealth of information to help them manage their operations more efficiently. Manufacturers have also been developing sophisticated autonomous tractors and other vehicles over the last several years, and have prototypes in operation today.

Case IH, for example, unveiled an autonomous tractor concept in 2016—the Case IH Autonomous Concept Vehicle—built with a fully interactive interface that allows remote monitoring of pre-programmed operations. These include automatically accounting for implement widths, and plotting the most efficient paths in a field depending on terrain, obstructions, and other machines in use in the same field. A remote operator can monitor and control the tractor from a computer or tablet. Such vehicles can operate around the clock, and can provide the farmer with predictive information on maintenance.<sup>20</sup>

Equipment manufacturers and third-party vendors are also offering software and Global Positioning System (GPS) packages that can track and map an agricultural producer's mechanized equipment. This enables farmers to monitor their machines on a tablet or smartphone and direct them to where they are needed—when, for example, a storm is coming—and to re-route support vehicles carrying fuel, seed, and fertilizer. Similar tracking and mapping software is also available for livestock. Collars or tags placed on the animals can send real-time data to farmers and ranchers not only on livestock location, but also on weather conditions, health, and mating patterns.<sup>21</sup>

Finally, companies are developing innovative technologies for offshore aquaculture operations that can grow and harvest different varieties of seafood in oceans, including smart floating farms and submersible cages that can be located near cities or out at sea.<sup>22</sup> Ocean Farming, for example, a subsidiary of the Norwegian fish farming company SalMar, is adapting deep-water petroleum technology to develop offshore salmon farms that would anchor 100-metre steel cages that float below the surface to the ocean floor and adapt to the motion of waves and currents. The company estimates these could be eight times as productive as traditional inshore fish farms.<sup>23</sup>

### Enhancing sustainability

The introduction of sustainable techniques such as contour farming—the practice of planting crops in rows running parallel, rather than perpendicular, to the contours of the land—reduced topsoil loss by 65% within five years during the environmental and humanitarian crisis known as the Dust Bowl in the USA during the 1930s.<sup>24</sup> In recent decades, many key innovations in sustainability have focused on more efficient irrigation techniques. In most parts of the world where irrigation is necessary, variations of field flooding—the least efficient method—are still used. More efficient methods, such as central pivot systems, which use wheeled booms to apply water to crops more precisely, have been in use in high-income countries since the 1950s.

T-L Irrigation, a leading producer of centre wheel systems, introduced a new system for arid farming areas in 2014 that combines the central pivot and drip irrigation approaches. Drip hoses, spaced a

few feet apart, apply water directly to crops, minimizing evaporation, and can reach water efficiency levels of 95%.<sup>25</sup> By adding sensors to these types of irrigation equipment to optimize water application, water use could be reduced by as much as 50% and yields could be increased by 10% or more.<sup>26</sup>

Access to fresh water is another focus of sustainability efforts, especially in arid climates.

In 2012, the World Bank reported that 14 of the 20 most water-scarce countries in the world were located in the Middle East and North Africa (MENA) region.<sup>27</sup> Desalination currently plays a critical role in supplying water to the populations of MENA countries, and will continue to do so moving forward as these populations continue to grow. But desalination plants are energy and resource intensive, and for that reason many MENA countries are investing in concentrating solar power (CSP) plants, which use large mirrors to generate thermal energy for desalination. Given the high costs associated with CSP, the public and private sectors will need to work together to ensure broader adoption.<sup>28</sup>

In addition to improving sustainability, players across the agricultural supply chain are also keenly interested in creating transparency and trust about their sustainability efforts. For example, major food companies and retailers are making public sustainability commitments to improve their environmental footprints. Land O'Lakes, a farmer-owned cooperative with more than 4,300 members based in Minnesota, USA, created a new business unit named SUSTAIN to align its environmental sustainability efforts across its enterprise, which operates in all 50 US states and more than 50 other countries.<sup>29</sup> The SUSTAIN

programme focuses on sustainable crop production by delivering products, services, and insights; enhancing sustainability within the dairy foods and feed businesses; and partnering with other entities, including governments, to improve efficiency and collaboration on water conservation and sustainability. The programme also offers tracking, reporting, and aggregated results that enable farmers to communicate their sustainability results to their customers and retailers to document and communicate the sustainability of their products to end consumers.

---

### The R&D challenges in agriculture

The imperative to raise the productivity of agricultural R&D by up to 70% over the next three decades will require the public and private sector to address several critical challenges.

Speeding R&D cycles and furthering the widespread adoption of promising innovations—particularly in low-income countries—are a precursor to improving outputs. The lags between successful R&D efforts and the widespread adoption of agricultural innovations tend to be long; at least 15 to 25 years before peak impacts, with further adoption lags that can continue for decades. In the USA, for example, the earliest research on hybrid corn technology began as early as the 1890s, and focused research did not begin until 1918. Commercial adoption, however, began only in the 1930s and was uneven. And not until 1960 was almost all US corn acreage in hybrids. Thus the total adoption cycle took over 40 years—or arguably longer.<sup>30</sup>

Another challenge is that many of the most promising agricultural innovations are capital-intensive, and agriculture has historically been dominated by small businesses with

low profitability and limited access to capital. Several trends offer promise in overcoming such obstacles, however. For one, consolidation in agriculture will boost efficiency, with fewer farmers and ranchers managing larger fields. In addition, more widespread use of crop insurance is an example of a financial innovation that could provide farmers and ranchers with more financial security. Agricultural insurance lowers risks as well as improving access to credit. At present, in higher-income countries, 1.99% of agricultural GDP is spent on agricultural insurance, but that falls to 0.29% in upper-middle-income countries, 0.16% in lower-middle-income countries, and 0.01% in low-income countries.<sup>31</sup>

Some scientists and researchers also note that economic and environmental changes, such as changes in weather patterns and crop pests and diseases, could undermine past patterns of productivity growth. This is a particular concern in low-income countries, where the demand for food is growing the fastest. Low levels of public-sector R&D investment, which is best suited to creating solutions to these kinds of problems, could slow productivity improvements and put these countries at risk.

---

### Conclusions: Feeding the World

The public sector needs to reverse the negative trend in R&D spending growth in many high-income countries, and increase R&D spending in low-income countries—making investments in basic scientific research in agriculture and supporting technologies. But governments can also foster an attractive environment for venture capital funds and corporate ventures focusing on agricultural innovation, and help ensure that the investments being

made by the private sector can make a greater impact, by taking the following steps:

- Support agricultural extension efforts to disseminate knowledge about new technologies and techniques and to demonstrate their business case. Publicly funded agricultural extension has been a key historical link between agricultural R&D and farmers and ranchers in high-income countries. Governments and supra-national organizations should prioritize implementing such programmes in low-income countries.
- Streamline regulation to reduce lag times, provide targeted tax relief to enhance farmers' incomes and financial security, and offer preferential access to land and market support for promising agricultural techniques and technologies.
- Create public-private partnerships, which governments can use to leverage public-sector investment, enhance private-sector involvement in agriculture infrastructure, and fill gaps in the delivery and adoption of innovation by public- and private-sector entities acting independently.<sup>32</sup>
- Maintain and expand regional and international trade in agriculture outputs. Many of the gains in productivity in recent decades have been enabled by globalization and the rise of extended agricultural value chains.

The rise of commercial R&D in agriculture underway today—and the resulting innovations in improving yields, asset productivity, and sustainability—provide the means for meeting the food needs of the

world's growing population by 2050. But to reach that goal, both the public and private sectors will need to keep the R&D pipeline flowing and make investments and commitments to ensure that innovative technologies and techniques are widely and rapidly adopted by countries across the income spectrum.

## Notes

- 1 See <http://www.un.org/en/development/desa/news/population/2015-report.html> for more on population growth estimates.
- 2 PwC, 2015.
- 3 Pardey et al., 2016a.
- 4 USDA Economic Research Service, 2017
- 5 Global Harvest Initiative, 2016.
- 6 Pardey et al., 2016b.
- 7 Pardey et al., 2016b.
- 8 Pardey et al., 2016a.
- 9 See Chapter 4 of this report.
- 10 Jaruzelski et al., 2016.
- 11 Russell and Sandall, 2017.
- 12 See <http://www.isaaa.org/resources/publications/pocketk/16/> for more information on biotech crop adaptation.
- 13 Montenegro, 2016.
- 14 See [https://climate.com/?gclid=CKvDi5qVtNECFZWLswodSusK\\_A](https://climate.com/?gclid=CKvDi5qVtNECFZWLswodSusK_A) for more information on The Climate Corporation's FieldView platform.
- 15 See <http://mydairydashboard.com/index.html> for more on the joint venture between Virtus Nutrition and Dairy.com.
- 16 PwC, 2016a.
- 17 Earlham Institute, 2017.
- 18 ET Bureau, 2016.
- 19 See <https://www.eliwhitney.org/7/museum/eli-whitney/cotton-gin> and <http://www.farmcollector.com/equipment/ten-agricultural-inventions-in-farming-history> for more on the invention of the cotton gin.
- 20 See <https://www.caseih.com/northamerica/en-us/Pages/campaigns/autonomous-concept-vehicle.aspx> for more on the Case IH autonomous concept vehicle.
- 21 See <https://www.theintelligenceofthings.com/article/connected-farm-big-data-agriculture/> for more on connected farm solutions.
- 22 Kearnes, 2016.
- 23 Nortrade, 2015.

- 24 The Nature Conservancy, No date.
- 25 See [http://tlir.com/products/precision\\_mobile\\_drip\\_irrigation/](http://tlir.com/products/precision_mobile_drip_irrigation/) for information about T-L Precision Mobile Drip Irrigation.
- 26 Goldman Sachs, 2016.
- 27 The convention in the GII is to refer to UN regions. In this chapter, the 'Middle East and North Africa (MENA) region' refers to the region as defined by the World Bank; for a list of these countries, see <http://www.worldbank.org/en/region/mena>.
- 28 World Bank, 2012.
- 29 See <https://www.landolakesinc.com/Blog/December-2016/Land-O-Lakes-SUSTAIN-gears-up-for-more-on-Land-O-Lakes-SUSTAIN-programme>.
- 30 Pardey and Alston, 2010.
- 31 Villalobos, 2013.
- 32 Moreddu, 2016.

## References

- Earlham Institute. 2017. 'Double Fish Production while Preserving Biodiversity: Can It Be Done?' *EurekaAlert/AAAS*. Public release, 11 January. Available at [https://www.eurekaalert.org/pub\\_releases/2017-01/ei-dfp011117.php](https://www.eurekaalert.org/pub_releases/2017-01/ei-dfp011117.php).
- ET Bureau. 2016. 'ET Startup Awards 2016: How AgroStar Is Making a Profit while Making a Difference.' *The Economic Times*, 8 August. Available at <http://economictimes.indiatimes.com/small-biz/startups/et-startup-awards-2016-how-agrostar-is-making-a-profit-while-making-a-difference/articleshow/53590267.cms>.
- Global Harvest Initiative. 2016. *2016 Global Agricultural Productivity Report® (GAP Report®)*. Washington, DC: Global Harvest Initiative. Available at <http://www.globalharvestinitiative.org/index.php/gap-report-gap-index/2016-gap-report>.
- Goldman Sachs. 2016. 'Precision Farming: Cheating Malthus with Digital Agriculture.' *Equity Research*, Profiles in Innovation, 13 July. Available at [http://docdrop.org/static/drop-pdf/GSR\\_agriculture-N1sH6.pdf](http://docdrop.org/static/drop-pdf/GSR_agriculture-N1sH6.pdf).
- Jaruzelski, B., V. Staack, and A. Shinozaki. 2016. 'The Global Innovation 1000: Software-as-a-Catalyst.' *strategy+business* (Winter 2016: 85). Available at <http://www.strategy-business.com/feature/Software-as-a-Catalyst?gko=7a1ae>.
- Kearnes, M. 2016. '7 Cutting-Edge Offshore Aquaculture Innovations and Designs.' *SeafoodSource*, 13 April. Available at <http://www.seafoodsource.com/news/aquaculture/7-cutting-edge-offshore-aquaculture-innovations-and-designs?limitstart=0>.

- Montenegro, M. 2016. 'CRISPR Is Coming to Agriculture—with Big Implications for Food, Farmers, Consumers and Nature'. *Ensis*, 28 January. Available at <https://ensia.com/voices/crispr-is-coming-to-agriculture-with-big-implications-for-food-farmers-consumers-and-nature/>.
- Moreddu, C. 2016. 'Public-Private Partnerships for Agricultural Innovation: Lessons from Recent Experiences'. *OECD Food, Agriculture and Fisheries Papers* No. 92. Paris: OECD Publishing. Available at <http://dx.doi.org/10.1787/5jm559p9rmx-en>.
- Nortrade. 2015. 'Petroleum Technology for Ocean Farming'. The Norwegian trade portal. Available at <http://nortrade.com/sectors/articles/petroleum-technology-for-ocean-farming/>.
- Pardey, P. G. and J. M. Alston. 2010. *U.S. Agricultural Research in a Global Food Security Setting: A Report of the CSIS Task Force on Food Security*. Washington, DC: Center for Strategic and International Studies. Available at <https://www.csis.org/analysis/us-agricultural-research-global-food-security-setting>.
- Pardey, P. G., C. Chan-Kang, J. M. Beddow, and S. M. Dehmer. 2016a. 'InSTePP International Innovation Accounts: Research and Development Spending, version 3.5'. St. Paul, MN: International Science and Technology Practice and Policy (InSTePP) Center. Available at <http://www.instepp.umn.edu/products/documentation-instepp-international-innovation-accounts-research-and-development-spending>.
- Pardey, P. G., C. Chan-Kang, S. P. Dehmer, and J. M. Beddow. 2016b. 'Agricultural R&D Is on the Move.' *Nature* 537 (15 September): 301–3. Available at <http://www.nature.com/news/agricultural-rd-is-on-the-move-1.20571>.
- PwC. 2015. 'Shaping Our Future: Global Annual Review, 2015'. Available at <http://www.pwc.com/gx/en/about-pwc/global-annual-review-2015/campaign-site/pwc-global-annual-review-2015.pdf>.
- . 2016a. *Clarity from Above: PwC Global Report on the Commercial Applications of Drone Technology*. PwC, May. Available at <http://www.pwc.pl/pl/pdf/clarity-from-above-pwc.pdf>.
- . 2016b. *Understanding the AgTech Ecosystem*. PwC. Available at <http://read.pwc.nl/i/661786-understanding-the-agtech-ecosystem>.
- Russell, K. and L. Sandall. 2017. 'Corn Breeding: Lessons from the Past'. *Plant & Soil Sciences eLibrary*. Available at <http://passel.unl.edu/pages/informationmodule.php?idinformatonmodule=1075412493&topicorder=10&maxto=12>.
- The Nature Conservancy. No date. 'When the Dust Settled: U.S. Farm Bill Conservation Programs Have Roots in Dirty Thirties'. Available at <http://www.nature.org/ourinitiatives/regions/northamerica/when-the-dust-settled.xml>.
- USDA (United States Department of Agriculture), Economic Research Service. 2017. 'International Agricultural Productivity'. Available at <https://www.ers.usda.gov/data-products/international-agricultural-productivity/>.
- Villalobos, J. Á. 2013. 'Agricultural Insurance for Developing Countries: The Role of Government'. A presentation at the Agricultural Outlook Forum, 22 February 2013, Washington, DC. Available at [https://www.usda.gov/oce/forum/past\\_speeches/2013\\_Speeches/Villalobos.pdf](https://www.usda.gov/oce/forum/past_speeches/2013_Speeches/Villalobos.pdf).
- World Bank. 2012. *Renewable Energy Desalination: An Emerging Solution to Close the Water Gap in the Middle East and North Africa*. Water Partnership Program (WPP). Washington, DC: World Bank. Available at <http://documents.worldbank.org/curated/en/443161468275091537/Renewable-energy-desalination-an-emerging-solution-to-close-the-water-gap-in-the-middle-east-and-north-africa>.



# Innovation in Agriculture and Food Systems in the Digital Age

HAROLD VAN ES and JOSHUA WOODARD, Cornell University

Agriculture and the worldwide food system are challenged to feed an estimated global population of 9.7 billion people by 2050 with diminishing land and water resources.<sup>1</sup> Agricultural land areas can no longer be expanded because most global arable lands have already been put into production. The remaining lands are increasingly lost to urbanization or need to be preserved for habitat conservation, biodiversity, and climate buffers.<sup>2</sup> Moreover, the unsustainable overuse of freshwater resources from irrigation is making less water available for future crops, and food security is being affected by increased risk from climate change and an uncertain geopolitical landscape.

Concerns with diminishing resources and expanding populations are exacerbated by changing diets in many developing countries (which are now using more animal-based protein and fresh produce). This will ultimately require higher global production levels of the primary source of protein, carbohydrates, and nutrients: crops. An effective strategy for gaining enhanced agricultural production levels should focus on sustainable improvements in five major areas:

- further optimization of resources in currently productive agricultural regions;
- intensification of production in areas that have good basic

agricultural resources but are currently low-producing (e.g., West Africa and Southeast Europe);<sup>3</sup>

- expansion of local and controlled environment production systems such as urban farms, greenhouses, and indoor growing systems that provide high-value crops to local and regional markets;
- improved crop and animal genetics that facilitate higher production levels and result in less susceptibility to yield-depressing agents such as diseases and insects; and
- greater efficiencies and less waste in the food supply chain.

## Digital agriculture

Digital data will be getting collected at a rate of 40 zettabytes (ZB—the equivalent of 40 trillion gigabytes, or GB) per year by 2020.<sup>4</sup> Increased storage and computational capacity, coupled with high-resolution environmental and remotely sensed data, have created unprecedented opportunities for data-driven discovery in agriculture and food systems.<sup>5</sup> Many agricultural improvements can be facilitated by these digital innovations.

This chapter defines ‘digital agriculture’ as the deployment of computational and information

technologies in farming, which will play a key role in achieving innovation goals. It is a new direction for ‘precision agriculture’, a more established concept that is historically aimed at crop production. Digital agriculture offers new opportunities through the ubiquitous availability of highly interconnected and data-intensive computational technologies as part of the so-called Fourth Industrial Revolution.<sup>6</sup> It can be applied to all aspects of agricultural production systems, and it reflects a shift from generalized management of farm resources towards highly optimized, individualized, real-time, hyper-connected and data-driven management. For example, instead of treating all farm fields uniformly, small field zones may each receive their own highly optimized management prescriptions; animals may be monitored and managed individually rather than as a whole herd. The desired outcomes of digital agriculture are more productive, profitable, and sustainable systems.

Digital agriculture can leverage the smart use of data and communication to achieve system optimization. The tools that enable digital agriculture are multiple and varied, and include cross-cutting technologies such as computational decision and analytics tools, the cloud, sensors, robots, and digital communication tools (Table 1). In addition, field-based activities are enabled

by geo-locationing technologies such as Global Positioning Systems (GPS), geographical information systems, yield monitors, precision soil sampling, proximal and remote spectroscopic sensing, unmanned aerial vehicles, auto-steered and

guided equipment and variable rate technologies. Animal-focused technologies include radio frequency identification (RFID chips) and automated (robotic) milking and feeding systems, among others. Controlled-environment

agriculture (greenhouses, indoor farms, etc.) is also increasingly enabled by digital technologies such as sensors and robots.

Digital agriculture can potentially accumulate large amounts of data, and analytical capabilities that

**Table 1: Enabling technologies for digital agriculture**

| Production environment            | Type of technology                                     | Purpose and benefits  |
|-----------------------------------|--|---|
| <b>Cross-cutting technologies</b> | Computational decision tools                           | Use data to develop recommendations for management and optimize multitudes of farm tasks  |
|                                   | The cloud  | Provide efficient, inexpensive, and centralized data storage, computation, and communication to support farm management   |
|                                   | Sensors  | Gather information on the functioning of equipment and farm resources to support management decisions   |
|                                   | Robots   | Implement tasks with efficiency and minimal human labour  |
|                                   | Digital communication tools (mobile, broadband, LPWAN) | Allow frequent, real-time communication between farm resources, workers, managers, and computational resources in support of management   |
| <b>Field</b>                      | Geo-locationing (GPS, RTK)                             | Provide precise location of farm resources (field equipment, animals, etc.), often combined with measurements (yield, etc.), or used to steer equipment to locations  |
|                                   | Geographic information systems                         | Use computerized mapping to aid inventory management and to make geographical crop input prescriptions (fertilizer, etc.)   |
|                                   | Yield monitors   | Employ sensors and GPS on harvesters to continually measure harvest rate and make yield maps that allow for identification of local yield variability   |
|                                   | Precision soil sampling                                | Sample soil at high spatial resolution (in zones) to detect and manage fertility patterns in fields   |
|                                   | Unmanned aerial systems (UAS, or drones)               | Use small, readily deployed remote-control aerial vehicles to monitor farm resources using imaging UAS  |
|                                   | Spectral reflectance sensing (proximal and remote)     | Measure light reflectance of soil or crop using satellite, airplane, or UAS, imaging, or field equipment-mounted sensors, to make determinations on soil patterns, crop, or animal performance, or on nutrient/pest problems        |
|                                   | Auto-steering and guidance                             | Reduce labour or fatigue with self-driving technology for farm equipment (including robots); can also precisely guide equipment in fields to enable highly accurate crop input placement and management                             |
|                                   | Variable rate technology                               | Allow continuous adjustment of application rates to precisely match localized crop needs in field areas with field applicators for crop inputs (chemicals, seed, etc.)  |
|                                   | On-board computers                                     | Collect and process field data with specialized computer hardware and software on tractors, harvesters, etc., often connected to sensors or controllers   |
| <b>Livestock</b>                  | Radio frequency ID                                     | Transmit identity data with tags attached to production units (mostly animals) that allow data collection on performance as well as individualized management   |
|                                   | Automated milking, feeding, and monitoring systems     | Perform milking or feeding operations automatically with robotic systems, often combined with sensors that collect basic biometric data on animals, thereby reducing labour needs and facilitating individualized animal management |

Note: GPS = global positioning system; LPWAN = low-power wide-area networks; RTK = Real Time Kinematic high-accuracy positioning system.



facilitate the effective employment of these data are key implementation factors. The development of computational tools that address system dynamics and optimization are similarly critical; they require a deep understanding of the biological, physical, chemical, and socio-economic processes that together make agricultural production possible. Therefore digital agriculture technologies require talent in science and entrepreneurship.

Production efficiencies can be gained both from the integration of data associated with multiple technologies and from the real-time transfer of data between field equipment, barn, office, and the cloud. The recent surge in digital agriculture technologies has led to the accumulation of large amounts of data. High-resolution soil data, site-specific weather maps, aerial imagery, nutrient applications, and milking and animal health records are being continuously generated by farms. Much of that information can be sent via broadband or mobile connections to cloud-based services, but inadequate telematics (the long-distance transfer of digital information) often constrains the potential benefits from these technologies. In addition, farmers and researchers are finding it difficult to manage, interpret, or make use of their data as a result of their volume and complexity.<sup>7</sup> Growth in hybrid fields such as computational agriculture, computational sustainability, and data science that aim to use farm data are partial responses to these needs.<sup>8</sup>

In the end, agriculture will follow other industrial sectors in that the benefits from digital technologies will materialize and become a source of increased production efficiencies once ubiquitously available data are effectively employed. In a global economic environment,

a nation's agricultural competitiveness and ability to sustain critical natural resources will be strongly tied to its ability to innovate in these aspects of the production system. The question is not whether the global agricultural industry should adopt digital technologies, but how this adoption process can occur in an environment that encourages it to fully capitalize on the potential production gains.

### Types of innovation

At the farm enterprise level, different types of technology investments may be distinguished:

1. **Capital investments** that promote efficiencies (computer hardware/software, robotic systems, variable-rate technology, sensors, high-precision GPS, etc.). These are invariably offered by established equipment companies that have made significant technology investments and typically compete in global markets.
2. **Service investments** that provide actionable information (remote sensing, cloud-based decision models, etc.). These services are offered by companies ranging from global corporations to small tech companies.
3. **Farm knowledge and human capital investments** that involve the development of highly localized actionable knowledge for a specific farm, herd, or crop-growing environment (optimized seeding, nutrient and pest management, animal feeding, etc.). These investments involve the collection of data—often from investments discussed under (1) and (2)—that are analysed to generate farm-specific recommendations. These knowledge investments are made at the local level, with consultants

working in partnership with farm managers.

The above investments each require somewhat different support infrastructures. Large capital investments not only require educated farmers to use the equipment effectively, but also need dealership networks with competent staff and operational farm credit systems. Digital services such as remote sensing and decision models are highly scalable technologies that generally do not involve upfront financial or knowledge investments on the part of farm owners or managers, but are generally pay-as-you-go arrangements. However, in order to effectively incorporate digital technologies, a farm-specific knowledge base that involves a more sustained commitment to technology investments and analytics is still required, and it demands both educated farmers and local consultants who are trained in digital agriculture technologies.

### Where does innovation in digital agriculture occur?

Digital agriculture innovation is both knowledge- and skills-intensive because agricultural production systems are complex and multifaceted and solutions require knowledge ranging from broad to specific. For example, tools that optimize nitrogen dynamics (see below) need to consider soil, weather, and crop-related processes that all have interacting physical, biological, and chemical components. These in turn need to be considered in the context of a wide diversity of practices, production environments, and socioeconomic conditions on farms. Solutions are often more complex and less scalable than optimization processes in manufacturing industries or communications. This is

arguably the primary reason why digital innovation in agriculture has been relatively slow and the leading global digital technology companies have made few inroads into agriculture.

Currently most digital innovations in agriculture are led by ‘Big Ag’ companies, smaller innovative agricultural technology (ag-tech) companies, and top agricultural universities. Where are they located? Corporate innovation in digital agriculture technologies is mostly associated with a few global-scale companies that offer durable (farm equipment) and consumable (seed, chemicals, etc.) goods and services. These industries have in recent years consolidated to the point where most major farm purchases are controlled by a small number of companies in a highly competitive global market. These corporate leaders are primarily headquartered in Northern America and Western Europe and increasingly differentiate themselves in the marketplace by their ability to innovate with digital technologies. Yet smaller companies, typically based in the same countries, also offer innovative technology solutions.

University innovations are typically associated with the internationally prominent agricultural institutions in developed countries (mostly in Northern America and Western Europe). A constraint on university-based innovation in many developing countries is the common institutional separation of agriculture from other relevant disciplines—basic sciences, engineering, and medicine—that is, separate agricultural universities cultivate intellectual isolationism at a time when collaboration with other disciplines is critical for innovation. Not unrelated, agricultural universities

in developing countries also generally do not attract the most talented students and professors because the profession is considered less prestigious and offers lower remuneration. In all, the primary innovations in digital agriculture occur in a limited set of countries in part because of structural, institutional, and economic barriers.

#### Issues with digital agriculture adoption

A recent report based on surveys and literature analyses identified a number of concerns and opportunities associated with the penetration of advanced technologies into agriculture.<sup>9</sup> Factors related to infrastructure (e.g., reliable mobile data access), research and development, technical information, and relevant educational resources were all cited in that report as important factors in a recent survey of farmers in New York State, United States of America (USA). Some of those factors are described below.

**Farm size:** Large farms tend to engage in digital agriculture more readily because capital investments provide earlier returns on investment as a result of scale efficiencies, but the technology competence of farmers is also an important adoption factor.<sup>10</sup> Some digital agriculture technologies are attractive to medium and small farms because they are less scale-dependent or are highly compelling for a specific production environment. For example, organic vegetable growers can benefit greatly from precision planting and equipment guidance systems because they rely on mechanical weed cultivation that risks crop damage if done without precision technologies. Similarly, medium-size farms may be attracted to robotic milking and feeding systems

or automated greenhouses because of farm labour shortages.

**Data:** As farmers adopt digital agriculture technologies they accumulate large amounts of data, increasingly through cloud-based services. They are concerned with data privacy and ownership issues because legal concerns around agricultural data are unresolved at this time. Farmers are generally more comfortable sharing data with trusted partners such as universities and local cooperatives than with large companies that may repurpose the data for corporate interests.<sup>11</sup> Farm data are generally not protected in current statutes, but nonprofit initiatives (e.g., Ag Data Transparency) offer third-party certification on data ownership and privacy issues.<sup>12</sup>

A second, and related, data issue revolves around availability. As data are increasingly accumulated by large corporate entities, concerns arise about their availability for aggregated analytics and the development of next-generation management recommendations. Public-sector and scientific communities do not have universal access to valuable private-sector data, and ventures for community data sharing infrastructure are generally absent in agricultural and economics realms.

A third issue is government agency attitudes towards agricultural research data and associated priority areas. Results of a recent survey of agricultural researchers suggest that widespread data management practices fall short of generally accepted best practices.<sup>13</sup> In this context, legislative proposals calling for greater data sharing among public-sector agencies have been put forward,<sup>14</sup> but, so far, with very little effect.<sup>15</sup> Public-private partnerships such as Socrata, CyVerse, and the Health Data Consortium have emerged to

coordinate and increase data sharing and access, which are important steps for data gathered under public auspices.

**Analytics and management gap:** Production environments (soil, climate, crops, animals, etc.) vary greatly in agriculture. The effective employment of digital technologies therefore requires locally appropriate analytics and management responses. In general, the engineering innovations by means of sensors, robotics, and software are rapidly advancing, but the ability to make the technology smart and applicable to local production environments lags behind.

**Education and research gaps:** The engagement of digital agriculture requires knowledgeable and skilled farm managers and labourers, as well as a cadre of well-educated consultants and service providers. Most educational institutions are inadequate in offering such instruction, and professional talent tends to favour urban over rural living. In addition, few institutions have the capacity or resources to answer the research questions that advanced farmers ask.

**Connectivity and digital divide:** Agriculture by its very nature is mostly conducted in rural areas that are poorly connected, even in the most developed countries. The industry is therefore highly impacted by the so-called digital divide. This current state of inadequate connectivity limits the full deployment of digital agriculture technologies in most rural areas, including broadband access for information communication; mobile (cellular) coverage and data transmission speeds for uploading and downloading data from field equipment or remote farm buildings; universal access to precision

equipment guidance technology that requires reliable relay stations and mobile connections; and low-power wide-area networks that offer opportunities for the widespread use of sensor technology and equipment communications. Advanced connectivity investments in rural areas are generally expensive because of low customer density and are often not regarded as economically justified by communications companies.

**Business development and employment:** Many farmers and ag-professionals agree that digital agriculture has a bright future, offers good business and employment opportunities, and will result in environmental benefits and efficiencies.<sup>16</sup> But it may also profoundly impact businesses and employment in rural areas around the globe. In high-wage countries, farmers are eager to employ automation and digital technologies to reduce challenges with their farm labour force—which often depends on migrant workers and therefore poses legal and management challenges. Digital technologies will also facilitate those management farm enterprises that are larger than would otherwise be possible, and may intensify the global trend of farm consolidation. In developing countries where wages are lower and farms generally smaller, digital technologies will help advance improved management practices and better access to markets (e.g., through mobile technologies), but will also impact employment opportunities in rural areas.

---

#### Examples of digital agriculture technology implementation

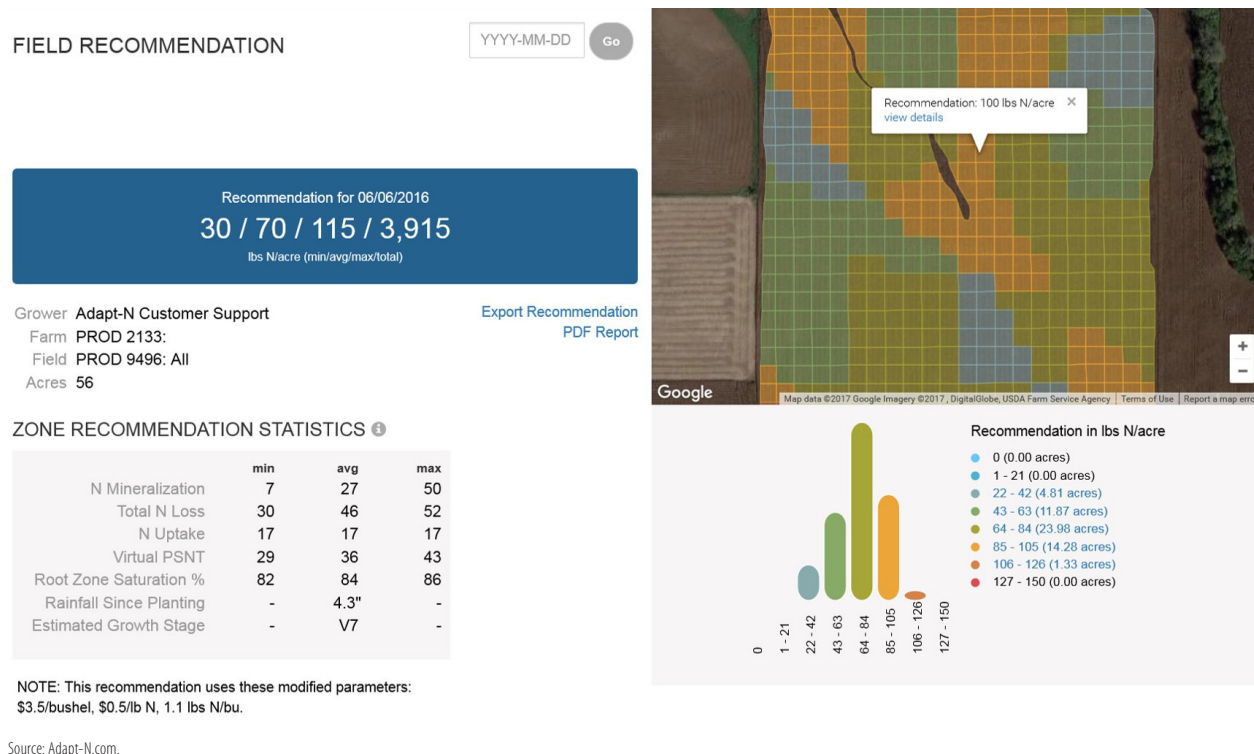
Implementing digital agriculture technology can take different forms. Three of these are considered below.

#### Cloud-based nitrogen advisors

Agriculture includes some ‘wicked problems’, including the use of nitrogen fertilizer that is needed to grow many of the world’s crops at high production levels. The widespread adoption of nitrogen fertilizer use after World War II and especially during the Green Revolution has greatly enhanced food production and reduced malnutrition. But it has also led to serious environmental concerns, including high energy use, greenhouse gas emissions (through nitrous oxide), and water quality degradation. Notably many of the world’s estuaries (Gulf of Mexico, Baltic Sea, etc.) experience low oxygen levels (hypoxia) from nitrogen inflows, which in turn result in the high mortality of critical fish species.

These concerns are in large part related to excessive nitrogen use, where more fertilizer is applied than is needed for the crop. This appears wasteful, but where farmers are uncertain about the ‘right’ amount of fertilizer needed they actually respond in an economically rational manner to the realities of their production environments, avoiding the high risk of under-nourishing their crops and incurring yield losses. Most of the uncertainties are associated with (1) variable production environments (soil, crop, management), and (2) weather variability.

Recent technological developments have proven that data and model computations can address these uncertainties and offer more reliable nitrogen management advice to farmers through cloud-based services. This technology offers real-time nitrogen fertilizer advice, based on weather conditions, that is specific to field zones and thereby allows farmers to more precisely match nutrient additions

**Figure 1: Real-time nitrogen field advice through a cloud service**

with crop needs (Figure 1). In on-farm field evaluations, this technology has proven to offer a win-win opportunity: it increases farmers' profits while reducing negative environmental impacts.<sup>17</sup> Similar technologies can be employed for irrigation and pest management, among others.

Some of the main advantages of employing such cloud-based services are:

- the high scalability such services provide allows the technology to be rapidly employed in many growing environments,
- employment at scale allows for dramatic reductions in per-unit (hectare) expense and can drive down adoption costs, and
- cloud-based and mobile communications allow for continuous access and real-time monitoring of the status of farm resources.

The next phase of technology deployment will likely be the integration of highly computational, data-intensive tools with low-cost field sensor technologies offering management advice based on ensemble technologies.

#### Precision farming services in Bulgaria

Prior to Bulgaria's political and economic reforms of 1989, the country's agriculture was relatively efficient by Eastern European standards, and included large cooperative farms and highly consolidated production units (fields and livestock facilities). After the reforms, Bulgaria liquidated many of the former collective farms, and the associated land privatization resulted in a subdivision of fields into smaller plots with a great number of heirs—that is, large fields are often owned by multiple absentee landowners (82% of holdings are comprised of fewer than two hectares).<sup>18</sup> But through lease

agreements with many individual landowners, private farmers can still cultivate the vast majority of the land through large-scale agriculture, with wheat, sunflower, and maize as primary crops. Furthermore, since its European Union accession in 2007, the EU Common Agricultural Policy invested around US\$4 billion in Bulgaria's agriculture, much of it through direct payments intended to support farms, rural employment, good management practices, and stable food supplies.

These developments have resulted in viable large-scale farming in Bulgaria, and also created exceptional opportunities for the adoption of precision farming methods. Many farmers are purchasing advanced field equipment, and regional technical service providers are offering associated products and services. For example, NIK is a company that works with farmers to implement modern precision technologies in



Bulgaria.<sup>19</sup> These technologies are offered through (1) strategic partnerships with Northern American and European technology leaders that allow for capital and service investments (farm management software, mapping and navigation hardware and software, precision application equipment, auto-steering and guidance systems, weather and satellite monitoring, irrigation equipment, etc.), and (2) skilled field professionals who implement technologies on farms and help develop local knowledge. In summary, the rapid adoption of digital farming technology in Bulgaria can be attributed to a combination of:

- large-scale production units that are a result of land reforms under socialist governments prior to 1989,
- a workable land lease system that allows private farmers to manage large land tracks with multitudes of small land owners,
- farm payments from the European Union, and
- strategic partnerships with leading technology providers.

#### Remote sensing and financial risk management to alleviate poverty

The USA has long had major government programmes in place to facilitate risk management for farmers in various forms. Today the bulk of that funding is allocated to risk management and insurance programmes with great success. However, uptake has been slower in the developing world. This is in part the result of the fact that the programmes are not as well funded in developing countries; furthermore, verifying yields and losses is much more difficult in remote areas of the developing world, despite the fact that those agricultural

producers face risk all the same. Several programmes have emerged recently to address these issues using index-based insurance schemes.<sup>20</sup> Initially, pilot programmes in the developing country context relied heavily on station-level weather data. However, these data are often sparse and are themselves difficult to verify. In recent years there has been a movement towards a different solution: using remotely sensed data to determine losses. The Index Based Livestock Insurance programme (IBLI) in Kenya and Ethiopia was one of the earlier adopters of this approach.<sup>21</sup> As newer remote sensing platforms come online, as well as lower-cost custom options (e.g., nano-satellites, unmanned aerial systems, etc.), there will likely be a large movement towards designing the risk management programmes of the future around these sensing technologies to indicate both when losses occur and the extent of those losses.

#### Conclusions

The penetration of advanced digital technologies into the agricultural industry is progressing rapidly in advanced economies, and is increasingly impacting developing countries. Because of several unique characteristics of agriculture (involving its highly localized and variable resources, poor connectedness in rural areas, education and research gaps, support businesses, and global players), digital agriculture requires special consideration from governments and industry leaders. This will be well worth the effort because it is a primary path towards a sustainable food supply.

#### Notes

- 1 UN DESA, 2015.
- 2 Montgomery, 2007.
- 3 Foley, 2011.
- 4 Tien, 2013; Song et al., 2016.
- 5 Woodard, 2016a.
- 6 Schwab, 2016.
- 7 van Es et al., 2016.
- 8 Woodard, 2016a, 2016b.
- 9 van Es et al., 2016.
- 10 Castle et al., 2015.
- 11 Castle et al., 2015.
- 12 Further information about Ag Data Transparency is available at <http://www.fb.org/ag-data>.
- 13 Fernandez et al., 2016.
- 14 Murray, 2015.
- 15 Woodard, 2016a.
- 16 van Es et al., 2016.
- 17 Sela et al., 2016; Sela et al. 2017.
- 18 European Commission, 2015.
- 19 More information about NIK is available at <http://www.nik.bg/en>.
- 20 Woodard et al., 2016.
- 21 Woodard et al., 2016.

#### References

- Castle, M., B. D. Lubben, and J. Luck. 2015. 'Precision Agriculture Usage and Big Agriculture Data'. *Cornhusker Economics*, University of Nebraska-Lincoln Extension. Available at <http://agecon.unl.edu/documents/2369805/20977275/5-27-15.pdf/b80d3d0a-684e-4bdd-993c-96246691bc95>.
- European Commission. 2015. 'Bulgaria: Common Agricultural Policy'. DG Agriculture and Rural Development, Unit for Agricultural Policy Analysis and Perspective. 15 March. Available at [http://ec.europa.eu/agriculture/sites/agriculture/files/cap-in-your-country/pdf/bg\\_en.pdf](http://ec.europa.eu/agriculture/sites/agriculture/files/cap-in-your-country/pdf/bg_en.pdf).
- Fernandez, P., C. Eaker, S. Swauger, and M. L. E. Steiner Davis. 2016. 'Public Progress, Data Management and the Land Grant Mission: A Survey of Agriculture Researchers' Practices and Attitudes at Two Land-Grant Institutions'. *Issues in Science and Technology Librarianship* 83: (Winter).
- Foley, J. A. 2011. 'Can We Feed the World and Sustain the Planet?' *Scientific American* 305 (5): 60–65.
- Montgomery, D. R. 2007. *Dirt: The Erosion of Civilizations*. Berkeley and Los Angeles, CA: University of California Press.

- Murray, P. 2015. S.991: Evidence-Based Policymaking Commission Act of 2015. 114th Congress. Available at <https://www.congress.gov/bill/114th-congress/senate-bill/991>.
- Schwab, K. 2016. *The Fourth Industrial Revolution*. Geneva: World Economic Forum.
- Sela, S., H. M. van Es, B. N. Moebius-Clune, S. R. Marjerison, J. J. Melkonian, D. Moebius-Clune, R. Schindelbeck, and S. Gomes. 2016. 'Adapt-N Outperforms Grower-Selected Nitrogen Rates in Northeast and Midwest USA Strip Trials'. *Agronomy Journal* 108 (4): 1726–34.
- Sela, S., H. M. van Es, B. N. Moebius-Clune, R. Marjerison, D. Moebius-Clune, R. Schindelbeck, K. Severson, and E. Young. 2017. 'Dynamic Model Improves Agronomic and Environmental Outcomes for Maize Nitrogen Management over Static Approach'. *Journal of Environmental Quality*. doi:10.2134/jeq2016.05.0182
- Song M.-L., R. Fisher, J.-L. Wang, and L.-B. Cui. 2016. 'Environmental Performance Evaluation with Big Data: Theories and Methods'. *Annals of Operations Research* March 2016. doi:10.1007/s10479-016-2158-8.
- Tien, J. M. 2013. 'Big Data: Unleashing Information'. *Journal of Systems Science and Systems Engineering* 22: 127–51.
- UN DESA (United Nations, Department of Economic and Social Affairs), Population Division. 2015. *World Population Prospects: The 2015 Revision, Key Findings and Advance Tables*. Working Paper No. ESA/P/WP 241.
- van Es, H. M., J. D. Woodard, M. Glos, L. V. Chiu, T. Dutta, and A. Ristow. 2016. *Digital Agriculture in New York State: Report and Recommendations*. Ithaca, NY: Cornell University. Available at [bit.ly/NYSDigitalAgReport](http://bit.ly/NYSDigitalAgReport).
- Woodard, J. D. 2016a. 'Data Science and Management for Large Scale Empirical Applications in Agricultural and Applied Economics Research'. *Applied Economic Perspectives and Policy* 38 (3): 373–88. Available at <https://doi.org/10.1093/aep/ppw009>.
- . 2016b. 'Big Data and Ag-Analytics: An Open Source, Open Data Platform for Agricultural & Environmental Finance, Insurance, and Risk'. *Agricultural Finance Review* (Invited Paper, IARFIC Keynote Address). Available at <http://www.emeraldinsight.com/doi/abs/10.1108/AFR-03-2016-0018>.
- Woodard J. D., A. Shee, and A. Mude. 2016. 'A Spatial Econometric Approach to Designing and Rating Scalable Index Insurance in the Presence of Missing Data.' *The Geneva Papers on Risk and Insurance: Issues and Practice* 41 (2): 259–79.

## Digital Technologies Transforming Indian Agriculture

**ANKUR SETH**, formerly with the Confederation of Indian Industry – Jubilant Bhartia Food and Agriculture Centre of Excellence (FACE)

**KAVERY GANGULY**, Confederation of Indian Industry – Jubilant Bhartia Food and Agriculture Centre of Excellence (FACE)

India is the world's largest sourcing destination for the information technology (IT) industry, accounting for approximately 67% of the US\$124–130 billion market.<sup>1</sup> However, the emergence of farm technologies integrated with a robust information and communication technology (ICT) framework is still evolving in India, and it holds tremendous potential to both positively impact agricultural performance and enhance farmers' income. The impact of technology in unlocking value for the people at the bottom of the pyramid and improving access to critical services is well demonstrated in the healthcare sector in India, as observed in the case of mobile technology-enabled telemedicine and low-cost devices that can address health conditions such as anaemia in a large section of the population. Technology has powered Indian agriculture time and again by helping overcome productivity stagnation, strengthening market linkages, and enhancing farm management. In the past, Indian agriculture faced a formidable challenge to grow more food, but it faces an even more difficult challenge today and for the future: to grow more sustainably and inclusively. Major challenges confronting Indian agriculture include declining total productivity, diminishing and degrading natural resources, a rapidly growing demand for food (not just for quantity but also for quality), stagnating farm incomes, fragmented land holdings,

and unprecedented climate change. It has been established that technology adoption modernizes farmers' production practices and leads to uniform annual returns for farmers, reduced risk of crop failure, and increased yields.<sup>2</sup>

Direct applications of digital technology include remote sensing (via satellites), geographic information systems, crop and soil health monitoring, and livestock and farm management, among other applications. At the pre-harvest stage, digital technology can recommend crop and input selection and assist in obtaining credit and insurance. At the on-farm stage, there is need for weather advisories and disease- and pest-related assistance; and at the post-harvest stage, real-time data on both domestic and export markets are needed. The growth of competitive markets and demand for consistent food quality is making the adoption of such tech-based solutions imperative for the Indian farmer. Much of the scope for application and innovation remains to be exploited. The application of digital technology in agriculture has been instrumental in promoting data generation as well as the advanced analytics that allow farmers to make smart decisions about farming and to benefit from an economical use of inputs and labour.

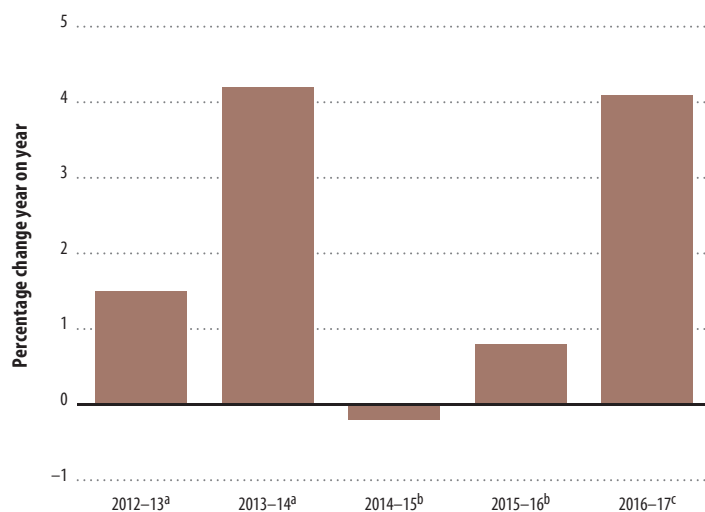
### Technology: A key driver for sustainable agriculture

India is one of the leading contributors to the global food basket. The country's food grain production stood at 252.23 million tonnes in 2015–16, and has a record production of 271.98 million tonnes in 2016–17.<sup>3</sup> India's horticulture output—comprising fruits and vegetables, floriculture, honey, plantation crops, medicinal plants, and spices—was around 283.4 million tonnes in 2015–16, surpassing food grains and making India the second largest fruit and vegetable producer in the world. India is also the world's largest producer of milk (155.5 million tonnes in 2015–16) and second largest producer of sugar, and the leading country in coconut production per government estimates. In 2016–17, after two successive years of sub-par monsoons, the growth of agriculture and allied sectors in India improved significantly (Figure 1). This growth is being primarily driven by the livestock and fisheries sectors, contributing to the diversification of the production basket towards high-value foods. Although fluctuating, the agricultural growth rate over the years reflects the increasing resilience of the sector to natural shocks and market volatility, an increase that also demonstrates the impact of favourable investments, technology uptake, and strategic policy efforts.

India's population has nearly doubled since the 1970s; it is currently estimated at over 1.2 billion and is



**Figure 1: Growth rate of gross value added in agriculture and allied sectors, 2011–12 base prices**



Source: Government of India, 2017b; 2017c.

Note: Data are government estimates: <sup>a</sup> second revised estimate; <sup>b</sup> first advance estimate; <sup>c</sup> first revised estimate.

growing at 1.4% annually, putting pressure on natural resources such as land and water to produce enough food. Moreover, with rising incomes, a structural change in the dietary patterns of an average Indian is diversifying the country's food demand to include high-value foods. According to the National Sample Survey estimates for 2011–12, although cereals account for 26% (20%) of the total food consumption expenditure in rural (urban) India, high-value foods (milk, meat, eggs, fish, fruits, and vegetables) account for 42% (46%) in rural (urban) India.<sup>4</sup>

Sustaining food security in India holds a larger implication for global markets.<sup>5</sup> India's agricultural export value growth rate was the highest in the world for the decade ending 2013 (Figure 2), at 21.3%—more than the average annual percent increase in agricultural export value in countries such as Indonesia (17.6%), Brazil (14.9%), and China (11.8%).<sup>6</sup>

To respond successfully to the growing food demand both domestically and globally, India will have to

produce more. Yields of major crops are low in India compared with those in other countries. For instance, the rice yield in India is 2.6 tonnes per hectare—far lower than the 4.7 in China, 3.7 in Brazil, 5.9 in the United States of America (USA), or 9.5 in Australia; that of wheat is 3.0 tonnes per hectare in India, 5.3 in China, and 3.1 in the USA; and the maize and soybean yields are 2.5 and 0.75 tonnes per hectare in India compared with 5.9 and 1.8 tonnes, respectively, in China.<sup>7</sup>

Leveraging technology to achieve higher and sustainable agricultural growth is not novel for farmers and other relevant stakeholders in India. Noteworthy are the green revolution (1966–67), the white revolution (1970–96), and the gene revolution (in cotton) in early 2000. The green revolution, which relied on extensive cultivation of high-yielding varieties of wheat, led to a fivefold increase in production and, as a result, also led to rising farmers' incomes.<sup>8</sup> The three decades from 1973 to 1999 can be regarded as the highlight in the

timeline of agriculture productivity in India, when the food grain production nearly doubled.<sup>9</sup> It is interesting to note that the increase in production was more a result of an increase in the yield rather than an expansion of cultivated area. Similarly, the white revolution led to record milk production in India and enabled higher returns for dairy farmers. It established a national milk grid and introduced the crossbreeding of indigenous cows with high-milk-yielding European breeds, pasteurization of milk for long-duration storage, and refrigerated transport systems to distribute milk across the country. During the same period, agriculture machines were introduced on Indian farms; these primarily consisted of tractors and seed drills to improve productivity per unit of land and water.

Following the successful adoption of *Bacillus thuringiensis* (Bt) cotton, India's cotton production increased from 14.0 million bales in 2000–01 to 38.6 million bales in 2014–15; it is estimated to be 35.1 million bales in 2016–17. India became the largest cotton producer in the world, accounting for 26% of the global production. Yield levels also increased from 278 kilograms (kg) per hectare to 511 kg per hectare to 568 kg per hectare during the above periods.<sup>10</sup> In 2015, India continued to have the largest area being cultivated with Bt cotton in the world—11.6 million hectares sowed by 7.7 million small farmers and an adoption rate of 95%. According to estimates, India enhanced farm income from Bt cotton by US\$18.3 billion between 2002 and 2014 and US\$1.6 billion in 2014.<sup>11</sup>

In the wake of concerns that intensive farming adversely impacts environmental balance, India will need to adopt sustainable farming practices that include employing efficient irrigation methods with a

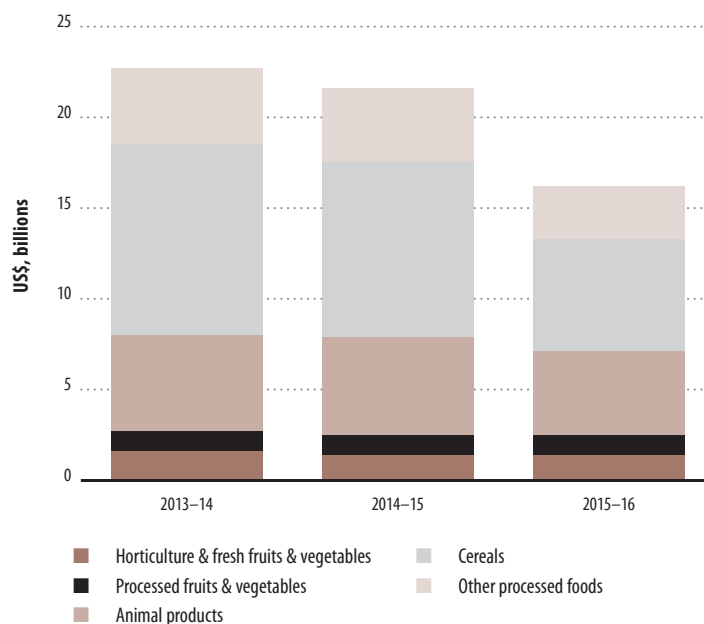
simultaneous focus on groundwater regeneration, monitoring soil degradation, and adopting energy-efficient production methods. Adopting advanced technology has helped small countries, including the Netherlands and Israel. Notably, these countries, have augmented the production of high-value crops through enormous productivity breakthroughs and, even more importantly, by ensuring the optimal utilization of resources and maintaining the environmental balance.

Currently technologies that cater to the optimal utilization of resources (particularly those that are linked to natural resource availability and environmental impact), effective market linkages for improved service delivery, and the discovery of the highest price possible as observed in the case of India through the country's electronic National Agricultural Market (e-NAM)—a technology-driven unified market platform—have a brighter future in India. The success of technology adoption lies in customizing to address particular challenges at the local level, supporting institutions and policies to create an enabling ecosystem, and harnessing the potential of these technologies to scale and commercialize within a defined time period.

### **An emerging ecosystem of digital technologies in Indian agriculture: The rise of start-ups and young entrepreneurial firms**

The agriculture sector has attracted large conglomerates, leading IT companies, investors, and young innovators in India; the ecosystem for technology and digital solutions is expanding at an impressive pace. The global market for precision agriculture is expected to grow at an annual growth rate of 13.09% to reach a market size of over US\$6.34 billion by

**Figure 2: Key agricultural exports from India, US\$ billions**



Source: APEDA 2017, statistical data on agricultural exports, available at <http://agriexchange.apeda.gov.in/index/exportstatement.aspx>.

2022.<sup>12</sup> Although Northern America will maintain its dominance in the sector, the fastest growth is projected for India and China, which are expected to see an annual growth rate of 18.29% until 2022.<sup>13</sup>

The agro-tech start-up ecosystem in India has also been receiving renewed interest from investors, and an estimated 34 ventures received US\$295 million in investments in 2016 in the country—the highest investment amount recorded in India in the past three years.<sup>14</sup> In Asia, China had 10 deals totalling US\$427 million, while 53 Indian start-ups raised US\$313 million and four Japanese companies raised US\$8.9 million. The most active geographies—those countries with the highest number of agriculture start-ups—remained consistent year-over-year, with the USA, India, Canada, the United Kingdom, Israel, and France remaining the top six by number of deals.<sup>15</sup>

Among the prominent ventures backed by large conglomerates in India is ITC's e-Choupal, a comprehensive digital knowledge hub for farmers, which has 6,100 installations covering over 35,000 villages and serving over 4 million farmers.<sup>16</sup> Launched in 2000, the first-of-its-kind initiative not only benefited the farmers doing business through their network, but this model also led to a ripple effect on the public sector-managed food grain management systems that resulted in an upgrade.

Mahindra & Mahindra (M&M), one of India's leading producers of tractors and farm equipment, is innovating alongside expanding its core business. M&M's Trringo, a mobile-based app enabling farmers to rent tractors, is a unique example of leveraging technology to help farmers use machinery without having to make the large investment (US\$7,500) of buying tractors.<sup>17</sup> Through Trringo,

the farmers benefit from available latest machines, freeing labour as well as raising productivity and product quality. In addition, the farmers are required to pay only for the services they use without locking any money in as capital. This is particularly revolutionary in a country such as India, where agriculture is characterized by smallholders (who operate on less than 2 hectares of land) and who are often resource poor and lack access to formal channels of credit. The ‘uberization’ of tractors and farm machines (as some have coined it—a concept similar to uber taxis, which is a platform aggregating demand and supply of taxi services and connecting both through a mobile app) has the potential to fast-track farm mechanization and take it to regions within India where farm sizes are really small, yet abundant in water and exhibit suitable soil and climate conditions that could produce much more than their current output.

In another example, Tata Consultancy Services (TCS), India’s leading IT firm, offers personalized advisory services in voice and visual formats using communication devices such as mobile phones through its mKRISHI platform. The growing penetration of mobile phones in rural regions of India is driving the development of several mobile-based applications by government departments, entrepreneurs, and the private sector.<sup>18</sup> The rural subscriber base in India for mobile services has been growing at steady pace, reaching approximately 342 million subscribers in 2012–13, 378 million in 2013–14, and 414 million at the end of 2014–15.<sup>19</sup> With easier access to mobile phones, farmers can connect with traders and other farmers. Small farmers can also utilize their mobile phones to seek information on input availability or market prices, thereby reducing costs—both because they

do not have spend the time needed to get into town to find this information, and because it allows them to get competing prices and choose the best one. Other benefits that have been recorded are improved access to information about selecting seed varieties appropriate to a particular farm; and how to identify best cultivation practices, protect from weather-related damage, and get a better handle on plant diseases.<sup>20</sup>

Digital technology in Indian agriculture is not about big box solutions only. A large number of young entrepreneurs have ventured into this sector to tackle specific challenges. The technology thrust of these ventures has been on reducing the time duration of crop cycles, saving on water and energy, reducing the usage of agro-chemicals, automating for efficient farm management, strengthening farmer market linkages, and improving cold chain logistics for higher value addition.

Examples of these leading start-ups include Stellapps Technologies, which is providing dairy farm optimization and monitoring services with a special focus on small- and medium-herd farms. Their applications and tools leverage the Internet of Things, big data, the cloud, mobility, and data analytics to improve milk production, milk procurement, and the cold chain, and to boost animal insurance and farmer payments.<sup>21</sup> Ekgaon Technologies, an IT-based network integrator, offers a range of services to farmers, rural businesses, and women. The ekgaon OneVillageOneWorld Network is leveraging mobile communication technology to encourage the sustainable development of women-self-help-groups (SHGs) and small farmers across India. The platform has over 900,000 women and 300,000 farmers spread across villages in India.<sup>22</sup>

Drones and robotics are also increasingly used in Indian agriculture, although the ventures in this area are still budding and there is a long way to go before these technologies are scaled up in any major way. Agnext, an Indian start-up, has developed drones among other digital technologies with the objective of creating an integrated hyperlocal farm data collection and crop analytics platform.

A number of new start-ups are developing solutions to tackle climate change challenges. For example, Skymet Weather Services is involved in monitoring and predicting weather and providing agri-risk solutions.<sup>23</sup> Skymet can measure and predict yield at the village level for any crop with a high level of accuracy and can also accurately forecast the weather in the short, medium, and long term. Ecozen Solutions has developed state-of-the-art solar-powered products for irrigation and cold storage, with the aim of catering to smallholder farms and regions with limited or no electricity.<sup>24</sup> Barrix Agro Sciences offers eco-friendly crop protection methods that have the potential to minimize a significant proportion of the damage caused by pests and diseases without overdosing crops and plants with chemicals, thus preventing soil and water contamination.<sup>25</sup>

There are also ventures that started out as agri-tech start-ups in India but, owing to their innovative solutions, are now operating as medium-scale businesses. EM3 AgriServices, founded in 2014, has quickly risen to become a pioneer in the farming-as-a-service (FaaS) model. EM3’s *Samadhan techno khetis centres* offer machines needed to perform all critical farm operations on a pay-for-use basis.<sup>26</sup> At their centres, the organization employs agri-professionals who are well versed in the agronomy of the target area. Another

such noteworthy venture, eKutir Global, offers an online and mobile-based platform to connect marginal farmers with stakeholders across the value chain such as soil-testing labs, suppliers of seeds and fertilizers, banks, exporters, food-processing units, and branded retailers. Agri Suite by eKutir offers a one-stop solution for all the needs of a farmer; their field partners also train farmers to use their application.<sup>27</sup> Over time, services that go beyond merely selling a product but that also provide training about how to use, maintain, and repair that product, as well as supplementary components such as advisory and marketing services, have become an increasingly important and integral part of any product offering. Technology is playing an important role in bringing these elements together.

Despite the tremendous gains achieved, the long-term impact of the earlier technology revolutions was limited to selected agricultural pockets in the country, and further efforts to advance these revolutions lost momentum over time. In the context of start-ups, the common barriers to commercialization and the scaling up of technology are related to access to finance, which is in turn related to operational finance, funding/capital deficiencies, and cash flow management; gaps in technology infrastructure; and issues concerned with cyber security. Furthermore, limited access to farmer networks for effective piloting of the products is seen to impede the commercialization plans of start-ups. For innovation and entrepreneurship to be effective in transforming agriculture in India, it will be important to address these issues and create an enabling environment in which they can grow and flourish. To a large extent, the effort towards this transformation has been catalysed by the government's special

programme on start-ups, Startup India.<sup>28</sup> Moreover, large companies with knowledge about the diversity of Indian agriculture could also support these start-ups by mentoring, which would help them pilot and scale up their activities for potential commercialization.

---

#### **Policy and institutions: Key enablers for scaling up digital technologies in India**

India's present public policy with regard to agriculture is focused on encouraging innovation and entrepreneurship, and out-of-box thinking towards achieving sustainable higher growth and income security in the farm sector. Because more than 50% of the working population is in agriculture and farm size is shrinking, the per capita output is small. Thus it is true and desirable that people move out of agriculture and bring the current percentage of the workforce employed in agriculture from 54.6 % down many fold. New forms of engagement have emerged in this sector that could make agriculture more remunerative and exciting for the new generation. The government—through its flagship programme Startup India, launched in 2016—aims to boost start-ups across sectors by providing hand-holding services, access to funding, and incubation. This programme is of immense significance for the agriculture sector. The other flagship programme—Digital India, which seeks to empower people through access to digital technology riding an increasingly robust infrastructure and service platform—has equally immense potential to positively impact agriculture. The government has also launched the Custom Hiring Centre, a rental model for using tractors and other farm equipment with the twin objective of encouraging rural entrepreneurship

and fast-tracking the mechanization of Indian agriculture.

The budget for 2016–17 announced by the central government confirms its commitment to modernize agriculture systems in India through a slew of measures such as setting up a dedicated micro-irrigation fund, establishing new mini labs in the Krishi Vigyan Kendras (KVKs) agricultural extension centre, ensuring 100% coverage of all 648 KVKs in the country for soil sample testing, and expanding the coverage of the e-NAM from 250 markets to 585 markets.<sup>29</sup>

According to the Department of Industrial Policy and Promotion (DIPP) of the Ministry of Commerce and Industry, the Indian agricultural services and machinery sectors have cumulatively attracted foreign direct investment equity inflow of about US\$2,278.3 million from April 2000 to March 2016.<sup>30</sup> This reveals the trend of global and domestic partnerships being forged across the value chain to keep agriculture on a path of fast-track growth. Some notable developments include the launch of an Agritech laboratory with a focus on agri-biotech in Hyderabad by the Intertek Group, a UK-based total quality assurance provider; Mahindra and Mahindra Ltd acquisition of a 35% stake in a Finnish combine harvesters manufacturer, Sampo Roselnew Oy; ICRISAT's plan to set up a Rs.100 crore (US\$14.67 million) fund in a year to help small entrepreneurs in the agribusiness space; and the Indian Farmers Fertiliser Cooperative (IFFCO)'s joint venture with Japanese firm Mitsubishi Corp for manufacturing agrochemicals in India.

---

#### **Conclusions**

A successful future growth strategy for agriculture will need to perceive

agriculture as a business enterprise involving constant innovation and catering to dynamic market demand. Although agricultural technologies are fast evolving in India and a mix of business models are driving the ecosystem, there is a need to design the pathway to successful commercialization and to scale it up by utilizing the right incentives and policy support. Technology will continue to play an important role while the dynamics of the agriculture sector changes and produces new challenges. With the private sector playing an increasingly important role in investments, operations, and expertise, agriculture will gain immensely as the public sector catalyses these efforts. The IT revolution in India was brought forward by the private sector, with the public sector creating an enabling environment.

Uptake of technologies at market prices in a sector that has traditionally been heavily subsidized remains challenging, but farmers are prompt to identify what works in their interest and are ready to pay for it. Digital technologies offer the potential to achieve the necessary conditions for scale, with distributed low cost and customized delivery, creating a unique opportunity for private enterprise and innovation to thrive. The challenge before India lies in balancing high growth with inclusive growth; leveraging technology to achieve these twin goals will be a fascinating journey to track.

A developed agriculture system is based on three key pillars: knowledge, infrastructure, and a robust delivery mechanism. Supporting the research and development ecosystem in agriculture directly contributes to creating knowledge and preparing for the future. To strengthen the supporting framework for growth, it will be important to focus on creating new physical markets, improving

storage and transport facilities, making better roads, and ensuring a continued electricity and water supply. These system components also facilitate efficient mechanisms for delivery and the monitoring of relevant government schemes and extension services that will accelerate the pace of development. The public policy regime in India has been supporting technology-led agricultural growth and has been increasingly developing new institutions to ease access and affordability of technology adoption among farmers.

### Notes

- 1 IBEF, 2017.
- 2 Emerick et al., 2016.
- 3 Government of India, 2017a.
- 4 Government of India, 2013.
- 5 If India has to depend on imports, it will be difficult to supply enough because the volume of the need is so high. If India is able to grow more than it needs, it can be a global exporter. Both import and export impact price in different ways.
- 6 USDA-FAS, 2014.
- 7 OECD, 2017.
- 8 Dastagiri et al., 2014.
- 9 Government of India, 2017d.
- 10 The Cotton Corporation of India Ltd, 2017.
- 11 ISAAA, 2015.
- 12 BIS Research 2015.
- 13 Tech Mahindra, No date.
- 14 Shashwati, 2017.
- 15 Agfunder, 2017.
- 16 Information on ITC's e-Choupal is available at <http://www.itcportal.com/businesses/agri-business/agri-commodities-and-rural-services.aspx>, accessed 11 February 2017.
- 17 Information on M&M's Trringo comes from <https://www.trringo.com/about-us/>, accessed 11 February 2017.
- 18 For more information about TATA Consultancy Services, see <https://www.tcs.com/>.
- 19 TRAI, various issues.
- 20 Mittal and Mehar, 2013.
- 21 This information on Stellapps comes from <http://www.stellapps.com/index.php/about-stellapps/>, accessed 11 February 2017.

- 22 Information about ekgao and its OneVillageOneWorld Network can be found at <http://ekgaon.co.in/ekg/index.php>, accessed 11 February 2017.
- 23 Information about Skymet Weather Services comes from <http://www.skymetweather.com/>, accessed 11 February 2017.
- 24 Information about Ecozen Solutions can be found at <http://www.ecozensolutions.com/about-us>, accessed 11 February 2017.
- 25 Information about Barrix Agro Sciences can be found at <http://www.barrix.in/About-Us>, accessed 11 February 2017.
- 26 Information about EM3 AgriServices is available at <http://www.em3agri.com/>, accessed 11 February 2017.
- 27 Information about eKutir Global is available at <http://www.ekutirsb.com/>, accessed 11 February 2017.
- 28 Information about Startup India is available at <http://www.startupindia.gov.in/>.
- 29 Key features of the budget can be found at the Government of India's Union Budget 2017–18, available at <http://indiabudget.nic.in/ub2017-18/bh/bh1.pdf>.
- 30 GBV, 2017.

### References

- Agfunder. 2017. *AgTech Investing Report: Year in Review 2016*, January 2017. Agfunder. Available at <https://agfunder.com/research/agtech-investing-report-2016>.
- APEDA (Agricultural and Processed Food Products Export Development Authority). 2017. Three Year Export Statement of APEDA Products. APEDA agriXchange. Available at <http://agriexchange.apeda.gov.in/index/exportstatement.aspx>.
- BIS Research. 2015. *Global Precision Agriculture Market: Analysis and Forecast, 2016 to 2022*. November, 2014. BIS Research. Available at <http://bisresearch.com/industry-report/global-precision-agriculture-market-analysis-forecast-2015-2022-technology-vra-soil-mapping-yield-monitoring-precision-irrigation-others-components-and-systems.html>
- The Cotton Corporation of India Ltd. 2017. National Cotton Scenario. Available at <http://cotcorp.gov.in/national-cotton.aspx#indiancotton>. Accessed on 13 March 2017.
- Dastagiri, M. B., M. N. V. Prasad Gajula, and I. P. Ganeshagouda. 2014. 'World and Indian Agriculture: Revolutions & Multi Speed Strategies for Future'. *Science Discovery* 2 (1): 14–26. doi:10.11648/j.sd.20140201.12.
- Emerick, K., A. de Janvry, E. Sadoulet, and M. H. Dar. 2016. 'Technological Innovations, Downside Risk, and the Modernization of Agriculture'. *American Economic Review* 106 (6): 1537–61. Available at <https://www.aeaweb.org/articles?id=10.1257/aer.20150474>.



- GBV (Global Business Ventures). 2017. *Agriculture Report*. Available at <http://globalbusinessventures.in/agriculture-report/>.
- Government of India. 2013. Key Indicators of Household Consumer Expenditure in India. 68th National Sample Survey (July 2011 – June 2012). National Sample Survey Office. Ministry of Statistics and Program Implementation. New Delhi: Government of India.
- . 2017a. Third Advance Estimates of Foodgrain Production for 2015–16. Directorate of Economics and Statistics. Department of Agriculture, Cooperation and Farmers' Welfare. Ministry of Agriculture and Farmers' Welfare. New Delhi: Government of India.
- . 2017b. Economic Survey 2017. Economic Division. Department of Economic Affairs. Ministry of Finance. New Delhi: Government of India.
- . 2017c. Press Note on Second Advanced Estimates of National Income 2016–17 and Quarterly Estimates of Gross Domestic Product for the Third Quarter (Q3) of 2016–17. Central Statistics Office, Ministry of Statistics and Programme Implementation. New Delhi: Government of India.
- . 2017d. Union Budget 2017–18. Available at <http://indiabudget.nic.in/ub2017-18/bh/bh1.pdf>.
- IBEF (India Brand Equity Foundation). 2017. IT & ITes Industry in India. Available at <http://www.ibef.org/industry/information-technology-india.aspx>, accessed 8 February 2017. New Delhi: India Brand Equity Foundation.
- ISAAA (International Service for the Acquisition of Agri-biotech Applications). 2015. *ISAAA Brief 51-2015: Executive Summary*. Available at <http://www.isaaa.org/resources/publications/briefs/51/executivesummary/default.asp>.
- Mittal, S. and M. Mehar. 2013. 'Agricultural Information Networks, Information Needs and Risk Management Strategies: A Survey of Farmers in Indo-Gangetic Plains of India'. *Socioeconomics Working Paper* 10. Mexico, D.F.: CIMMYT.
- OECD (Organisation for Economic Co-operation and Development). 2017. OECD Data: Agriculture. Available at <https://data.oecd.org/agriculture.htm>, accessed 15 February 2017.
- Shashwati, S. 2017. 'Data Harvesting Makes Agri-Tech Startups Hot for Investors'. *Economic Times*, 23 January. Available at <http://economictimes.indiatimes.com/small-biz/startups/data-harvesting-makes-agri-tech-startups-hot-for-investors/articleshow/56726006.cms>.
- Tech Mahindra. No date. "Precision Agriculture and Potential Market in India." White Paper: Research Insights. Tech Mahindra. Available at [http://www.techmahindra.com/sites/ResourceCenter/White%20Papers/New\\_Gen\\_Services/PrecisionAgriculture-PotentialMarket-India.pdf](http://www.techmahindra.com/sites/ResourceCenter/White%20Papers/New_Gen_Services/PrecisionAgriculture-PotentialMarket-India.pdf).
- TRAI (Telecom Regulatory Authority of India). Various years. Annual Report, 2012–13, 2013–14, 2014–15. New Delhi: Telecom Regulatory Authority of India.
- USDA-FAS (United States Department of Agriculture, Foreign Agricultural Service). 2014. 'India's Agricultural Exports Climb to Record High'. *International Agricultural Trade Report*. USDA-FAS. Available at [https://www.fas.usda.gov/sites/default/files/2015-02/india\\_iatr\\_august\\_2014.pdf](https://www.fas.usda.gov/sites/default/files/2015-02/india_iatr_august_2014.pdf).





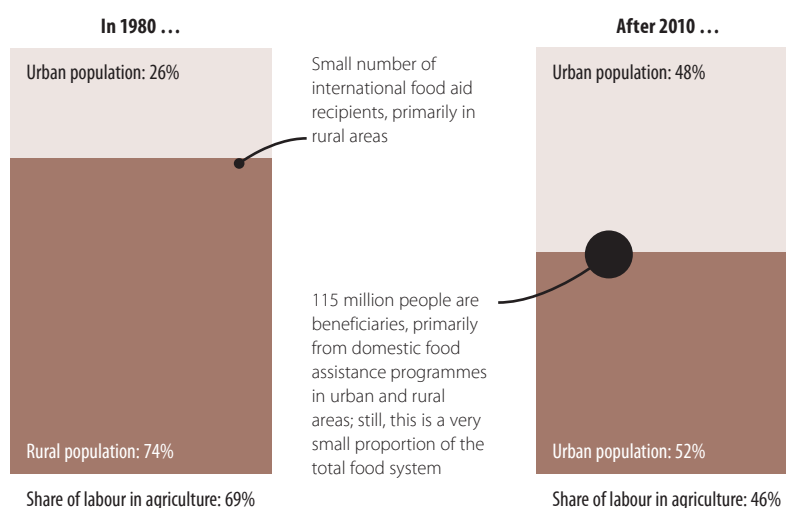
## Innovations in Food Distribution: Food Value Chain Transformations in Developing Countries and their Implications for Nutrition

MIGUEL I. GÓMEZ and KATIE D. RICKETTS, Charles H. Dyson School of Applied Economics and Management, Cornell SC Johnson College of Business, Cornell University

Millions of individuals are affected by malnutrition globally. Malnutrition in developing countries is characterized as a triple burden,<sup>1</sup> which includes undernourishment (insufficient calorie and protein intake), micronutrient malnutrition (hidden hunger), and over-nutrition (excess calories leading to overweight and obesity). In 2010, undernourishment and micronutrient malnutrition affected about 900 million and 2 billion people, respectively, in developing countries.<sup>2</sup> Meanwhile, over-nutrition—reflected in escalating overweight and obesity rates along with higher incidence of chronic diseases such as diabetes—continues to expand in developing countries.<sup>3</sup> The causes of this triple burden are multiple, but the availability, variety, and composition of foods that make up peoples' diets play a major role.

This chapter explains how food value chain (FVC) innovations in recent years are influencing the triple burden of malnutrition in developing countries. These chains are changing fast as a result of population and income growth; technological progress in food production and distributions; urbanization; and the expansion of modern food retailing, distribution, and wholesaling firms.<sup>4</sup> As a result, today's developing-country FVCs exhibit great diversity, because modern food sector firms either establish their own food chains or

**Figure 1: Developing-country food systems: Key differences between 1980 and 2010**



Source: Based on Gómez et al., 2013.

Note: The trend of people moving to urban areas and working in less physically demanding jobs continues in 2017. Updated data would show an even higher percentage of urban dwellers and beneficiaries of food assistance programmes.

interact with traditional FVC actors, such as smallholder farmers and traders, wet markets (which sell fresh meat and produce), corner stores, and street vendors. A deeper understanding of the drivers of emerging FVC arrangements, the interactions of businesses that participate in them, the products offered, and the markets targeted can provide valuable insights into strategies to curb malnutrition.

### Food system transformation

Figure 1 highlights key differences between a representative food system in 1980 and 2010.<sup>5</sup> In 1980,

about 74% of people in low- and middle-income countries resided in rural areas. The share of food sold in local rural wet markets and grown for household consumption was relatively high, while the share sold in supermarkets out of total food consumed was very small.<sup>6</sup> In the same year, the share of low- and middle-income countries' total labour force in agriculture was approximately 69%;<sup>7</sup> these workers expended considerable energy in manual labour. In addition, domestic public food-based safety nets to provide food assistance to those missed by the commercial sector were practically non-existent

**Table 1: Food value chain typologies and their influence on nutrition**

| Type                         | Participants  | Implications for food access   | Nutritional impacts   |
|------------------------------|---|--|---|
| <b>Traditional</b>           | Traditional traders buy primarily from smallholder farmers and sell to consumers and traders in wet, mostly local, markets.             | <ul style="list-style-type: none"> <li>• <b>Affordability:</b> A local clearing-house for products, with flexible prices, product volumes, and quality standards.</li> <li>• <b>Availability:</b> Food hub for consumers and local 'mom and pop' stores to access directly from traders and smallholder farmers; market offerings are highly dependent on production seasonality.</li> </ul>   | <ul style="list-style-type: none"> <li>• Traditional FVCs help reduce micronutrient deficiencies and undernourishment by offering low-priced fruits, vegetables, livestock products, and staples, particularly in rural areas and in poor neighbourhoods of urban areas.</li> <li>• Production seasonality, combined with lack of post-harvest and distribution infrastructure, increase FVC intermediation costs and limit the ability of traditional FVCs to reduce micronutrient deficiencies and undernourishment.</li> </ul> |
| <b>Modern</b>                | Domestic and multinational food manufacturers procure primarily from commercial farms and sell through modern supermarket outlets.      | <ul style="list-style-type: none"> <li>• <b>Affordability:</b> Economies of scale enable the production, marketing, and distribution of packaged/processed foods at low per-unit prices.</li> <li>• <b>Availability:</b> Modern supermarkets provide year round, wide product assortment, primarily in urban areas; supermarkets are successfully expanding the market for processed and packaged foods.</li> </ul>                      | <ul style="list-style-type: none"> <li>• Modern FVCs may contribute to alleviate micronutrient deficiencies by offering a wide assortment of products year round, but supermarkets' physical locations and quality standards may imply higher retail prices, missing the poor.</li> <li>• Modern FVCs may contribute to obesity/overweight malnutrition by expanding the reach of inexpensive, calorie-dense processed/packaged foods, primarily in urban areas.</li> </ul>   |
| <b>Modern-to-traditional</b> | Domestic and multinational food manufacturers sell through the network of traditional traders and retailers (e.g., mom and pop stores). | <ul style="list-style-type: none"> <li>• <b>Affordability:</b> Food manufacturers benefit from economies of scale to connect with traditional distributors and retailers, offering low-priced processed foods to reach low-income consumers.</li> <li>• <b>Availability:</b> By linking with traditional retailers, food manufacturers develop intense distribution strategies in urban areas and in rural, isolated markets.</li> </ul> | <ul style="list-style-type: none"> <li>• Expansion of processed/packaged foods into isolated, rural regions may alleviate undernourishment, but it can result in over-nutrition among urban consumers.</li> <li>• Food fortification initiatives focusing on modern-to-traditional FVCs may help reduce micronutrient malnutrition.</li> </ul>  |
| <b>Traditional-to-modern</b> | Supermarkets and food manufacturers source food from smallholder farmers and traders.   | <ul style="list-style-type: none"> <li>• <b>Affordability:</b> Increased income opportunities in high-value crop and livestock production for smallholder farmers and traders can expand food budgets because most are net food buyers.</li> <li>• <b>Availability:</b> Increased production and crop diversification may increase food available for local consumption.</li> </ul>  | <ul style="list-style-type: none"> <li>• Traditional-to-modern FVCs may reduce micronutrient deficiencies and undernourishment of smallholder farmers and traders through higher incomes leading to diet diversification.</li> <li>• Opportunities for smallholder farmers and traders to benefit directly from participation appear limited and may miss asset-poor farmers; substantial benefits are generated through off-farm employment opportunities.</li> </ul>  |

Source: Gómez and Ricketts, 2013.

in developing countries, other than those programmes supported by foreign food aid shipments from high-income countries.<sup>8</sup>

Developing-country food systems became dramatically different by 2010. A larger portion of people in developing countries lived in urban areas by then and depended on commercial FVCs to deliver their food, while they typically worked in less physically demanding jobs than agriculture, expending far fewer calories in daily labour. In 2011, only about 52% of low- and middle-income country people resided in rural areas and

the share of agricultural labour had fallen to about 46%.<sup>9</sup> Thus the share of food sold in local rural markets and grown for household consumption after 2010 was significantly smaller than it was in 1980. The percentage of people residing in rural areas and the share of agriculture in total labour continue falling today. Meanwhile, modern food retail and wholesale and the foreign direct investment of global food manufacturers have expanded rapidly.<sup>10</sup> Another key feature of today's food systems is that many developing countries are establishing food-based safety

nets—'food assistance programmes' (FAPs)—for those individuals who are at risk of experiencing macronutrient and micronutrient deficiencies. The World Bank (2013) estimates that, on average, nearly 115 million people benefited annually from safety nets in developing countries during 2011–14.

#### **Emerging food value chain typologies: Implications for nutrition**

Table 1 offers a typology that assigns FVCs into four broad categories to reflect ongoing FVC transformations

in developing countries. For each FVC category, the table describes its primary characteristics and participants, explains the essential mechanisms affecting food access (availability and affordability), and describes its impact on elements of the triple malnutrition burden. The typology recognizes the existence of a modern sector (e.g., large commercial farms, agribusinesses, multinational food manufacturers, and modern supermarkets), a traditional sector (e.g., smallholder farmers and traders, wet markets, and ‘mom and pop’ stores), and the interaction between modern and traditional actors at different FVC stages. A discussion of the implications of each FVC type on nutrition follows.

#### **Traditional food value chains**

Consumers in traditional FVCs follow long-established patterns and most often purchase food directly from smallholder farmers and traders in regional/local wet markets, or from a network of traditional retailers that includes independently owned mom and pop corner stores, street vendors, or roadside stands.<sup>11</sup> Wet markets, in turn, can include large, regional markets that function like distribution hubs, or smaller, local, weekly markets with more limited product assortment. Product availability in these FVCs tends to be seasonal. Traditional FVCs are common in small rural markets located relatively close to production regions. Products delivered by traditional FVCs travel longer distances to reach urban consumers, primarily in lower-income neighbourhoods.<sup>12</sup>

Despite the expansion of modern supermarkets and food manufacturers, evidence suggests that food categories that are important sources of micronutrients continue to be accessed primarily through traditional FVCs in developing countries.<sup>13</sup> For example,

over 90% of all fruits and vegetables are purchased in traditional FVC retail outlets in Kenya, Nicaragua, and Zambia,<sup>14</sup> and 90% of households in Ethiopia buy their beef through a local butcher in wet markets.<sup>15</sup> These large market shares are mainly the result of three advantages accruing to traditional FVCs, particularly with respect to perishable products: (1) their ability to offer products at low prices, (2) their considerable flexibility in product quality standards, and (3) their convenience for consumers as a result of their flexible retail market locations.<sup>16</sup>

Food products rich in micronutrients (e.g., fruits and vegetables) and staple foods rich in calories (e.g., pulses, grains) tend to be more affordable in traditional FVCs than in modern supermarkets. These marketing channels often deliver nutritional benefits to rural residents who are largely missed by modern FVCs. Additionally, important nutritional benefits accrue to low-income people in urban areas, where traditional FVC retailers enjoy cost and location advantages. Moreover, traditional FVCs offer relatively more flexibility to target consumers who are willing to settle for lower food standards. This is reflected in significant retail price differences between modern and traditional FVCs.

Nevertheless, the post-harvest and distribution infrastructure requirements of perishable foods are more expensive and more technologically advanced than they are for other food types. Traditional FVC infrastructure is typically lacking in developing countries and may imply higher price variability and limited year-round availability in traditional FVCs, imposing higher distribution costs and high post-harvest losses, as well as less quantity and lower quality.<sup>17</sup> Lack of access to adequate post-harvest processing and distribution

infrastructure may limit the ability of traditional FVCs to contribute to year-round availability of micronutrient-rich foods, resulting in high intermediation costs that may offset, to some extent, the cost advantages in retailing.

#### **Modern food value chains**

These FVCs are largely driven by the expansion of modern retail enterprises in developing countries, primarily in urban areas with a large consumer base. They generally involve domestic and multinational food manufacturers and wholesalers, as well as commercial agribusinesses and farms.<sup>18</sup> In general, modern FVC participants coordinate the supply chain through formal, well-documented contractual arrangements that feature predetermined product standards, volume requirements, and purchase prices.<sup>19</sup> Such tight coordination, together with access to a network of global and domestic suppliers, allows modern FVCs to offer a wide year-round assortment of fresh and processed/packaged food products. These chains also generally benefit from economies of size in the production, marketing, and distribution of shelf-stable packaged/processed foods.

Modern FVCs are changing the dietary landscape in the developing world. Overall, research suggests that modern FVCs help alleviate micronutrient deficiencies by offering a wide assortment of products year round for a diverse diet, but often only for urban households with relatively high incomes.<sup>20</sup> Higher retail prices of foods rich in micronutrients (produce, dairy products, meats) resulting from stricter product standards may limit the ability of lower-income consumers to afford a diet with an adequate micronutrient intake.<sup>21</sup>

A number of studies suggest that the expansion of modern FVCs is

associated with an increased market for processed/packaged foods, with at least two implications for nutrition.<sup>22</sup> First, modern FVCs may be contributing to obesity/overweight malnutrition by expanding the reach of inexpensive, calorie-dense processed/packaged foods, primarily in urban areas. There is evidence that dietary changes in developing countries, along with other factors (e.g., change in lifestyles, reduced manual labour), are associated with the emergent global epidemic of obesity, particularly among younger people.<sup>23</sup> Although there are no studies showing causality between the expansion of processed/packaged food categories and obesity, it is plausible that this is a primary contributing factor driving the increase in the number of overweight and obese people in developing countries. Second, there may be demand substitution effects, such that low-priced packaged/processed foods substitute for fresh produce and livestock products, further worsening nutritional outcomes.

#### Modern-to-traditional food value chains

These FVCs consist of food manufacturers utilizing traditional wholesale and retail networks to market primarily processed/packaged foods. Two key characteristics of these FVCs are that food manufacturers often benefit from economies of scale in production and distribution, and from an increased ability to coordinate the downstream supply chain (as opposed to having to negotiate with large, powerful supermarkets). These two characteristics allow modern-to-traditional FVCs to implement intensive, year-round distribution strategies for processed/packaged foods, targeting lower-income consumers in urban areas as well as consumers who get their food from smaller, remote markets in rural areas.

The market for processed/packaged foods has been growing substantially more quickly in developing countries than in their developed counterparts.<sup>24</sup> Much of this growth is being fuelled by food manufacturers selling products through traditional FVC retailers in urban and rural areas. For example, in India, small independent grocers (*'kirana'* stores) are ubiquitous in urban and rural areas and represented over 53% of processed/packaged food retail sales in that country in 2010.<sup>25</sup> Similarly in Brazil, small corner stores (called *'mercadinhos'*) represented over 21% of processed/packaged food retailing in 2010.<sup>26</sup>

Moreover, processed/packaged foods sold through modern-to-traditional FVCs may help alleviate (and prevent) undernourishment in remote rural areas. These products can be made available to consumers year round at stable prices in remote rural areas, which often experience high food price variability as a result of production seasonality and production risk (e.g., adverse weather during the cropping cycle). The influence of modern-to-traditional FVCs on the nutrition of urban consumers with relatively low incomes appears to be negative because, similar to the case of modern FVCs, the ongoing market expansion of processed/packaged foods through modern-to-traditional FVCs may be associated with excess weight and obesity, mirroring long-established over-nutrition trends in developed countries.<sup>27</sup>

Although expanded sales of processed/packaged foods may be associated with over-nutrition in urban areas, fortification of these foods may provide an avenue for alleviating micronutrient deficiencies with modern-to-traditional FVCs. The World Economic Forum (2009) suggests that innovative public-private partnerships can create incentives to

develop business models targeting micronutrient concerns among the poor. These partnerships are being established at three distinct levels:

1. *Investing in new product development of fortified foods*—for example, nutritious yogurt fortified with essential micronutrients is distributed by Grameen-Ladies at affordable prices to address vitamin A deficiency in Bangladesh and elsewhere in South Asia, where over 8 million children are affected.<sup>28</sup>
2. *Expanding distribution networks for existing fortified foods*—for example, in Mozambique, the National Committee for Food Fortification is a government-food industry partnership aiming at expanding distribution of fortified products such as vegetable oil with vitamin A, and wheat flour with zinc, iron, B-complex vitamins, and folic acid.<sup>20</sup>
3. *Strengthening consumer demand for micronutrient-rich processed/packaged foods*—examples of public-private collaborations expanding education and distribution of fortified foods include a partnership between GAIN and nutrition/supplement companies such as Herbalife.<sup>30</sup>

These private-public partnerships necessarily include the network of traditional FVC retailers and traders because these entities offer the primary point of sales employed by the poor to access food.

Increasing business partnerships between large food manufacturers and traditional retailers is (and will continue) expanding the affordability and availability of processed/packaged foods in developing countries. These products are often rich in calories but poor in important micronutrients.

Modern-to-traditional FVCs may have a mixed influence on nutrition, depending on the population segment targeted. For example, they can assist in efforts to prevent or at least reduce undernourishment in some rural, remote areas, but they can also create problems associated with over-nutrition in urban areas for patrons of traditional FVC retail outlets. There is substantial enthusiasm for public-private partnerships that link food manufacturers to the network of traditional retailers to alleviate micronutrient deficiencies through fortification.

#### Traditional-to-modern food value chains

These chains are characterized by smallholder farmers and traders selling primarily high-value crop and livestock products (e.g., meats, dairy products, fruits, and vegetables) to modern supermarkets and food manufacturers. These FVCs are interesting primarily for their impacts on the nutrition of smallholder farmers and traders, not of end consumers. The impacts come from higher-income opportunities, which may involve selling products to supermarket supply chains directly; or indirectly, through off-farm employment in food production and post-harvest activities. Here we focus on participation in domestic markets because developing-country FVCs are primarily domestically oriented,<sup>31</sup> and also focus on nutritional implications for smallholder farmers and traders in rural areas because most of them are net food buyers.<sup>32</sup>

Farmers who participate in supermarket supply chains enjoy higher income opportunities,<sup>33</sup> even when facing strict product safety and product standards established by supermarkets.<sup>34</sup> Nevertheless, these benefits may reach only farmers with advantageous endowments and education.<sup>35</sup> Furthermore, recent studies

suggest that the poorest farmers and traders may benefit indirectly by linking with modern FVCs through the labour market markets—for example, off-farm employment in commercial agriculture and post-harvest processing.<sup>36</sup> There is evidence of a positive correlation between smallholder farmer and trader participation in traditional-to-modern FVCs and reduction in undernourishment.<sup>37</sup> Most of these benefits appear to occur indirectly, particularly for the poorest farmers, in the form of off-farm employment opportunities in commercial farms and post-harvest businesses.

#### Conclusions

FVCs in developing countries have changed dramatically in recent years, driven primarily by the expansion of modern food manufacturers, wholesalers, and retailers, which coexist and interact with traditional FVC actors. These FVCs are changing in ways that have no precedent in developed countries, where the transition occurred gradually, over a longer period of time. The FVC typology discussed here sheds light on how the relationships among participating business, the types of products offered, and the needs of the consumer targeted are all affecting the triple malnutrition burden (undernourishment, micronutrient deficiencies, and over-nutrition) in the developing world.

Drawing general conclusions about the impact of emerging value chains on nutrition is far from simple. Traditional FVCs, for example, tend to facilitate access to micronutrient-rich foods (e.g., fruits and vegetables) for urban low-income people and most rural residents. Nevertheless, lack of post-harvest and distribution infrastructure may limit the ability of traditional FVCs to assist in

micronutrient deficiency reduction year round, and may result in higher intermediation costs affecting the food prices and demand for low-income consumers. Given that micronutrient deficiencies affect more people today, interventions to boost the efficiency of traditional FVCs can be effective in improving access to micronutrients, particularly among urban and rural poor people. Modern FVCs, for their part, may simultaneously promote over-nutrition and reduce micronutrient deficiencies among urban emerging middle- and high-income individuals. Nevertheless, these effects may be nonexistent for the urban poor and rural residents because these markets are missed by the modern supermarket.

The interactions between traditional and modern FVC participants in developing countries are extremely important, highlighting the need for a more nuanced view of the links between nutrition and food value chains. In particular, intensive processed/packaged food distribution strategies promoted by modern food manufacturers linking to traditional retailers may contribute to over-nutrition in urban areas, but may prevent or reduce undernourishment in remote rural areas. In addition, the distribution networks established in these chains may offer opportunities to form partnerships between governments and private businesses to use food fortification to reduce micronutrient deficiencies targeting specific regions where this malnutrition problem is prevalent. Regarding efforts to link smallholder farmers and traders to the modern sector, the evidence suggests that important nutritional benefits may occur through elevated incomes, and primarily generated by off-farm employment in farm and post-harvest activities—as opposed to direct selling.



Developing-country FVCs will continue evolving with the expansion of the modern sector and the adoption of innovative food distribution and retailing technologies. This ongoing transformation will play a key role in global initiatives to alleviate the triple burden of malnutrition. Future research should shed light on how these FVC transformations can be leveraged by private firms and governments to reduce micronutrient deficiencies, alleviate undernourishment, and control the so-called over-nutrition epidemic. In addition, very little is known about demand substitution effects among process/packaged foods, staples, fruits and vegetables, and livestock products and how consumers respond to changes in the relative prices of these product categories. This should be a priority for future research. Finally, future work examining individual- or household-level consumption patterns over time can illuminate ways that changes in product assortments offered to end consumers affect malnutrition.

## Notes

- 1 Pinstrup-Andersen and Watson, 2011.
- 2 FAO, 2013; Gómez et al., 2013.
- 3 Popkin, 1998, 1999.
- 4 Reardon and Timmer, 2007.
- 5 Gómez et al., 2013.
- 6 Reardon and Timmer, 2007.
- 7 FAO, 2013.
- 8 Barrett and Maxwell, 2005; IEG, 2011.
- 9 FAO, 2013.
- 10 Reardon et al., 2003, 2007, 2009; Regmi and Gehlhar, 2005.
- 11 Gorton, 2011; Reardon et al., 2010; Reddy et al., 2010; Ruben et al., 2007.
- 12 Ruben et al., 2007.
- 13 FAO, 2005; Guarín 2013.
- 14 Gorton, 2011; Reardon et al., 2010; Tschirley et al., 2009.
- 15 Jabbar et al., 2010.

- 16 Guarín, 2013; Jabbar and Admassu, 2010; Minten, 2008; Schipmann and Qaim, 2010; Wanyoike et al., 2010.
  - 17 Gómez et al., 2011.
  - 18 Reardon and Gulati, 2008; Reardon and Timmer, 2007.
  - 19 Reardon and Barrett, 2000.
  - 20 Humphrey, 2005; Reardon et al., 2003; Reardon and Gulati, 2008.
  - 21 Gómez and Ricketts, 2013.
  - 22 Burch and Lawrence, 2007; Hawkes, 2008; Reardon et al., 2012.
  - 23 Caballero, 2007; Garde, 2008; Harris and Graff, 2012.
  - 24 Hawkes et al., 2010.
  - 25 Euromonitor, 2011.
  - 26 Euromonitor, 2011.
  - 27 Mendez et al., 2005; Wang et al., 2002.
  - 28 Singh and West, 2004.
  - 29 CONFAM, 2012.
  - 30 Information about the Global Alliance for Improved Nutrition (GAIN) can be found at [www.gainhealth.org](http://www.gainhealth.org).
  - 31 Gómez et al., 2011.
  - 32 Barrett, 2008.
  - 33 Bellemare, 2012; Miyata et al., 2009.
  - 34 Berdegue et al., 2005; Minten et al., 2008.
  - 35 Michelson 2013; Neven and Reardon, 2009.
  - 37 Gómez et al., 2011; Maertens and Swinnen, 2009.
  - 37 Ndhleve et al., 2012; Smith et al., 2005.
- Caballero, B. 2007. 'The Global Epidemic of Obesity: An Overview'. *Epidemiologic Reviews. Oxford Journals* 29 (1): 1–5.
- Euromonitor. 2011. 'Packaged Food 2011 (Part 1): Global Market Performance and Prospects'. Available through [www.portal.euromonitor.com](http://www.portal.euromonitor.com), accessed 23 May 2012.
- FAO (Food and Agriculture Organization of the United Nations). 2005. *The State of Food and Agriculture*. Rome: FAO.
- . 2013. *The State of Food and Agriculture 2013: Food Systems for Food Security and Better Nutrition*. Rome: FAO.
- Garde, A. 2008. 'Food Advertising and Obesity Prevention: What Role for the European Union?' *Journal of Consumer Policy* 31 (1): 24–44.
- Gómez, M., C. Barrett, L. Buck, H. De Groot, S. Ferris, O. Gao, E. McCullough, D. D. Miller, H. Outhred, A. N. Pell, T. Reardon, M. Retnanestri, R. Ruben, P. Strubei, J. Swinnen, M. A. Touesnard, K. Weinberger, J. D. H. Keatinge, M. B. Milstein, and R. Y. Yang. 2011. 'Food Value Chains, Sustainability Indicators and Poverty Alleviation'. *Science* 332 (6034): 1154–55.
- Gómez, M., C. B. Barrett, T. Raney, P. Pinstrup-Andersen, A. Croppenstedt, J. Meerman, B. Thompson, and B. Carisma. 2013. 'Post-Green Revolution Food Systems and the Triple Burden of Malnutrition'. *Food Policy* 42: 129–38.
- Gómez, M. I. and K.D. Ricketts. 2013. 'Food Value Chain Transformations in Developing Countries: Selected Hypotheses on Nutritional Implications'. *Food Policy* 42: 139–50.
- Gorton, M. 2011. 'Wet Markets, Supermarkets and the "Big Middle" for Food Retailing in Developing Countries: Evidence from Thailand'. *World Development* 39 (9): 1624–37.
- Guarín, A. 2013. 'Domestic Supply Chains: Producers, Wholesalers, and Urban Consumers in Colombia'. *Development Policy Review* 31 (5): 511–30.
- Harris, J. and S. Graff. 2012. 'Protecting Young People from Junk Food Advertising: Implications for Psychological Research for First Amendment'. *Law Journal of Public Health* 2: 214–22.
- Hawkes, C. 2008. 'Dietary Implications of Supermarket Development: A Global Perspective'. *Development Policy Review* 26 (6): 657–92.
- Hawkes, C., C. Blouin, S. Henson, N. Drager, and L. Dube. 2010. *Trade, Food, Diet and Health: Perspectives and Policy Options*. Hoboken NJ, USA: Wiley-Blackwell.
- Humphrey, J. 2005. *Shaping Value Chains for Development Global Value Chains in Agribusiness*. Deutsche Gesellschaft für International Zusammenarbeit (GIZ), Eschborn.

## References

- Barrett, C. 2008. 'Smallholder Market Participation: Concepts and Evidence from Eastern and Southern Africa'. *Food Policy* 33 (4): 299–317.
- Barrett, C. B. and D. G. Maxwell. 2005. *Food Aid after Fifty Years: Recasting Its Role*. London: Routledge.
- Bellemare, M. 2012. 'As You Sow, So Shall You Reap: The Welfare Impacts of Contract Farming'. *World Development* 40 (7): 1418–34.
- Berdegue, J., T. Reardon, F. Balsevich, L. Flores, and R. Hernandez. 2005. 'Supermarket and Small Horticultural Product Farmers in Central America'. In *Global Supply Chains, Standards, and the Poor: How the Globalization of Food Systems and Standards Affects Rural Development and Poverty*, ed. J. F. M. Swinnen. Oxford: CABI. 135–44.
- Burch, D. and G. Lawrence, eds. 2007. *Supermarkets and Agri-Food Supply Chains: Transformations in the Production and Consumption of Foods*. Cheltenham: Edward Elger.

- IEG (Independent Evaluation Group). 2011. *Social Safety Nets: An Evaluation of World Bank Support, 2000–2010*. Washington, DC: Independent Evaluation Group, the World Bank Group.
- Jabbar, M. A. and S. A. Admassu. 2010. 'Assessing Consumer Preferences for Quality and Safety Attributes of Food in the Absence of Official Standards: The Case of Beef, Raw Milk and Local Butter in Ethiopia'. In *Demand for Livestock Products in Developing Countries with a Focus on Quality and Safety Attributes: Evidence from Case Studies. Research Report 24*, eds. M. A. Jabbar, D. Baker, and M. L. Fadiga. Nairobi: ILRI. 38–58.
- Jabbar, M. A., D. Baker, and M. L. Fadiga, eds. 2010. *Demand for Livestock Products in Developing Countries with a Focus on Quality and Safety Attributes: Evidence from Case Studies. Research Report 24*. Nairobi: ILRI.
- Maertens, M. and J. Swinnen. 2009. 'Trade, Standards, and Poverty: Evidence from Senegal'. *World Development* 37 (1): 161–78.
- Mendez, M., C. Monteiro, and B. Popkin. 2005. 'Overweight Exceeds Underweight among Women in Most Developing Countries'. *American Journal of Clinical Nutrition* 81 (3): 714–21.
- Michelson, H. 2013. 'Small Farmers, NGOs, and a Walmart World: Welfare Effects of Supermarkets Operating in Nicaragua'. *American Journal of Agricultural Economics* 95 (3): 628–49.
- Minten, B. 2008. 'The Food Retail Revolution in Poor Countries: Is It Coming or Is It Over?' *Economic Development and Cultural Change* 56 (4): 767–89.
- Miyata, S., N. Minot, and D. Hu. 2009. 'Impact of Contract Farming on Income: Linking Small Farmers, Packers, and Supermarkets in China'. *World Development* 37 (11): 1781–90.
- Ndhleve, S., L. Muserwa, and L. Zhou. 2012. 'Household Food Security in a Coastal Rural Community of South Africa: Status, Causes and Coping Strategies'. *Journal of Agricultural Biotechnology and Sustainable Development* 4 (5): 68–74.
- Neven, D. and T. Reardon. 2009. 'The Rise of Kenyan Supermarkets and Evolution of Their Horticulture Product Procurement Systems: Implications for Agricultural Diversification on Smallholder Market Access Programs'. *Development Policy Review* 22 (6): 669–99.
- Orr, D. 2011. 'Mozambique Aims to Halve Malnutrition by 2020'. World Food Programme Story, 21 March 2011. Available at <http://www.wfp.org/stories/mozambique-takes-action-fight-malnutrition>.
- Pinstrup-Andersen, P. and D. D. Watson II. 2011. *Food Policy for Developing Countries*. Ithaca and London: Cornell University Press.
- Popkin, B. 1998. 'The Nutrition Transition and Its Health Implications in Lower-Income Countries'. *Public Health Nutrition* 1 (1): 5–21.
- . 1999. 'Urbanization, Lifestyle Change, and Nutrition Transition'. *World Development* 27 (11): 1905–16.
- Reardon, T. and C. Barrett. 2000. 'Agroindustrialization, Globalization, and International Development: An Overview of Issues, Patterns, and Determinants'. *Agricultural Economics* 23 (3): 195–205.
- Reardon, T., C. B. Barrett, J. A. Berdegue, and J. F. M. Swinnen. 2009. 'Agrifood Industry Transformation and Small Farmers in Developing Countries'. *World Development* 37 (11): 1717–27.
- Reardon, T. and A. Gulati. 2008. 'The Supermarket Revolution in Developing Countries: Policies for Competitiveness and Inclusiveness'. *IFPRI Policy Brief 2*, June. Washington, DC: International Food Policy Research Institute.
- Reardon, T., S. Henson, and A. Gulati. 2010. 'Links between Supermarkets and Food Prices, Diet Diversity and Food Safety in Developing Countries'. In *Trade, Food, Diet and Health: Perspectives and Policy Options*, eds. C. Hawkes, C. Blouin, S. Henson, N. Drager, and L. Dube. Hoboken NJ, USA: Wiley-Blackwell. 111–30.
- Reardon, T. and P. Timmer. 2007. 'Transformation of Agricultural Output in Developing Countries since 1950: How Has Thinking Changed?' In *Handbook of Agricultural Economics: Agricultural Development: Volume 3, Farmers, Farm Production and Farm Markets*, eds. R. E. Evenson, P. Pengali, and T. P. Schultz. Oxford: Elsevier B.V. 2808–55.
- Reardon, T., C. Timmer, C. Barrett, and J. Berdegue. 2003. 'The Rise of Supermarkets in Africa, Asia, and Latin America'. *American Journal of Agricultural Economics* 85 (5): 1140–46.
- Reardon, T., C. Timmer, and B. Minten. 2012. 'Supermarket Revolution in Asia and Emerging Development Strategies to Include Small Farmers'. *Proceedings of the National Academy of Sciences of the United States of America* 109 (31): 12332–37.
- Reddy, G., M. Murthy, and P. Meena. 2010. 'Value Chains and Retailing of Fresh Vegetables and Fruits, Andhra Pradesh'. *Agricultural Economics Research Review* 23: 435–60.
- Regmi, A. and M. J. Gehlhar. 2005. *New Directions in Global Food Markets*. Washington, DC: U.S. Department of Agriculture.
- Ruben, R., A. van Tilbur, J. Trienekens, and M. van Boekel. 2007. 'Linking Market Integration, Supply Chain Governance, Quality, and Value Added in Tropical Food Chains'. In *Tropical Food Chains: Governance Regimes for Quality Management*, eds. R. Ruben, M. van Boekel, A. van Tilbur, and J. Trienekens. Wageningen Academic Publishers, 13–46.
- Schipmann, C. and M. Qaim. 2010. 'Spillovers from Modern Supply Chains to Traditional Markets: Product Innovation and Adoption by Smallholders'. *Agricultural Economics* 41 (3/4): 361–71.
- Sing, V. and K. West. 2004. 'Vitamin A Deficiency and Xerophthalmia among School-Aged Children in Southeastern Asia'. *European Journal of Clinical Nutrition* 58: 1342–49.
- Smith, L., M. Ruel, and A. Ndiaye. 2005. 'Why Is Child Malnutrition Lower in Urban than in Rural Areas? Evidence from 36 Developing Countries'. *World Development* 33 (8): 1285–1305.
- Tschirley, D., M. Ayieko, M. Hichaambwa, J. Goeb, and W. Loescher. 2009. 'Modernizing Africa's Fresh Produce Supply Chains without Rapid Supermarket Takeover: Towards a Definition of Research and Investment Priorities'. *Conference Proceedings, International Livestock Research Institute (ILRI) Toward Priority Action for Market Development of African Farmers, 13–15 May 2008, Nairobi*.
- Wang, Y., C. A. Monteiro, and B. Popkin. 2002. 'Trends of Obesity and Underweight in Older Children and Adolescents in the United States, Brazil, China, and Russia'. *American Journal of Clinical Nutrition* 75 (6): 971–77.
- Wanyoike, F., S. Kaitibie, S. Kuria, A. Bruntse, I. N. Thendiu, D. M. Mwangi, and A. Omoro. 2010. 'Consumer Preferences and Willingness to Pay for Improved Quality and Safety: The Case of Fresh Camel Milk and Dried Camel Meat (nyir nyir) in Kenya'. In *Demand for Livestock Products in Developing Countries with a Focus on Quality and Safety Attributes: Evidence from Case Studies, Research Report 24*, eds. M. A. Jabbar, D. Baker, and M. L. Fadiga. Nairobi: ILRI. 93–102.
- World Bank. 2013. 'Overview: Safety Nets'. Available at <http://worldbank.org/en/topic/safetynets/overview>.
- World Economic Forum. 2009. *The Next Billions: Business Strategies to Enhance Food Value Chains and Empower the Poor*. Geneva: World Economic Forum. Available at [http://www3.weforum.org/docs/WEF\\_FB\\_FoodValueChainsAndPoor\\_Report\\_2009.pdf](http://www3.weforum.org/docs/WEF_FB_FoodValueChainsAndPoor_Report_2009.pdf).





## Policies and Institutions Fostering Innovation and Agriculture Technologies in Brazil

ROBSON BRAGA DE ANDRADE, National Industry Confederation (CNI), Social Services for the Industry (SESI), and the Brazilian National Service for Industrial Training (SENAI)

GUILHERME AFIF DOMINGOS, Brazilian Micro and Small Business Support Service (Sebrae)

Compared with other developing countries, Brazil has a relatively well-developed innovation system and a favourable scientific infrastructure. It has several universities well placed in the world rankings, a growing role in world knowledge production, and a diversified economic structure.

However, from the point of view of the National Industry Confederation (CNI) and the Brazilian Micro and Small Business Support Service (Sebrae), the country still faces many challenges in fostering science and technology and in creating an environment more suitable for innovation. Perhaps the most successful example in Brazil of how policies and institutions can foster science and innovation oriented towards society's major goals is in the agricultural sector.

This chapter first aims to describe the main characteristics of the Brazilian innovation system and policies. Second, it provides evidence of the growing participation of a different set of agents in the country's innovation system. Finally, it depicts the country's agriculture research system and outlines improvements needed to address new technological challenges in agriculture and food production.

### **Brazil's innovation policies and institutions: The current scenario**

Over the last 15 to 20 years, Brazil has greatly improved the policies that are intended to foster innovation. Indeed,

the country has implemented a series of measures and policies to reinforce its innovation capacity. Among the new policies are research and development (R&D) tax incentives and subsidized credit for innovation, as well as some regulatory measures that ease the university–enterprise relationship. The Brazilian government also substantially increased public R&D expenditures, at least until the recent fiscal crisis in 2014.

Zuniga et al. have systematized the main public policies and instruments that currently exist in Brazil to support innovation (Table 1) as well as the estimated amount of money invested through these instruments in 2012.<sup>1</sup> Some of the funding sources for innovation indicated in the table, such as the mandatory R&D investments from companies in regulated sectors, are not strictly public. These investments are obligations assumed by companies in regulated sectors and are, therefore, private resources.<sup>2</sup>

According to De Negri, all this effort in designing new policies builds a relatively comprehensive picture of innovation policies when it comes to the diversity of instruments. She explains, 'Currently, the country can count on many of the instruments used in most of the developed world to foster innovation, such as: i) subsidized credit; ii) tax incentives; iii) subventions for companies (grants); iv) grants for research projects at universities and research centers, among others'.<sup>3</sup>

Some recent policies deserve special mention because of their role in the country's innovation system, specifically in the agriculture sector. The first relevant attempt to increase funding to foster innovation in the country was the creation of Sectoral Funds. These funds are meant to be defrayed by taxes or contributions levied on certain sectors and to support innovation projects in those sectors. The first of these funds, created in 1999, was the fund for the oil sector, financed by a share of oil and gas royalties.

One of the funds, for agribusiness, was created in 2001; it specifically aims to foster technologies in areas such as agronomy, veterinary medicine, biotechnology, economics, and agricultural sociology. This fund also intends to promote technological updates in the agricultural industry and to stimulate the expansion of investments in tropical agricultural biotechnology and in the diffusion of new technologies. Also created in 2001, the Biotechnology Fund aims to support technologies, research infrastructure, and qualification in the area. Another important sectoral fund for agriculture in Brazil is the Energy Fund, which is particularly concerned with improving energy efficiency and fostering renewable energy, such as biofuels.

The innovation law of 2004, in turn, established the rules of engagement for researchers from public institutions in research projects with

**Table 1: Primary innovation and S&T policies and instruments in Brazil (main sources of funding for S&T), 2012**

|   | Policies and Instruments   | Value (Current Reais) |
|---|--|-----------------------|
| <b>Tax breaks</b>   | Tax incentives for R&D stipulated by Law No. 11,196/2005 (the good law)      | 1,476.8               |
|   | Tax incentives from the Informatics Law (No. 8,248/1991 and No. 10,176/2001) | 4,482.2               |
|   | Other tax incentives for innovation  | 464.0                 |
|   | <b>TOTAL (Tax Incentives)</b>  | <b>6,423.0</b>        |
| <b>Public credit for innovation (disbursements)<sup>a</sup></b> | FINEP  | 1,800.0               |
|   | BNDES  | 2,200.0               |
|   | <b>TOTAL (public credit)</b>   | <b>4,000.0</b>        |
| <b>Public investments in S&amp;T</b>                            | States (excluding post-graduation)   | 7,033.7               |
|   | Federal Government (excluding post-graduation)                               | 18,387.9              |
|   | <b>TOTAL (excluding post-graduation)</b>                                     | <b>25,421.6</b>       |
|   | <b>TOTAL (with post-graduation)</b>  | <b>40,045.0</b>       |
| <b>Mandatory investments in R&amp;D for regulated companies</b> | Electric Sector R&D Program (approximate values)                             | ~ 300.0               |
|   | Oil Sector R&D Program   | 1,226.7               |
|   | <b>TOTAL</b>   | <b>1,526.7</b>        |

Source: Extracted from Zuniga et al., 2016, Table 1, p. 63.

Data sources: ANEEL (Electricity Regulatory Agency database), available at <http://www.aneel.gov.br/?idiomaAtual=1>; ANP, 2013; BNDES, 2013; the Ministry of Science, Technology and Innovation (MCTI) database, available at [www.mcti.gov.br/indicadores](http://www.mcti.gov.br/indicadores); and the Brazilian Innovation Agency (FINEP).

Note: a According to Zuniga et al., the value that expresses the subsidized credit for innovation is the total volume of the credit portfolio for innovation at BNDES and FINEP. In other words, this does not represent the implicit costs of such instruments for the Brazilian government. BNDES = National Bank for Social and Economic Development; FINEP = Brazilian Innovation Agency; S&T = science and technology.

companies, as well as for the commercialization of intellectual property derived from these partnerships. This was a significant improvement in the regulations concerned with the interaction between universities and companies. This law also launched the possibility of public funds being given to companies in the form of a grant for carrying out R&D. Until the promulgation of this law, there had been no such possibility in the Brazilian legal framework.

Finally, the ‘Good Law’ (Lei do Bem) generated several tax incentives for Brazilian companies in 2005. When it comes to innovation, one of the most important of these is the tax incentives for private investments in R&D. Before this law there were two programmes that provided tax breaks to private companies that invested in R&D in both industry and agriculture. Those programmes demanded that, before receiving the incentive,

companies should have their research projects approved by the Ministry of Science and Technology. The bureaucracy involved in this kind of requirement was responsible for this earlier incentive never having been broadly used by Brazilian companies—either in industry or in agriculture. The Good Law, therefore, expanded the comprehensiveness of the tax incentives and facilitated its use for private companies conducting R&D in the country.

From the regulatory point of view, several improvements have been made in Brazilian legislation in the last decades. These begin with the Industrial Property law, approved in 1996, and the cultivars protection law, in 1997. Besides these, a new law on biodiversity made research on Brazilian biodiversity easier. This law entered into force in 2015 and, from this date, research using Brazilian genetic resources, as well

as the development of products based on the country’s biodiversity, do not require prior authorization.

#### The emerging role of CNI and Sebrae

New institutional actors have recently emerged as important players in the Brazilian debate on innovation and technology. CNI business leaders created the Entrepreneurial Mobilization for Innovation (MEI) in 2008. The MEI aims to make innovation a centre of corporate strategies and increase the effectiveness of innovation policies in the country. This initiative recognizes that innovation is essential for competitiveness and, therefore, for the country’s growth and development. Currently, the MEI has around 200 business leaders as members and counts on support from government working in partnership to strengthen innovation in Brazil.<sup>4</sup>

Besides mobilizing Brazilian entrepreneurs, the CNI, by means of the Brazilian National Service for Industrial Training (SENAI), has also created several new technological institutes in the country. The SENAI institutes of innovation were inspired by the German model of the Fraunhofer Institutes, and they aim to increase the productivity and competitiveness of Brazilian industry by developing innovative solutions for companies of all sizes.

Until now, 21 different institutes have been established to conduct applied R&D, providing technological and laboratory support for prototyping and pilot plants, as well as consultancy work to facilitate technology transfer to Brazilian companies. These institutes are spread over 12 different states of the country. For instance, the Institute of Innovation in Biotechnology, in São Paulo, develops innovative solutions for bioengineering focused on areas such as food processing, chemistry, and energy, among others. The Institute for Biomass Innovation, in Três Lagoas in the state of Minas Gerais, offers solutions in biomass processing for sugar and ethanol producers, pulp and paper, biofuels and biodiesel, and the chemical sectors.

Brazil also has an important network of public and private providers of technology extension services for small and medium-sized enterprises. These services include training in technology and managerial skills, in the diffusion of information, and in metrological services.

The most important organization providing these services and supporting micro and small enterprise development in Brazil is the Brazilian Micro and Small Business Support Service (Sebrae), created in 1972 by the Brazilian government. Sebrae became independent, as a private nonprofit organization, in 1990. It

develops its activities in collaboration with the public and private sectors through its National Deliberative Council, which includes government institutions, business organizations, and research institutions.<sup>5</sup> Sebrae offers several solutions in different areas of business organization, among them innovation. Specific programmes to foster innovation have been created.

One of these is SEBRAETEC, a programme that allows small businesses access to technological and innovation support in order to improve processes, products, and services and to introduce innovation in enterprises and markets in the following areas: quality, productivity, intellectual property, sustainability, digital services, and design. Sebrae pays 70% of the company's innovation costs, and the company is responsible for 30%. Some specific examples of services covered by SEBRAETEC in agriculture and food production are:

- genetic selection in the search for yield increase, because this diagnoses genetic problems that affect fertility, diseases, longevity, and quality in milk and animal farming;
- good agricultural practices and HACCP (Hazard Analysis & Critical Control Points) needed to meet the required standards for wholesale markets and export markets for fruits, vegetables, coffee, honey, distilled beverages (cachaça), and agroindustry products;
- laboratory analysis for quality diagnosis and monitoring, such as water quality parameters for fish and shrimp farming, microbial standards for milk and for sugarcane juice (for cachaça production), and soil tests;
- technical assistance for several types of crops; and

- assistance in meeting the country's Technical Norms and Standards.<sup>6</sup>

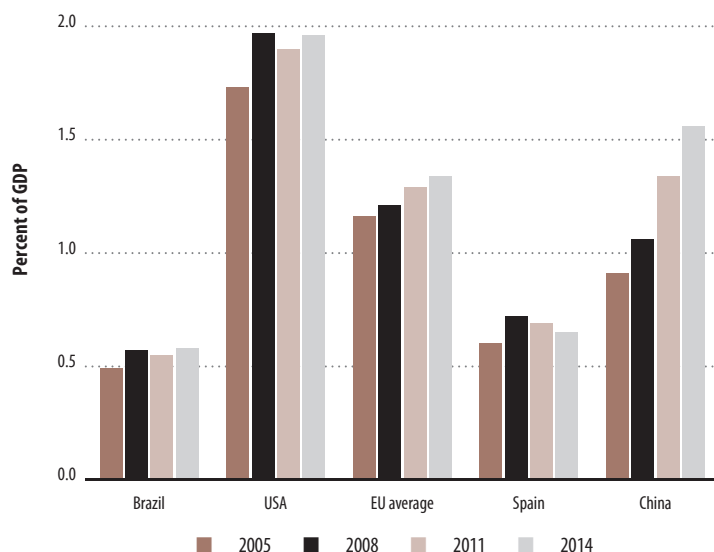
### Outcomes and challenges

In terms of innovation policies and the engagement of society in knowledge production, it is possible to conclude that Brazil has achieved important advances in the last decade. One indication of this broader coverage of the policies appears in the latest Brazilian innovation survey.<sup>7</sup> The survey indicates that the share of innovative companies reporting having received public support to innovate has reached about 40%, compared with around 20% in the early 2000s.

The framework of Brazilian innovation policies is broader than it used to be. When it comes to their effectiveness, the results are not so clear. Different researchers in the country have carried out some studies to evaluate the effectiveness of several of these policies.<sup>8</sup> These evaluations, however, are not regular and systematic and are not frequently used by the government to redesign the policies. To some extent Brazilian innovation policies have been known to inspire good examples around the world, although the policy design should eventually be improved. Some studies also suggest that some of the policies adopted are not crowding out but are instead stimulating private investment in R&D.<sup>9</sup> Tax incentives from The Good Law, for instance, have been evaluated by several researchers.<sup>10</sup> The results from these studies, as well as testimonies from several Brazilian industrial leaders, suggest that the effects of this incentive are relevant for Brazilian industry. However, several other policies need much better evaluation.

Indeed, improving the evaluation of innovation policies in Brazil

**Figure 1: Business R&D investments (BERD) as a share of GDP, Brazil and selected countries (2005, 2008, 2011, and 2014)**



Source: IBGE, 2016; OECD, Innovation in Science, Technology and Industry database, available at <http://www.oecd.org/sti/inno/>, accessed February 2017.

Note: The European Union member states are Austria, Belgium, Bulgaria, Croatia, Cyprus, Czechia, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, and the United Kingdom.

is crucial, especially in terms of data transparency and accountability. The agencies responsible for supporting innovation should be more committed to evaluation and to the creation and disclosure of indicators and data on the policies. The ministries and public agencies responsible should provide incentive for the creation of some key performance indicators to evaluate the policies under their responsibility. Reinforcing transparency and accountability is, in fact, the only way to improve the assessment of the results of innovation policies.

A more in-depth evaluation could help with an understanding, for example, why—despite the creation and consolidation of several public policies for innovation—overall Brazilian performance on several innovation indicators is still lacking

in efficacy. The country's position in the Global Innovation Index (GII) is not improving over the years. On the contrary, in 2011, Brazil held 47th place in the GII rankings; in 2016, the country ranked 69th.<sup>11</sup>

Figure 1 shows business R&D investments (BERD) as a share of GDP. The stability of the Brazil's performance over the years, especially after 2008, is evident. Compared to the performance of most other countries, the country is clearly lagging behind.

Why is this happening? Despite all the efforts that have been made in terms of public policies, why are the aggregate results of the country still weaker than expected? According to De Negri, part of this can be explained by the decrease of industry's share in GDP, since this sector is responsible for a great share of total

R&D investment in the country.<sup>12</sup> There are other relevant constraints, however, that prevent the Brazilian economy from becoming more innovative; these constraints equally affect industry and agriculture.

The first obstacle is a very bureaucratic and rigid business environment. One of the indicators of such an environment is the time necessary for an entrepreneur to start a new business: in Brazil, this is more than 100 days. To answer to the demands of the market and to create new products and processes to meet these demands, agility and flexibility are crucial. It is not by chance that the institutional dimension is where Brazil has the worst GII scores. Even worse, the indicators on this dimension show no improvement over the last few years. That is a serious deficiency for the country, and it is time to address it.

The second relevant factor hindering the country's innovation performance is competition and integration with international markets. To foster competition, it is important for Brazil to build an economy that is more integrated in global value chains and international markets. The country needs to foster internationalization—not only in terms of goods and services, but also in terms of knowledge, ideas, and human capital.

Finally, there is a need for readily effective and focused public policies. In spite of the fact that some policies are relatively well evaluated, the country still has to make them more mission-oriented than before. One of the gaps apparent in the Brazilian innovation system is the lack of interaction between universities and research centres, on one hand, and companies on the other. It is necessary to build instruments able to integrate scientific production, knowledge, and technologies with the greater needs of Brazilian society.

In this regard, the innovation system in Brazil's agriculture sector is a great example to follow.

### **Fostering technologies for agriculture and food production: The challenges ahead**

In addition to improving the business environment and building a more internationalized economy, one of the major challenges for Brazilian innovation policies is their ability to promote, in a more intensive way, a kind of R&D geared to the greater needs of Brazilian society—research that is sometimes called 'mission-oriented R&D'. The agriculture sector in Brazil is one of the best examples of how to support mission-oriented R&D.

Throughout its history, Brazil has established a broad and competitive R&D system focused on the agriculture sector. The National Agricultural Research System (SNPA), established in 1992 by ordinance of the Ministry of Agriculture, Livestock and Food Supply, has been able to develop technological innovations that were critical for agribusiness expansion in the country. From more resistant and productive seed varieties to new cultivation techniques, the technologies developed by the SNPA made it possible to grow soybeans in the Brazilian Cerrado.

The system includes institutions such as the Brazilian Agriculture Research Corporation (Embrapa), the State Agricultural Research Organizations (OEPAS), universities, and federal and state research institutions as well as other organizations related to agriculture research. The Agronomic Institute of Campinas (IAC), for instance, founded in 1887, is one of the oldest research institutions in the country and one of those responsible for developing several agriculture

technologies. The entire system comprises a very diverse set of institutions—each with several different characteristics and roles—that work together to sustain a virtuous process of innovation in agriculture sector.

Embrapa, a public research institution founded in 1973 under the stewardship of the Ministry of Agriculture, Livestock, and Food Supply, plays a leadership role in this system. Currently, the institution counts on a budget of around 3 billion Brazilian reais (R\$) and more than 9,000 employees. It operates through 46 decentralized research units spread out in almost every state in the country. The research portfolio of the agency includes projects such as (1) diagnosing the physical, chemical, and microbiological quality of soils; (2) identifying and mapping weeds resistant to herbicides; (3) using geotechnologies (such as those that map rainfall); and (4) conserving plant growth—promoting microorganisms by working with biological nitrogen fixation and other mechanisms.

Embrapa is also known for its strong use of intellectual property protection and has served as a model for other centres on how to manage technology and technology transfer to other companies and institutions. Embrapa's Technology Transfer Office staff is recognized as a group of well-trained and competent professionals and Embrapa is among the top patent applicants in the country.

One of the main advantages of this system is its proximity and close relation to farmers, which allows it to provide them with the necessary solutions to their problems. It has proved to be very successful in providing Brazilian farmers with new technologies in areas such as genetic engineering, soil improvement and correction, plant and animal breeding, livestock technologies, and so on. However, some researchers are

pointing to the risk that the country will lose technological leadership in several areas in which it has already had a strong influence, falling behind the technological frontier in agriculture. The main challenges in this regard are the human capital and scientific competences in agriculture research. To overcome this risk, Bonacelli et al. suggest an urgent reorientation of policies for agriculture that takes into account new technologies and new scientific competencies.<sup>13</sup>

This reorientation is even more important in face of new trends and challenges in agriculture technologies. Improvements in agricultural productivity and sustainability nowadays depend much more heavily on industrial technologies provided by the agricultural inputs industry than ever before. The *Business Insider Review*,<sup>14</sup> for instance, as well as other technological publications,<sup>15</sup> have listed some of the main emerging agriculture technologies over the next several years.

Sensors are making farms smarter and more connected, which enables real-time traceability as well as the diagnosis of crop and soil conditions, and the monitoring of livestock and farm machinery in real time. Sensors can be useful in several types of situations. Collars with chips and biometrics can identify and monitor vital information about livestock in real time. Crop sensors could prescribe the correct amount of fertilizers to apply to a specific site at a specific point in time, and this information could be sent directly to the application equipment.

Information technology can connect all the machinery and sensors in a farm to provide real-time information and to adopt the measures necessary to solve several kinds of problem. The adequate treatment of the vast amounts of data from crop yields,



soil-mapping, fertilizer applications, weather data, machinery, animal health, and so on can make farms much more efficient than before.

Precision agriculture will enable farming management based on observing all these kinds of data and providing adequate answers. Besides that, ‘further understanding of crop variability, geo-located weather data and precise sensors should allow improved automated decision-making and complementary planting techniques’.<sup>16</sup>

The food processing industry could also benefit greatly from genetic engineering to create ‘new strains of food animals and plants in order to better address biological and physiological needs’.<sup>17</sup> Automation continues to be an important tool for improving agriculture productivity. Nowadays automation also implies using drones, robots, machine learning, and Internet of Things (IoT) technologies.

There are several examples of these technologies that are already developed or in development in Brazil. Embrapa, for instance, has developed the ‘electronic tongue’ (a conductive and lipid-based sensor for the taste evaluation of beverages) and an irrigation sensor that informs the producer about the need for water in the soil. The combination of sensors and information technologies is the focus of a product developed by a start-up company that allows consumers to track the origin of meat. Another Brazilian company is developing solutions for topography, pest detection, and cattle counting using drones.

The fact that most new agriculture technologies are coming from the input industry—including machinery, agriculture chemical, animal genetics, seeds—demonstrates the enormous challenges faced by the agricultural research system, both in

Brazil and in general. Although it has the biggest tropical agriculture industry in the world, until now Brazil has not been able to take advantage of this large-scale production to create a competitive and internationalized input industry. In fact, despite having produced several important technologies for the agriculture sector, there are few internationally competitive Brazilian companies in either the food production chain or in the agricultural input market. Indeed, in the list of the major food-processing companies in the world, there is just one Brazilian company, which is in the meat industry. The Brazilian international presence in the agriculture input industry—such as crop seed/biotech, agricultural chemicals, animal health and breeding, and farm machinery industries—is also not as relevant as it could be given the size of its agriculture sector.

Moreover, increasing global market concentration in the agriculture input industry—as noted by the United States Department of Agriculture (USDA)—implies that fewer firms are now responsible for many of the innovations that result in growth in agriculture productivity.<sup>18</sup>

### Conclusions

For Brazil to play a leading role in the most important technological trends in agriculture today, it is vital that the country place the technologies of industry and services at the service of agriculture. Thus, from the perspective of CNI and Sebrae, some challenges faced by Brazilian agriculture need much more attention from public policies and the agriculture research system. These challenges are related, among others, to determining the best way to:

- intensify the adoption of precision agriculture and zootechnics, genetics, geo-technology, big

data, robots, drones, and artificial intelligence;

- increase the use of sustainable production processes;
- incorporate low-cost technologies, product innovations, and business model innovations into family agriculture; and
- intensify the use of software and mobile applications to support business management in the areas of logistics, farm finance, traceability, weather information, e-commerce, and cooperative organizations’ management.

The challenge presented by these trends is to make it possible for smallholders as well as large farms to access the new technologies so that they too can benefit from the promise of productivity and quality offered by these innovations. Several of these technological trends and challenges also constitute opportunities for small business, especially in the service sector. The implications for the Brazilian innovation system in agriculture are huge. They demand a new vision with policies oriented towards fostering innovation in agriculture to prevent the country from being relegated to only using new technologies instead of also generating them.

It is necessary, for instance, that the government continue to sponsor research to develop and deliver new technologies to Brazilian farms. To address the challenges above, it is also necessary to integrate agriculture needs with industry and services inputs. To provide just one example, the European Union, under the umbrella of the Horizon 2020, is sponsoring projects that look at the feasibility of bringing cost-effective precision farming tools from the laboratory to the farm.<sup>19</sup>



Besides designing more focused innovation policies, it is vital to solve some of other challenges mentioned earlier. Reducing bureaucracy and improving the business environment could be an important boost to the generation of new ideas and the creation of new businesses that could take advantage of the huge size of the Brazilian agriculture market. It is also imperative to look abroad and be connected to the main trends in agriculture research, which implies modernizing and internationalizing Brazilian research institutions and companies.

### Notes

- 1 This table was extracted from Zuniga et al., 2016, p. 63; it is the only known attempt to systematize in a single table all the public policies for innovation in Brazil. Unfortunately, they have not updated the data.
- 2 Zuniga et al., 2016.
- 3 De Negri, 2015, p. 2.
- 4 CNI, 2016.
- 5 Zuniga et al., 2016.
- 6 Brazil's technical norms for food and beverage production are regulated by ANVISA (Agência Nacional de Vigilância Sanitária).
- 7 This survey was conducted by the Instituto Brasileiro de Geografia e Estatística. See IBGE 2016.
- 8 Zuniga et al. (2016) mention a few of these studies. The main institutions producing evaluation studies in Brazil are the Institute for Applied Economic Research (IPEA), the Center for Strategic Studies and Management (CGEE), and some universities such as Unicamp.
- 9 Zuniga et al., 2016.
- 10 Zuniga et al., 2016.
- 11 CNI, 2016.
- 12 De Negri, 2016.
- 13 Bonacelli et al., 2016.
- 14 Zappa, 2014.
- 15 See also Leclerc, 2016.
- 16 Zappa, 2014.
- 17 Zappa, 2014.
- 18 Fuglie et al., 2012.
- 19 For information about the European Union's Horizon 2020 programme, see <https://ec.europa.eu/programmes/horizon2020/>.

### References

- ANP (National Petroleum Agency). 2013. *Statistical Yearbook*. Rio de Janeiro: National Agency of Petroleum, Natural Gas and Biofuels (Brasil). Available at <http://www.anp.gov.br/wwwanp/publicacoes#>.
- BNDES (National Bank for Social and Economic Development). 2013. *Annual Report*. Available at [http://www.bndes.gov.br/SiteBNDES/export/sites/default/bndes\\_en/Galerias/RelAnualEnglish/ra2013/Rel\\_Anual\\_2013\\_ingles.pdf](http://www.bndes.gov.br/SiteBNDES/export/sites/default/bndes_en/Galerias/RelAnualEnglish/ra2013/Rel_Anual_2013_ingles.pdf).
- Bonacelli, M. B. M., M. P. Fuck, and A. C. Castro. 2015. 'O sistema de inovação agrícola: instituições, competências e desafios do contexto brasileiro'. In Buainain, A. M., M.B.M. Bonacelli, e C. I. C. Mendes. *Propriedade Intelectual e Inovações na Agricultura*. Brasília, Rio de Janeiro: CNPq, FAPERJ, INCT/PPED, IdeiaD. (In Portuguese.) Available at <https://drive.google.com/file/d/0BwRGWdFxFUyTT190aEtoTl1Nm8/view>.
- CNI (Confederação Nacional da Indústria). 2016. *Desempenho do Brasil no índice global de inovação 2011–2016*. Brasília: CNI. (In Portuguese.)
- De Negri, F. 2015. 'Innovation in Brazil: Evolving Policies and Practices'. Unpublished working paper. Cambridge: MIT.
- Fuglie, K., P. Heisey, J. King, and D. Schimmelpfennig. 2012. 'Rising Concentration in Agriculture Input Industries Influences New Farm Technologies'. *Amber Waves*, December. USDA. Available at <https://www.ers.usda.gov/amber-waves/2012/december/rising-concentration-in-agricultural-input-industries-influences-new-technologies/>.
- IBGE (Instituto Brasileiro de Geografia e Estatística). 2016. *Pesquisa de Inovação Tecnológica (PINTEC)*. Rio de Janeiro: IBGE.
- Leclerc, R. 2016. 'The Next Phase for Agriculture Technologies'. *Forbes*, 5 July 2016. Available at <https://www.forbes.com/sites/robleclerc/2016/07/05/the-next-phase-for-agriculture-technology/#cefec66b88a>.
- OECD (Organisation for Economic Co-ordination and Development). 2017. *Main Science and Technology Indicators Database*, February 2017. Available at <http://www.oecd.org/science/msti.htm>.
- Zappa, M. 2014. '15 Emerging Agriculture Technologies that Will Change the World'. *Business Insider*, 5 May 2014. Available at <http://www.businessinsider.com/15-emerging-agriculture-technologies-2014-4>.
- Zuniga, P., F. De Negri, M. A. Dutz, D. Pilat, and A. Rauen. 2016. 'Conditions for Innovation in Brazil: A Review of Key Issues and Policy Challenges'. *IPEA Discussion Paper DP 0218*. Available at [http://www.ipea.gov.br/portal/images/stories/PDFs/TDs/ingles/dp\\_218.pdf](http://www.ipea.gov.br/portal/images/stories/PDFs/TDs/ingles/dp_218.pdf).



# Mobilizing Science, Technology, and Innovation to Transform Japanese Agriculture

YUKO HARAYAMA, Council for Science, Technology and Innovation, Cabinet Office of Japan

The agricultural sector in Japan is currently undergoing drastic changes. A comparison of statistical data for the years 1980 to 2016 shows that gross agricultural production decreased from 10.3 trillion yen to 8.8 trillion yen, agricultural land decreased from 5.46 million hectares (ha) to 4.47 million ha, the working population in the agricultural sector decreased from 6.97 million to 1.92 million, and the food self-sufficiency rate decreased from 53% to 39%, indicating a clear contracting tendency for agriculture in Japan. Moreover, the total area of farmland that has been abandoned because small-scale farmers quit or did not have a successor has increased from 123,000 ha to 284,000 ha, and the average age of farmers has greatly increased—reaching 66.8 years old in 2016. As a response to these trends,

there has been an accumulation of agricultural land for specific core farmers,<sup>1</sup> a trend that is expected to continue. Japanese agriculture is thus drastically changing from small-scale farming to large-scale farming with fewer workers. However, complex farmland structures with numerous small independent farms still remain in many places, making the productivity of agriculture in Japan low compared with that of other developed countries.

## Japanese agriculture: The current state and policy objectives

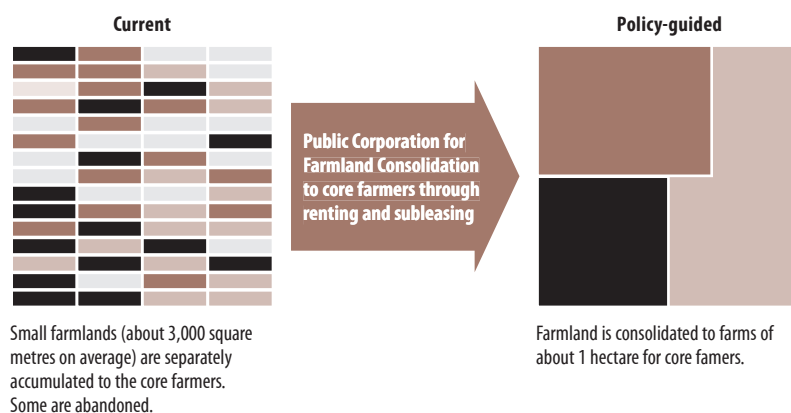
In 2013, the Japanese government initiated the Japan Revitalization Strategy, a new growth strategy to overcome two decades of economic stagnation since 1990. With regard

to agriculture, the government stated that its objective was to make agriculture, forestry, and fishery a growing industry, and it set key performance indicators (KPIs) (Box 1), such as an increase in the ratio of farmland used by business farmers to 80% in the next 10 years (ending in 2023). In order to achieve this objective, the government established a new organization called the Public Corporation for Farmland Consolidation to Core Farmers through Renting and Subleasing in 2014 (Figure 1). This organization rents separated small areas of farmland or uncultivated land from quitting farmers and consolidates small areas, if needed, to provide large-scale farmland for core farmers. In 2015, the farmland area utilized by core farmers increased by 80,000 ha,

### Box 1: Key performance indicators for agriculture in the Japan Revitalization Strategy

- » Increase the ratio of farmland used by business farmers to 80% in the next 10 years (ending in 2023); this was 48.7% as of the end of Fiscal Year 2013.
- » Reduce the cost of rice production by business farmers by 40% in the next 10 years (ending in 2023) over the current national average cost, including through efforts by industry on aspects of materials and distribution. The national average cost of rice production in 2011 was ¥16,001/60 kg.
- » Increase the number of corporate farmers fourfold from the 2010 level to 50,000 in the next 10 years (ending in 2023). In 2010 there were 12,511 farming corporations.
- » Expand the size of the agriculture sector based on the collaboration of primary, secondary, and tertiary sectors of the economy (called the 'sixth industrialization of Agriculture, Forestry and Fisheries') to ¥10 trillion in 2020.
- » With regard to dairy farming, increase the number of projects to promote collaboration among the primary, secondary, and tertiary sectors to 500 by 2020.
- » Increase the value of exports of Agricultural, Forestry and Fishery products and foods to ¥1 trillion before 2020, the initial target year.

Source: Japan Revitalization Strategy, 2013; see [http://www.kantei.go.jp/jp/singi/keizaisaisei/pdf/en\\_saikou\\_jpn\\_hon.pdf](http://www.kantei.go.jp/jp/singi/keizaisaisei/pdf/en_saikou_jpn_hon.pdf).

**Figure 1: Farmland consolidation through public corporation**

Source: Based on MAFF, with permission, available at <http://www.maff.go.jp/j/keiei/koukai/kikou/attach/pdf/index-39.pdf> (in Japanese).

Note: Because the average age of farmers has greatly increased and small-scale farmers have been quitting, the accumulation of farmlands to core farmers is in progress. In many cases, small farmlands are separated and so cannot be used by core farmers, thus inhibiting the improvement of productivity. To solve this problem, public corporations that rent farmland from quitting farmers and sublease to core farmers are established in each prefecture. Under this scheme, farmland owners will be paid by the corporation, and the corporation will consolidate the small farmlands into one large area, which it subleases to core farmers.

indicating that the accumulation of farmlands to the core farmers is progressing properly.

To promote the transition to large-scale farming, Japan's agricultural land law was amended to ease regulations for possession of farmland by a farming company (the new law was implemented on 1 April 2016). Of the four conditions (company style, business style, constituent members or voting rights, and board members) required for companies to own farmland, the last two were eased, allowing farming companies to be scaled up. The new law eases the promotion of investment into farming companies, which is expected to eventually make Japanese business farms larger. This will contribute to reaching another KPI formulated in the Japan Revitalization Strategy: 'Increase the number of corporate farmers fourfold from the 2010 level to 50,000 in the next 10 years (ending in 2023).'

Another KPI in that strategy is a reduction by 40% of the cost of rice production by business farmers in the next 10 years (ending in 2023)

compared with the current national average cost,<sup>2</sup> including through efforts by industry on aspects of materials and distribution. It seems to be difficult to reach this number using only policy tools. Investment in research and technology development is critical in this circumstance.

Since the structure of Japanese agriculture is evolving to large-scale farming, technology that supports this transition is needed. Two main technical problems face this trend in land use-based agriculture. First, automation technology for farm operations is needed to expand the limit of farmland use per person, which is critically important for large-scale farming. Second, the establishment of an efficient farm management system is needed for appropriate farm work plans to enable the management of many separated small-scale farms with multiple crop varieties to spread out harvest timing.

In fact, the Cross-ministerial Strategic Innovation Promotion Program (SIP)<sup>3</sup>—a national program for science, technology, and innovation initiated in 2013 by the

Council for Science, Technology and Innovation—aims to confront the most important societal challenges facing Japan, as well as to contribute to the resurgence of the Japanese economy. The SIP has become a powerful tool to address these challenges. Indeed, the project entitled 'Technologies for Creating Next-Generation Agriculture, Forestry and Fisheries'<sup>4</sup> is among 11 projects selected for the SIP.<sup>5</sup>

One of the main goals of this project is to increase the income of farmers by using innovative technology for smart farming and to enhance the value of agricultural products, working with agricultural policy making to introduce farmland structural reform, and expanding the size of agriculture-related industry (e.g., seedling industry).

The project has identified two major ways to reach these goals:

1. Incorporate robotics, information and communication technologies (ICTs), genome information, and other leading-edge technologies to produce a uniquely Japanese smart, ultra-labour-saving, and highly productive agriculture model.
2. Enhance the value of agricultural, forestry, and fishery products by developing new materials and offering distinct, functional health foods and other products, using techniques from medicine and engineering.

Finally, in 2016 the Japanese government formulated its 5th Science and Technology Basic Plan.<sup>6</sup> In this document, the government proposes the living concept 'Society 5.0', where ICTs, which have recently significantly advanced, will be fully utilized for the benefit of all citizens. Eleven projects in the SIP have been assigned as to explore the concept of Society 5.0, including the project

Technologies for Creating Next-Generation Agriculture, Forestry and Fisheries.

### Research on smart agriculture: An overview

Recently research deploying the Internet of Things (IoT), big data, and artificial intelligence (AI) has been galvanized. In the SIP project Technologies for Creating Next-Generation Agriculture, Forestry and Fisheries, these novel technologies are also integrated into the research activity for developing next-generation technologies that boost the productivity of Japanese agriculture.

To establish a large-scale smart farming system for rice production, automation technology needs to be developed. An efficient farm management system for appropriate farm work plans that enable the management of many separated small farms is also needed to reduce rice production costs. In this SIP project, two types of end users are considered: core farmers with family-style farms (of about 30 ha) and company farmers with larger farms (about 100 ha).

Research is being carried out to develop cultivation techniques based on automatically driven farm equipment, an automated water control system for paddy fields, a farming assistance system based on space assessment information, a precise automated fertilization system with sensing soil fertility for each farm, and a farming plan simulation system that enables efficient farm work in many small separated farms. Research is also being carried out to develop ground-breaking varieties of crops—such as crops with super high productivity, using various techniques such as genome-editing technology—and to enhance the value of agricultural products based on scientific evidence

for health (brain function and body locomotive function, etc.). By developing these technologies, the area of farm land per person is expected to expand from 12 ha to about 24 ha, thus removing factors limiting farm size for core farmers.

These technologies include an automatic driving system for farm equipment that is expected to contribute to the expansion of working farmland per person by using geometric space information generated by precise Global Positioning System (GPS) technology. This will enable work to be done at night as well as performed simultaneously by multiple types of equipment. Automatic driving systems for tractors and unstaffed work system products (with human monitoring) will be put on the market by 2018, when the Quasi-Zenith Satellite System service will become available. Moreover, an unstaffed automatic driving system with remote monitoring that can cross fields is under development and expected to be ready by 2020. Ensuring that safety guidelines are met is an ongoing effort of the Ministry of Agriculture, Forestry and Fisheries. A first-of-its-kind system for working large fields was developed successfully in 2016. Four automatic robot-tractors are used in this system to boost work efficiency. These tractors can work together with location error of less than 4 centimetres. Although tractor systems for large fields in Western countries have adverse effects on plant growth because of the high pressure exerted by tractors on the soil, the Japanese system does not have this problem, and farm work plans can therefore be designed to be flexible by changing the number of tractors being used.

To control water in paddy fields, farmers manually change the water level by using valves. Developing labour-saving technology is therefore

needed. Core farmers have to manage many small areas of farmland that have been abandoned by small-scale farmers. Core farmers plant different varieties of rice to distribute the harvesting timing, resulting in a significant increase in the burden of water management. To address this issue, research is now being conducted to develop an automated remote-controlled water control system. Automated valve-controlling equipment with a water-level sensor and networking equipment for wireless control have so far been developed. Water level-sensing data are stored in a cloud service, and farmers can remotely monitor these data and set the desired water level with a smart phone or tablet. This technology enables a 50% to 90% reduction in labour required for water control, which accounts for about 30% of rice paddy farm work. The technology is therefore expected to contribute to a significant increase in the area of farmland that can be used per person.

Technologies for an automated multi-robot tractor system or automated water control system for paddy fields need farm work plans based on precise farmland information such as specific data on crop growth, climate, water level, temperature, and so on. In the SIP Technologies for Creating Next-Generation Agriculture, Forestry and Fisheries project, technologies for collecting data on crop growth (nitrogen content, chlorophyll content, etc.) and soil fertility from many small separated farmland areas are being developed to maximize appropriate harvest timing and efficient fertilization. Satellites or drones are used to obtain these data. A system that generates maps over an area of 3,000 square kilometres for a crop's protein content or the appropriate harvest timing for rice has been developed. Farmers or farming advisors can obtain information at

any time from this system by using a tablet or smart phone. The information enables quality control of products, and the system has been used for a branding strategy for local rice labels such as ‘Seiten no Hekireki’ in Aomori Prefecture and ‘Tuya Hime’ in Yamagata Prefecture. Research is also being conducted to develop a sensing system that uses a drone equipped with a spectroscopic sensor or thermal imaging sensor and a controlling module. Information about visible light, near-infrared light, or thermal infrared light can be used to estimate nitrogen content, chlorophyll content, photosynthesis activity, and water stress. Based on this information, a diagnostic algorithm for accurately estimating plant growth is now being established.

Information about farmland such as data on plant growth, soil fertility, and climate data obtained by various sensors must be appropriately selected and processed before providing the results to farmers. Therefore a system for managing many farmlands that integrates and processes information from multiple systems and generates a farming plan according to each farmer’s strategy is now being developed. Elements of this system—including technologies such as an automatic driving system, an automated water-control system, and a farming plan simulation system—have been integrated into a single package of technologies and introduced to representative farmers in Chiba Prefecture. This enables the optimization made possible by using multiple technologies that comprise a single system and assessment of integrated technologies from the viewpoint of management. This approach is also effective for obtaining feedback from users, which can lead to practical improvements of the integrated technologies. The newly developed

technologies are expected to be used widely by Japanese rice farmers.

Many types of sensing systems for obtaining climate information on soil fertility, water level, temperature, and so on in paddy fields are connected to the Internet, and numerous data collected by these sensing systems will be accumulated in cyberspace. A data platform will be established and a huge amount of data about paddy fields will be available to everyone. These data can be analysed by AI or other tools, and data obtained every year will be utilized for further advanced cultivation technology.

In the field of horticulture, for example, environmental information—such as information on temperature, humidity, and CO<sub>2</sub> concentration inside a solar-powered plant factory—are collected by sensors connected to the Internet. These data are analysed together with biological data inside the tomato fruit obtained by cyclopaedic analysis of gene expression, metabolites, or other biological data. These integrated data will be utilized for environment control programmes to optimize the cultivating environment for tomatoes and other crops, enabling maximization of crop yield and controlling its quality to meet market requirements that may change on a daily basis. This novel technology will also be used to analyse the know-how of excellent farmers. Their techniques will be digitalized and provided to young farmers who have less experience with cultivation. These novel trials will enable a smooth transition of the cultivation techniques of experienced farmers to young farmers, and this is expected to help the Japanese agriculture industry to be competitive in the international market.

### **The future of crop breeding: Utilizing genome-editing technology**

Recently, in addition to traditional breeding techniques, genome-editing technology that assists in making precise and targeted changes to the genome of living cells has been greatly advanced (the most significant of these techniques is the CRISPR/Cas9).<sup>7</sup> This is expected to be a driving force for the development of ground-breaking crop varieties that cannot be achieved by traditional breeding techniques, and is predicted to accelerate the development of new varieties with high capacity.

In the SIP’s Technologies for Creating Next-Generation Agriculture, Forestry and Fisheries, studies with mutagenesis induced by heavy ion beams or other mutagens have been carried out to elucidate specific genomic loci that are responsible for production traits and to apply them for developing new ground-breaking varieties. The SIP project has already obtained null-segregant rice plants in which genes responsible for grain size or number have been edited. These plants can contribute to the ground-breaking variety with super high yield.

In the near future, the isolation and characterization of useful genes that are responsible for the translocation of nutrient compositions will enable the development of more productive varieties with greater yield. In tomatoes, genes responsible for gamma-amino butyric acid (GABA) content and parthenocarpy or other traits are now being edited to create varieties that are free from the need for artificial pollination or have a high GABA content in order to reduce the farmer’s hormone processing cost (for pollinating the plants) or to enhance the value of the products. Other major crops such as wheat, soybeans, potatoes, and so on have also been investigated as possible candidates for



optimizing genome-editing conditions or creating ground-breaking varieties.

Because the CRISPR/Cas9-based technology and other existing genome-editing technology, such as TALEN-based technology, have already been patented mainly by universities in the United States of America and Germany, research is also being conducted to develop Japanese genome-editing technology. Technology that induces point mutations in the targeted genes, such as target-AID (activation-induced cytidine deaminase),<sup>8</sup> as well as technology utilizing a pentatricopeptide repeat (PPR) motif,<sup>9</sup> which can be designed to bind any specific DNA/RNA site, are under development. These technologies are also being examined for creating ground-breaking crop varieties, and they constitute an integral part of the SIP project. Internationally competitive crop varieties and agricultural products based on these technologies will be developed in the near future and will contribute to an increase in exports of Japanese agricultural products.

Living modified organisms (LMOs) are regulated by multiple laws in Japan, but primarily by the law on biosafety—the Law Concerning the Conservation and Sustainable Use of Biological Diversity through Regulations on the Use of Living Modified Organisms—which has been enacted to ‘ensure the precise and smooth implementation of the Cartagena Protocol on Biosafety to the Convention on Biological Diversity’. In this Law, ‘LMO’ is defined as ‘an organism that possesses nucleic acid, or a replicated product thereof, obtained through technologies for the processing of nucleic acid extracellularly or technologies for fusing of the cells of organisms belonging to different taxonomical families’.<sup>10</sup> Genome-editing technology can

edit intended specific genomic sites without external nucleic acid or trace marks. Therefore there is no consistent decision as to whether genome-edited crops are subject to regulation or not. Considering this situation, research is also being conducted to develop a method to prove that the genome-edited crops do not possess extracellularly processed nucleic acid; methods for promoting consumer acceptance based on benefits are also being considered. Thus there is cooperation between administrative work and technology aiming at public acceptance of genome-edited agricultural products.

### Conclusions

In the SIP project Technologies for Creating Next-Generation Agriculture, Forestry and Fisheries, research on smart agriculture—especially research concerning rice production and the development of ground-breaking varieties—are ongoing towards the KPIs stated in the Japan Revitalization Strategy. By combining novel varieties that respond to consumers’ needs with next-generation cultivation technology that utilizes ICTs and other cutting-edge technologies, the productivity of Japanese agriculture is expected to be greatly enhanced. These state-of-art technologies could also be introduced to developing countries, and are expected to contribute to tackling the global food supply problem in the future.

### Notes

- 1 ‘Core farmer’ is defined in Japanese agriculture policy as an ‘efficient and stable farming management body such that the main workers’ lifetime income and labor time are at a level similar to that of workers in other industries’.
- 2 The average cost of rice production in 2011 was 16,001 yen per 60 kilograms.

- 3 See [http://www8.cao.go.jp/cstp/panhu/sip\\_english/sip\\_en.html](http://www8.cao.go.jp/cstp/panhu/sip_english/sip_en.html).
- 4 For more information about the Technologies for Creating Next-Generation Agriculture, Forestry and Fisheries project, see [http://www8.cao.go.jp/cstp/panhu/sip\\_english/42-45.pdf](http://www8.cao.go.jp/cstp/panhu/sip_english/42-45.pdf).
- 5 The 2016 budget for the SIP Technologies for Creating Next-Generation Agriculture, Forestry and Fisheries was 2.925 billion yen. Other SIP projects and their budgets (billion yen) in 2016 are as follows:
  - Innovative Combustion Technology: 1.9
  - Next-Generation Power Electronics: 2.41
  - Structural Materials for Innovation: 3.758
  - Energy Carriers: 3.49
  - Next-Generation Technology for Ocean Resources Exploration: 4.66
  - Automated Driving System: 2.713
  - Infrastructure Maintenance, Renovation, and Management: 3.156
  - Enhancement of Societal Resiliency against Natural Disasters: 2.33
  - Innovative Design/Manufacturing Technologies: 2.19
  - Cyber-Security for Critical Infrastructure: 2.5
- 6 See <http://www8.cao.go.jp/cstp/english/basic/5thbasicplan.pdf>.
- 7 This technique uses RNA-guided endonucleases known as Cas9 from the microbial adaptive immune system named CRISPR (clustered regularly interspaced short palindromic repeats), which can target any genomic loci specified by short guide-RNA. See Hue et al., 2014, for more details.
- 8 Nishida et al., 2016.
- 9 Yagi et al., 2015 and Yagi et al., 2014.
- 10 See [https://www.env.go.jp/en/laws/nature/law\\_ccsubdlrmo.pdf](https://www.env.go.jp/en/laws/nature/law_ccsubdlrmo.pdf).

### References

- Government of Japan. 2013. *Japan Revitalization Strategy: Japan Is Back*. Provisional report. Available at [http://www.kantei.go.jp/jp/singi/keizaisaisei/pdf/en\\_saikou\\_jpn\\_hon.pdf](http://www.kantei.go.jp/jp/singi/keizaisaisei/pdf/en_saikou_jpn_hon.pdf)
- Hsu, P. D., E. S. Lander, and F. Zhang. 2014. ‘Development and Applications of CRISPR-Cas9 for Genome Engineering’. *Cell* 157 (6): 1262–78.
- Nishida, K., T. Arazoe, N. Yachio, S. Banno, M. Kakimoto, M. Tabata, M. Mochizuki, A. Miyabe, M. Araki, K. Y. Hara, Z. Shimatani, and A. Kondo. 2016. ‘Targeted Nucleotide Editing Using Hybrid Prokaryotic and Vertebrate Adaptive Immune Systems’. *Science*, Epub 4 August. doi:10.1126/science.aaf8729.



Yagi Y, T. Nakamura, and I. Small. 2014. The potential for manipulating RNA with pentatricopeptide repeat proteins. *The Plant Journal* (2014) 78, 772–782.

Yagi, Y., M. Shirakawa, and T. Nakamura. 2015. 'The Challenges Faced by EditForce Inc. to Go Beyond Genome Editing'. *Nature*, Sponsor feature, 2015.12.

## Technological Future of the Agriculture and Food Sector in Russia

LEONID GOKHBERG and ILYA KUZMINOV, National Research University Higher School of Economics, Russia

The global agriculture and food sector is changing rapidly because of the intensive increase of global food demand, which is in turn the result of population growth and significant shifts in consumer preferences. There is a clear need for improvement in the sector's technological, infrastructural, and institutional basis to ensure its sustainable development.

The situation is further aggravated by a number of environmental issues, including the degradation of ecosystems, biodiversity loss, and the deterioration of soil and sea productivity. Climate change leads to growing pressures on the agricultural productive areas and on the world's oceans. In the long term, there are significant risks of fertilizer deficits due to depletion of mineral deposits. Furthermore, declining pesticide efficiency due to the inability of agrichemical science to keep up with the pace of pests' evolution is an unfolding trend with serious implications. This creates risks for the globalization of agri-food trade, and it leads to a resurrection of 'food nationalisms' and intensifying economic vulnerabilities associated with the globalized trade.<sup>1</sup>

Unfortunately, the new wave of technological advances (such as biotechnology, artificial ecosystems, circular agriculture, precision agriculture, robotics, smart logistics, and landless food production through the direct chemical synthesis of nutrients) rolls out rather slowly in many parts of the world. This is the result of a shortage of investment, political/societal/religious hostility to radical technologies, and inadequate labour force competences. Less expensive, yet highly effective, technological innovations and entirely new mechanisms for their promotion are required. The latter include the redesign of existing government policies related to science and technology (S&T), innovation, entrepreneurship, industrial organization, competition, and investment.

Having abundant land resources and significant industrial, S&T, and educational capacities, the Russian Federation (Russia) will, most probably, play an important role in combating the global challenges outlined above. To achieve this, however, the country will need to continue its reforms of the agriculture and food sector so that it becomes able to generate and absorb

technological and organizational innovations more efficiently.

### Implications of global challenges

In today's deeply internationalized economy, global challenges are important elements of the strategic agendas of national agriculture and food sectors, although some national priorities are determined solely by domestic factors. The global challenges affecting the agriculture and food sector could be categorized, rather generally, into environmental, social, economic, political, and axiological (related to the values foundations of societies).<sup>2</sup> However, most of the challenges and trends, in terms of their causation, are mixed by nature.

First of all, a growing discrepancy between the dynamics of food demand and supply makes the future of agriculture rather difficult to predict. Rates of agricultural productivity growth are declining because there is now a 'technology pause' between the 'green revolution' and the emergence of future production systems, which promise to be highly efficient, agile, autonomous, and isolated from the natural environment.<sup>3</sup>

The authors acknowledge the technical assistance provided by Elena Tochilina and Irina Loginova, who greatly helped in preparing this chapter.

The chapter was prepared within the framework of the project 'Study of Global Technology Trends: Development of Quantitative Approaches for Trend Analysis' of the Basic Research Program at the National Research University Higher School of Economics (HSE) and supported within the framework of a subsidy by the Russian Academic Excellence Project '5-100'.

The interlinked environmental challenges—which affect (and are partially produced by) the agriculture and food sector and threaten the stability of the world’s food supply—further aggravate the global food problem. As mentioned earlier, they include climate change, soil degradation, decreasing bio-productivity of the oceans, biodiversity loss, groundwater scarcity and contamination, reduction of the effectiveness of agrochemicals due to evolution of pests,<sup>4</sup> and the long-term threat of exhaustion of mineral resources for fertilizers, among others. Therefore the trend of declining productivity growth rates can even evolve into declining overall production with dire consequences for the food security of developing nations.

There are also a number of socio-economic and values-based challenges. Among them are economic globalization and the volatility of global food markets affected by new, non-food uses of agricultural products, such as biofuels; the growing polarization of food consumption patterns as a result of income, cultural, and educational gaps; the transformation of the demand for labour in agriculture, which threatens the sustainability of the rural lifestyles; growing biosafety threats against the backdrop of the rise of ‘garage biotechnology’, or amateur biotech endeavours; risks to arranging guaranteed continuity of food supply for megacities and broader urban agglomerations; and many others.

The answers provided by S&T and innovation to the global challenges are expressed in terms of the rise of new platform (universal, or convergent) technologies.<sup>5</sup> The developed nations demonstrate the rapid progress of radically new technologies (new generation sequencing, bioreactor-based synthetic food

production,<sup>6</sup> total recycling, biocontrolled and artificial agroecosystems, vertical farms, swarm robotic intelligence, etc.),<sup>7</sup> while the developing ones are still engaged in the adoption of the technologies of the previous wave (genetically modified crops, drip irrigation, and so on).

S&T and innovation processes are enabled by accompanying new business models made possible by modern information and communication technologies, which dramatically reduce both food losses and transaction costs in agriculture and food logistics. The diffusion of convergent technologies—including combinations of high-performance computation, broadband networking, and near-real-time data flows from satellites and aerial vehicles—seems to be one of the most important drivers of these organizational innovations.<sup>8</sup>

In parallel, technology development creates certain threats of large-scale disruptions for developing countries. These could be beneficial in the long term and on the global scale, but are harmful to short-term economic stability and food security at the national level. There are numerous ‘wild cards’ (or ‘black swans’) of this sort that refer to structural shifts with low probability but high impact for the agriculture and food sector.<sup>9</sup> The diffusion of genetically modified organisms (GMOs) in global crop production and aquaculture could make exports of the non-GMO countries uncompetitive and damage their trade balance. Shifts in the natural habitats imposed by climate change can cause unexpected zoonotic events, which are negative for the animal husbandry sector. Synthetic food technology commercialization can radically shift the demand-supply balance for factors of production, such as agricultural land, resulting in financial turmoil in some countries.

It is particularly important to distinguish the opportunities and threats on the national level that are emerging from global challenges. Because of Russia’s circumstances and location, the global food problem, climate change, and the development of radical technologies tend to affect the country differently than the rest of the world, at least in the short term. Russia comes out ahead in this regard mainly because less technologically advanced and less industrially and institutionally developed countries often lose from global innovation in the short run, when they lose rents associated with inexpensive exports.

The global food problem is constituted of the global demand for food rising above limits of sustainable supply.<sup>10</sup> It poses tremendous challenges to sustainable development, creating the risk of extreme famine events in Africa and South East Asia.<sup>11</sup> For Russia, with its vast land and water resources, the rising global demand for food provides a chance to establish itself in new international agriculture and food markets in circumstances when the markets of developed nations, being divided between producers from the United States of America, the European Union, Brazil, Canada, and Australia, are virtually closed for the country’s exporters.

Climate change, being disastrous for most subtropical and tropical agriculture and food producers because of higher frequencies of droughts, tsunamis, floods, and other extreme weather conditions, affects mostly non-agricultural areas of Russia, such as its Arctic regions. The impact of climate change on the main agricultural regions in chernozom (fertile black soil) and grey wood soil zones is mild and mixed, though the scientific consensus on the long-term net effects for Russia’s agriculture has not yet been reached.<sup>12</sup>

Diffusion of many promising technologies, such as genetically modified crops associated with much lower production costs, presents both opportunities and threats for the Russian agriculture and food sector—which is an established grain and oil seed exporter with a very conservative political stance towards GMOs. Recent progress in aquaculture (including recirculating aquaculture systems and plant-based fish feed) promise substitution of traditional, inefficient, and environmentally harmful sea fishing practices. In Russia, aquaculture technologies are quite underdeveloped, although its fisheries sector is one of the largest in the world. This situation creates economic threats to sectoral businesses in the northern and far eastern regions of the country.

In general, the described pattern is caused by excessive reliance on extensive production factors as a result of quite favourable natural prerequisites and insufficient attention to longer-term competitiveness factors related to progress in technology.

The Russian agriculture and food sector is sensitive to the situation in global markets of both the means of production (machinery, biomaterials, etc.) and the final products (grain, milk, meat, etc.). The capacity to both absorb foreign and domestic knowledge and to produce domestic innovations will be crucial to successfully facing the global challenges. Intensive investment and new initiatives in this field are needed for the agriculture and food sector to become more resilient. It must have less reliance on imported technologies, genetic material, veterinary drugs, fine biochemical and chemical substances, and less dependence on exports of agricultural raw materials rather than food products with high added value.

### **The status of the Russian agriculture and food sector**

Russia is one of the world's largest producers of food products (e.g., grain, oil seed, and meat). Its output reached US\$80 billion in 2015, with exports of US\$16.2 billion. This sector has shown remarkable stability during the economic turbulence of recent years. Although the national economy has experienced some stagnation effects since 2014, the agriculture and food sector demonstrated steady growth rates of 2% to 3% per year, and the share of loss-making agricultural companies has continued to shrink, becoming significantly lower than that in many other sectors of the economy. Nowadays this sector is an important pillar of political stability on the national level, which is highly dependent on the wide availability of affordable food of good quality. Russia is almost self-sufficient in food: from 81% to 100% of internal demand for food (depending on the product category) was covered by domestic production in 2015. The agriculture and food sector is crucial for social welfare in the rural areas because it employs around 9 million people. It is anticipated that growth rates of production and exports could accelerate further because of the growing demand in developing countries of Africa and Asia for the food products that Russia produces.

Although the country has inherited a rather unbalanced and rigid agriculture and food sector from the Soviet era, post-Soviet institutional reforms allowed for the efficient reallocation of resources based on market competition and the adoption of state-of-the-art technological innovations. The optimization of supply chains was coupled with the concentration of production in the areas that were most favourable in terms of both their soil and climate conditions and their location. All

these factors allowed Russia to move from the brink of famine in the late 1980s to solid food security in the 2010s, and to significantly increase agriculture and food exports.

At the same time, the overall productivity of the sector remains relatively insufficient because of the uneven penetration of new technologies and the slow diffusion of the new wave of organizational innovations, such as digitization of trading and logistics, equipment time sharing, life-long learning, and so on. These factors underpin the slow progress of production intensification across certain regions, sub-sectors, and particular types of producers.

Other challenges include low demand for innovations produced by the domestic applied agricultural research and development (R&D), as well as weak communication between the sectors of education, S&T, and agricultural business. The latter does not demonstrate substantial demand for domestic R&D and technology, while research institutes and universities have been generally unable to provide a continuous supply of ready-to-use and commercially attractive technologies (they are more and more inclined towards research that is supported by public funding but that has no specific objective or orientation).<sup>13</sup> Thus the positive effects of weak national currency for production and exports growth have been countered because a quick import substitution of significant part of technologies, equipment, chemicals, and genetic materials is not feasible. The challenge for domestic manufacturing of high-tech agriculture inputs, such as equipment, genetics, advanced fertilizers, and specialized information systems, is even more difficult to solve because of other barriers, such as economies of scale.

Of great importance is the sector-wide application of enabling

**Figure 1: Propensity to introduce new technologies by economic entities of different types in Russia's agriculture sector**

| Technology to be introduced                    | Private farm holdings<br>(self-sufficient farms) | Owner-operated farms/<br>individual enterprises<br>(semi-commercial farming) | Medium agricultural enterprises,<br>agricultural cooperatives<br>(commercial farming) | Major agricultural holdings<br>(commercial, export-<br>oriented farming) |
|--|--|--|---|--|
| Organic agriculture                            | Low  | Low  | Medium  | High   |
| Precision agriculture                          | Low  | Low  | Medium  | High   |
| Large-scale 'assembly-line' livestock breeding | Low  | Low  | Medium  | High   |
| Zero-tillage farming                           | Low  | Low  | Medium  | High   |
| Loose housing of livestock                     | Low  | Low  | Medium  | High   |
| Drip irrigation                                | Low  | Low  | Medium  | High   |
| Custom on-demand preparation of fertilizers    | Low  | Low  | Medium  | High   |
| Integrated pest management                     | Low  | Low  | Medium  | High   |
| Urban agriculture (vertical farming)           | Low  | Low  | Medium  | High   |
| Automation and computerization                 | Low  | Low  | Medium  | High   |
| Genetically modified and hybrid seed use       | Low  | Low  | Medium  | High   |
| Biofuels                                       | Low  | Low  | Medium  | High   |

Source: HSE, 2017a.

Note: Likelihood of technology introduction: ■ High ■ Medium ■ Low.

technologies such as broadband digital communications,<sup>14</sup> the Internet of Things, global geopositioning and other satellite services, unmanned aerial monitoring, smart digital trade infrastructures, robotics, biotechnology and bioenergy, and nanotechnology and new materials. However, efficient production systems based on the state-of-the-art technologies are concentrated within a limited range of large companies, mostly in the southern regions and around the largest urban agglomerations, while small producers in other areas are not able to absorb available technology innovations (Figure 1).

An answer to such challenges can be found in the re-arrangement of the sectoral innovation system, which is notable for its poor linkages between S&T organizations and businesses. Bridging the gap between academia and industry may allow Russia to become one of the major exporters of globally competitive high-quality agricultural products, production means, and services within two decades. There is also a need for closer technological cooperation and market integration with

other emerging economies, because this could allow Russia to gain access to large export markets for various means of agricultural production. No less important are further efforts to improve the domestic investment climate to attract direct investment from developed countries with gradual localization of high-tech products and technologies.

#### Prospects of S&T development

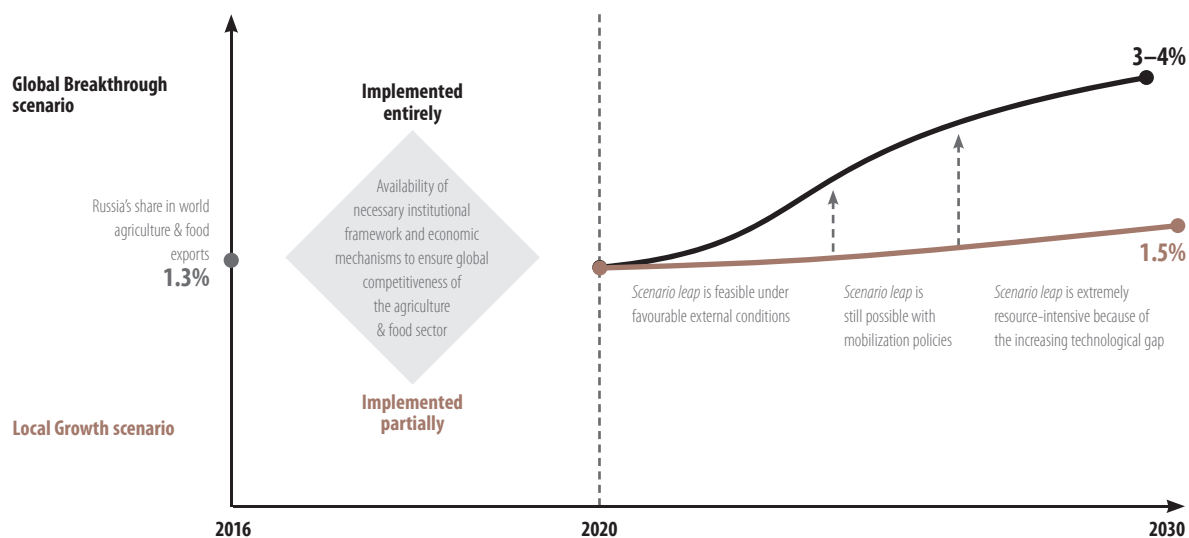
A complex picture of global challenges creates both threats and opportunities for Russia's agriculture and food sector. Whether Russian regulators, S&T organizations, and agriculture and food producers will be able to proactively adapt to threats and efficiently use evolving opportunities depends on the ability of different actors to clearly identify emerging global trends, map existing strengths and weaknesses, be agile in adapting the developmental strategies, and cooperate efficiently on a wide range of issues.

For the agriculture and food sector's stakeholders to become more able to participate in cooperative

future-oriented capacity building, the Government of the Russian Federation set the task of developing long-term S&T foresight of the agriculture and food sector in 2015. Depending on the future evolution of various global and national trends; the composition of existing strengths, weaknesses, opportunities, and threats; and the most likely policy choices made at key threshold points—macroeconomic, institutional, and political ones—two possible development scenarios can be considered for the period from 2020 to 2030.<sup>15</sup>

Russia can become a global supplier of high-value-added products, technologies, and services. This is the goal of the 'Global Breakthrough' scenario. Another option is less ambitious and easier to achieve, yet also desirable: this entails saturating the domestic market with competitive domestic products and technologies—the 'Local Growth' scenario. Both trajectories are possible and may start at the same point in time from identical external conditions. The difference between the higher and the lower trajectories is determined

Figure 2: S&T development scenarios for the Russian agriculture and food sector



Source: HSE, 2017a.

by the quality of the institutional framework and economic mechanisms by the year 2020; the gap between these trajectories will grow over time, making the leap from the less favourable scenario to the more ambitious one more and more resource-intensive (Figure 2).

In the Local Growth scenario, increasing commodity prices and devaluation-driven import substitution would stabilize the economy and allow it to return to a model of intensive imports of advanced technologies, equipment, and materials and large-scale exports of agriculture and food products. By 2020, the annual growth rate of the agriculture and food sector output would achieve 3% to 4% because of expansionary monetary and fiscal policies to help improve the investment climate. There would be a steady positive growth in the amount and quality of the harvest of most agricultural crops. In the food industry, a steady increase of output is expected. There would be a decrease in the growth rates of animal farming, which is affected by both the saturation of the internal market and the existing barriers to

export expansion. No significant structural changes in the sector and no intensive revitalization of national agricultural applied R&D based on cooperation with business would be expected (the level of non-public funding of agricultural R&D in this scenario could grow slightly from the current 17% to about 20%).<sup>16</sup> Slow import substitution of basic and traditional technologies would continue, while dependence on state-of-the-art solutions would persist. The points of growth under this scenario would be traditional commodities markets, which would not require adaptations to shifts in consumer preferences.

In the Global Breakthrough scenario, the strong growth of the agriculture and food sector would be supported by reformed S&T and innovation policies, a sound institutional environment, and an efficient innovation infrastructure and would go hand in hand with timely structural changes in production chains. Because more efficient business models and new technologies would enable highly competitive production, no export barriers would hinder the expansion of the sector. Natural

resources (vast fertile lands, available water resources) and cheap yet high-quality domestically produced fertilizers would be utilized in full. The growth of the agriculture and food sector would be accelerated by 1 to 2 percentage points in relation to the Local Growth scenario. Significant structural shifts would be envisaged for S&T and innovation activities, particularly those that take place on the basis of effective stimuli for academy-industry cooperation. The share of non-public funding of agricultural R&D could reach 35% to 45%. Accelerated replacement of obsolete production facilities, tax incentives, and other benefits aimed at promoting high-tech import substitution could lead to an intensification of innovation activity. Increased competition due to saturation of the domestic market could also contribute to growth in innovation.

In addition to traditional markets, domestic producers would be able to occupy various highly profitable niches in knowledge-based services for the agriculture and food sector; among these are cutting-edge solutions in biotechnology, information



**Table 1: Prospective S&T development areas for the agriculture and food sector**

| Traditional technologies  | Emerging technologies  |
|---|--|
| <ul style="list-style-type: none"> <li>Accelerated selection, seed growing, and animal breeding technologies</li> <li>Traditional genetic engineering of agricultural plants and animals</li> <li>Vaccines, antibiotics, and antiviral drugs for animal farming</li> <li>Integrated pest management techniques and bio-pesticides</li> <li>Equipment for biosafety control throughout the value chain</li> <li>Technologies of compound, slow-release, and customized fertilizers</li> <li>Basic precision agriculture technologies (geopositioning, navigation, and digital maps)</li> <li>General-purpose agricultural machine-building technologies</li> <li>Technologies for the deep processing of agricultural and fishery materials<sup>a</sup></li> <li>Basic biotechnologies of food processing</li> </ul> | <ul style="list-style-type: none"> <li>Next-generation sequencing and other advanced biotechnologies</li> <li>Technologies for sustainable, circular, and organic agriculture</li> <li>Advanced precision agriculture technologies (unmanned aerial vehicles, sensor networks, swarm robotics, artificial intelligence)</li> <li>Equipment for urban agriculture (recirculating aquaculture, vertical farms)</li> <li>Advanced waste utilization technologies, including next-generation bioenergy</li> <li>Smart agro-logistics, robotic storage, and transportation systems</li> <li>Technologies for the production of highly personalized and functional food</li> <li>Technologies for the production of synthetic and tissue-engineered foods</li> </ul> |

Source: HSE, 2017a.

Note: a 'Deep processing' refers to the production of high-value-added products with the use of sophisticated technologies—such as producing not only flour from grain, but also extracting amino acids from grain for the purposes of biotech industry; or producing pharmaceuticals from fish-based raw materials.

and communication technologies, robotics, aerospace, remediation of natural environment, and ecosystems design (Table 1). These would allow the sector to diversify overall output and secure export revenues. Technology-supported gradual transition from cycle-vulnerable business models of bulk commodities production to those based on the creation and export of intellectual property and tacit knowledge in various forms would also contribute to the sustainable growth of the sector.

### Conclusions

The Russian agriculture and food sector may be defined as stable for the time being because of the strong institutional reforms that have been implemented during the last 25 years. Post-Soviet Russia has managed to establish an effective production-distribution system in agriculture,

thus deflecting the risks of acute food shortages and achieving food security. However, the current productivity level in agriculture is not yet satisfactory. Undoubtedly there is still room for improvement in the institutional design of the sector to resolve such negative issues as regional and sub-sectoral monopolies, administrative pressures on local businesses, high transaction costs due to deficiencies of the commodities exchange infrastructure, and so on. In addition, a number of problems concerning both the adoption of imported technologies and the development of domestic ones that would be competitive on the market need to be addressed.

Therefore the current main goal is to shift the agriculture and food sector from a sustainable production system to a sustainable innovation system. For this purpose, it is necessary to revive the sector's applied agricultural R&D capacity, making

agricultural R&D activities financially sustainable. Reforms aimed at the revival of applied agricultural R&D can be implemented only by promoting close cooperation between agricultural science and business under a suitable institutional framework. Fostering the ability of the agriculture and food sector to create new knowledge and technologies and promote them to competitive markets is a necessary condition for achieving the developmental parameters of the Global Breakthrough scenario. To this end, S&T and innovation policy for the agriculture and food sector in Russia must, within several years, evolve towards an evidence-based paradigm designed to encourage intensive development, resource efficiency, and environmentally sound practices; provide targeted support for innovating companies; and suppress the opportunities of benefiting from non-innovative rents (such as land ownership) at the cost of other market actors and consumers.

The scenarios described above will assist policy makers in establishing relevant measures for the uptake of technologies by national agriculture and food producers. Development of national S&T capacities will depend on proper institutional solutions and economic mechanisms for technology transfer and innovation; a harmonious system of S&T foresight and monitoring will play important role in this regard.

### Notes

- 'Food nationalism' here refers to a government stance that emphasizes import substitution and protectionism in food and trade policy, so that the country primarily targets growth in domestic production to ensure food self-sufficiency for major products, rather than importing them from international markets.
- HSE, 2017a.



- 3 The mainstream technologies of the 1960s (fertilizers, pesticides, and advanced selection) that were so effective in boosting production have become obsolete in terms of their inability to enhance productivity further at the growth rates demonstrated earlier. At the same time, many new technologies are being introduced rather slowly. Thus it is likely that there are currently only a few drivers that promise immediate and radical productivity growth in the sector.
- 4 Hassanali et al., 2008.
- 5 Sokolov and Chulok, 2016.
- 6 Bonny et al., 2015.
- 7 Gokhberg, 2016.
- 8 Aubert et al., 2014.
- 9 For a discussion about these 'wild cards', see Saritas and Smith, 2011; for a discussion about 'black swans', see Taleb, 2007.
- 10 OECD, 2009; Godfray et al., 2010.
- 11 OECD, 2013.
- 12 HSE, 2016; Saritas and Kuzminov, 2017 (forthcoming).
- 13 Termed 'non-oriented research', this is an activity without clear market-related objectives.
- 14 Suprem et al., 2013.
- 15 HSE, 2017a.
- 16 HSE, 2017b.
- Hassanali, A., H. Herren, Z. Khan, J. Pickett, and C. Woodcock. 2008. 'Integrated Pest Management: The Push-Pull Approach for Controlling Insect Pests and Weeds of Cereals, and Its Potential for Other Agricultural Systems Including Animal Husbandry'. *Philosophical Transactions of the Royal Society B: Biological Sciences* 363 (1491): 611–21.
- HSE (Higher School of Economics). 2016. *Global Technology Trends*. Moscow: National Research University Higher School of Economics.
- . 2017a. *Science and Technology Foresight for Agriculture and Food Sector in the Russian Federation until 2030*. Moscow: National Research University Higher School of Economics. Available at [http://www.mcx.ru/documents/file\\_document/v7\\_show/37653.156.htm](http://www.mcx.ru/documents/file_document/v7_show/37653.156.htm).
- . 2017b. *Science and Technology Indicators in the Russian Federation*. Moscow: National Research University Higher School of Economics.
- OECD (Organisation of Economic Co-operation and Development). 2009. *The Bioeconomy to 2030: Designing A Policy Agenda*. Paris: OECD.
- . 2013. *Global Food Security: Challenges for the Food and Agricultural System*. Paris: OECD.
- Saritas, O. and I. Kuzminov. 2017 (forthcoming). 'Global challenges and trends in agriculture: impacts on Russia and possible strategies for adaptation'. *Foresight* 19 (2).
- Saritas, O. and J. Smith. 2011. 'The Big Picture: Trends, Drivers, Wild Cards, Discontinuities and Weak Signals'. *Futures* 43 (3): 292–312.
- Sokolov, A. and A. Chulok. 2016. 'Priorities for Future Innovation: Russian S&T Foresight 2030'. *Futures* 80:17–32.
- Suprem, A., N. Mahalik, and K. Kim. 2013. 'A Review on Application of Technology Systems, Standards and Interfaces for Agriculture and Food Sector'. *Computer Standards & Interfaces* 35 (4): 355–64.
- Taleb, N. 2007. *The Black Swan: The Impact of the Highly Improbable*, 2nd edition. London: Penguin.

## References

- Aubert, B., A. Schroeder, and J. Grimaudo. 2014. 'IT as enabler of sustainable farming: An empirical analysis of farmers' adoption decision of precision agriculture technology'. *Decision Support Systems* 54 (1): 510–20.
- Bonny, S., G. Gardner, D. Pethick, and J.-F. Hocquette. 2015. 'What Is Artificial Meat and What Does It Mean for the Future of the Meat Industry?' *Journal of Integrative Agriculture* 14 (2): 255–63.
- Godfray, H., J. Beddington, I. Crute, L. Haddad, D. Lawrence, J. Pretty, S. Robinson, S. M. Thomas, and C. Toulmin. 2010. 'Food security: The Challenge of Feeding 9 Billion People'. *Science Express* 327 (5967): 812–18. Available at <http://science.sciencemag.org/content/327/5967/812>.
- Gokhberg, L., ed. 2016. *Russia 2030: Science and Technology Foresight*. Moscow: National Research University Higher School of Economics. Available at <https://issek.hse.ru/en/news/172190256.html>.



# Innovation in the Agri-Food Sector in Latin America and the Caribbean

JOSÉ LUIS SOLLEIRO and ROSARIO CASTAÑÓN, National University of Mexico

KARLA RODRÍGUEZ, CamBioTec, A.C.

OLIVIA MEJÍA, National University of Mexico

Agri-food systems are fundamental to development. Over and above their contribution to a country's gross domestic product (GDP), which is less than the contribution of the manufacturing and services sectors, the multiple strategic functions of agriculture in economic, social, and environmental development determine that its participation is far greater than its share of GDP.

The agri-food sector faces the global challenge of providing enough food, feed, fuel, and fibre to meet growing and changing demand. The agricultural innovation system needs to develop and distribute innovations able to enhance productivity and sustainability along the supply chain, while helping the sector cope with climate change issues.<sup>1</sup> In developing countries, when talking about rural development it is fundamental to consider the additional challenge of strengthening rural societies and addressing the sustainability challenge, paying particular attention to social inclusion and equity.

The food processing industry is typically described as a relatively mature and slow-growing area of business that displays a relatively low level of research and development (R&D) investment and is quite conservative in the type of innovations it introduces to the market. The main reason for this characterization relates to end-customers, who are usually wary of radically new products and changes in consumption

patterns. Nevertheless, the recent stringency of legal requirements related to safety and health transforms food product and process innovation into a highly complex, time-consuming, and risky endeavour. Moreover, recent changes in the nature of both food demand and food supply, coupled with an ever-increasing level of competitiveness, have rendered innovation not only an unavoidable corporate activity, but also one that is increasingly vital for overall agribusiness profitability.<sup>2</sup>

This chapter analyses the main sources of innovation for agri-food systems and current trends in technological change, with an emphasis on biotechnology. It also includes a review of the scientific and technological activities necessary for innovation in the agri-food sector. Finally, the chapter adopts a system's approach and includes an analysis of the role of the different actors of innovation in the sector.

## Innovation in the agri-food sector

An innovation system for food and agriculture includes both participants of the supply chain (suppliers, producers, agro-industrial processors, distributors, exporters) and government workers and those involved with universities, research institutes, outreach and development agencies, and so on. Policies, legal frameworks, and attitudes that encourage and guide knowledge incorporation

processes, technology, and value-added production also complement the concept.<sup>3</sup>

In the case of agriculture, innovations commonly originate with suppliers; these can be considered 'process innovations' because they relate to production techniques—for example, the adoption of improved seeds; equipment for irrigation, harvesting, and packaging; and information management technologies—as well as improvements for quality assurance and farm management. According to the Organisation for Economic Co-operation and Development (OECD),<sup>4</sup> suppliers of farmers develop product innovations such as improved seeds and animal breeds, agricultural machines, irrigation systems, and greenhouses. The same happens in food processing industries, which produce product innovations such as particular foods to satisfy special niche markets (organic foods, for instance), functional food ingredients, and nutraceuticals (any products with extra health benefits derived from food sources) as well as enhanced raw materials from agriculture for industries such as the chemical, pulp, and paper, and pharmaceutical industries.

## The value chain: Complex and evolving

Innovations are now common along the value chain, which is extremely complex and multi-layered with a wide range of actors who participate

**Table 1: Summary of innovations for the agri-food sector, 2012–17**

| Technology                      | Main innovations   | Purpose or expected results   |
|---------------------------------|--|---|
| <b>Agrochemicals</b>            |  |   |
| Fertilizers                     | <ul style="list-style-type: none"> <li>Nano-fertilizers that supply one or more nutrients to plants and enhance their growth and yields</li> <li>Nano-materials that improve the performance of conventional fertilizers</li> </ul>  | Nano-fertilizers can significantly improve crop growth and yields; enhance the efficiency of fertilizer use; reduce nutrient losses; and/or minimize adverse impacts on the environment.  |
| Herbicides                      | <ul style="list-style-type: none"> <li>Herbicide tolerance traits (either from mutant selection or genetic modification) and safeners*</li> </ul>  | Improved safeners prevent herbicidal injury to crop plants without reducing weed control.   |
| Pesticides                      | <ul style="list-style-type: none"> <li>Safety in manufacture and use</li> <li>Convenience for the user</li> <li>Ease of pack disposal or re-use</li> <li>Reduction of the amount of pesticide applied</li> <li>Reduction of waste and effluent of all kinds</li> <li>Nano-encapsulation</li> </ul> | Developments in pesticide formulation technology and novel formulation types, sometimes in special packaging such as water-soluble packs, can give products a competitive advantage, add value, or extend the life cycle of active ingredients. |
| <b>Information technologies</b> | <ul style="list-style-type: none"> <li>Automation in facilities (greenhouses, storage, etc.)</li> <li>Data acquisition and analysis</li> <li>Positioning</li> <li>Mobile applications</li> <li>Intelligent sensors</li> </ul>  | Information technologies can result in improvements in resource and water management; improvements in monitoring soils, weather, and markets; traceability and food safety; and better logistics and quality management.                        |
| <b>Equipment</b>                | <ul style="list-style-type: none"> <li>Automation</li> <li>Flexible devices</li> <li>Robotics for homogeneous tasks</li> </ul>   | Cutting-edge equipment can deliver greater productivity and autonomy.   |
| <b>Food safety</b>              | <ul style="list-style-type: none"> <li>Monitoring of pathogens</li> <li>Risk management</li> <li>Analysis of consumer requirements</li> </ul>  | Food safety technologies can ensure compliance with regulatory requirements and niche-market demands.   |
| <b>Processing</b>               | <ul style="list-style-type: none"> <li>Quality improvement</li> <li>Functional ingredients</li> <li>Efficient resource and energy management</li> </ul>  | Better processing techniques can result in an improvement in product properties, shelf-life, and presentation.  |
| <b>Packaging</b>                | <ul style="list-style-type: none"> <li>Use of active materials for packaging</li> <li>Sensors and indicators</li> <li>Radio-frequency identification (RFID)</li> </ul>   | Packaging can improve product shelf-life and appearance and enhance food safety.  |
| Biotechnology                   | <ul style="list-style-type: none"> <li>GM plants and animals</li> <li>Molecular breeding</li> <li>Improved enzymes, yeasts, and bacteria for processing</li> </ul>   | Biotechnology can improve yields, reduce costs, improve quality, and provide better quality-control and safety systems.   |

Source: Authors, based on Abrol and Shankar, 2014; Bechar and Vigneault, 2017; Lee et al. 2015; Lehmann, 2012; and Magaña, 2014.

Note: \* Herbicide safeners selectively protect crop plants from herbicide damage without reducing activity in target weed species.

in innovation in the agri-food sector. According to the OECD, governments implement policies and regulations that affect the business and innovation environment (tax and agricultural policies, for example).

Other actors involved in the innovation process are brokers, input suppliers, markets, and consumers.<sup>5</sup>

Suppliers, who can be considered the first of the direct actors in the chain, include suppliers of seeds, fertilizers,

crop protection, gene-modifying technologies, machinery, equipment, veterinary vaccines, probiotics, information technology, and energy. They are connected by networks to producers or agriculture firms that work in agriculture, livestock, and fisheries and aquaculture. These producers are in turn connected to agro-industrial firms that provide processing, packaging, storage, and conservation services. Distributors and brokers then provide traders, storage services, and distribution agents. Finally, local and export markets service retailers, consumers, and export/import agencies. Underlying all these elements are financial services, which include development banking, commercial banks, public funds, international cooperation (international research centres, such as the International Maize and Wheat Improvement Center), and multi-lateral aid.

Over all these direct actors is the regulatory and policy framework, which establishes incentives and ‘rules of the game’ that also have an influence because they set the environment for firms’ activities. External sources of innovation include public and private research organizations, extension services, international research centres, technology brokers, universities, and technology transfer offices. These external actors supply important knowledge-based services to support innovations along the value chain.

### Sources of innovation for the agri-food sector

Because of the complexity of the agri-food value chain, many technological inputs are used to support innovation. A review of recent advances is presented in Table 1 to illustrate the diversity of technologies impacting different activities of this industry.

**Table 2: New plant breeding techniques**

| Technique  | Purpose  |
|--|--|
| <b>Sequence-specific nuclease (SSN)</b>                | Facilitates precise insertion and editing of genes through mutation or replacement         |
| <b>Oligo-directed mutagenesis (ODM)</b>                | Introduces a similar sequence that can be used as pattern to repair differences            |
| <b>Cisgenesis and intragenesis</b>                     | Uses genes of the same species to induce new traits in specific crops                      |
| <b>RNA-dependent DNA methylation</b>                   | Induces transcriptional silencing of genes   |
| <b>Reverse breeding</b>                                | Provides a precise method of producing hybrids   |
| <b>Agro-infiltration</b>                               | Uses <i>Agrobacterium</i> as a tool for the temporary expression of genes in plant tissues |
| <b>Grafting on genetically modified (GM) rootstock</b> | GM rootstocks can be used for improving performance of non-GM scions                       |
| <b>Genomics or synthetic biology</b>                   | Implies the introduction of multiple genes to modify metabolic paths                       |
| <b>Induced early flowering</b>                         | Transgenic early-flowering F1 seedlings are backcrossed in year 2 with another line        |

Source: Authors, based on Schaart et al., 2016.

The wide range of innovations introduced to this sector meets the requirements of a new competitive environment. The main drivers for efficiency in the agriculture and agri-food industry relate to increased pressure by customers on suppliers for sustainably produced products, as well as competitive pressure that triggers the need to reduce costs and the desire to expand into new export markets, which in turn implies complying with international food safety and health regulations.

### Biotechnology innovations for agri-food

A set of important innovations is based on biotechnology. The phrase ‘modern biotechnology’ refers to various scientific techniques used to produce specific desired traits in plants, animals, or microorganisms using genetic knowledge. Since its introduction to agriculture and food production in the early 1990s, biotechnology has been utilized to develop new tools for improving productivity in crops such as soybeans, corn, cotton, canola, papaya, squash, potato, and apple that are improved versions of the traditional varieties. In addition, improved yeast and enzymes are

used to make different food products through biotechnology.<sup>6</sup>

In the area of agriculture, biotechnology has been used to produce genetically modified organisms (GMOs), thus increasing productivity and introducing plants that are resistant to pests, drought, and contaminated soils. The use of biotechnology has led to an increase in yields and reduced cost in important crops such as maize, soybeans, cotton, and canola. Just recently genetically modified (GM) apples and potatoes have been approved for environmental release and consumption in the United States of America.<sup>7</sup>

The use of biotechnology in processing has brought better quality, safety, and long life to food products. New developments are also expected to bring to light raw materials with specific traits useful to specific processing industries. But modern biotechnology has been undergoing a heated debate about the safety of products that has led to strict regulations and entry barriers in important markets (notably in Europe).

Table 2 presents a classification of new plant breeding techniques that are being developed as a response to that restrictive environment. They include: (1) improved plants that

contain a new DNA fragment (usually a new gene); (2) improved plants that do not contain a new DNA fragment, but that have a mutation or modification in their own DNA; and (3) improved plants that do not contain a new DNA fragment or any modification of their DNA (such as hybrids).<sup>8</sup>

### Biotechnology in Latin America and the Caribbean

Applications of agricultural biotechnology have demonstrated its potential to support improvements in agricultural productivity and the sector’s economic growth. However, biotechnology opens new challenges and issues that must be addressed by R&D organizations as well as systems and policy makers.

In Latin America and the Caribbean, the biotechnology industry began to develop in the second half of the 1980s as a consequence of the reduction of barriers that limited foreign investment. The growth of the biotechnology industry was also associated with changes in the laws of intellectual property rights to grant patent protection to biotech inventions and plant breeders’ rights to new plant varieties. Patent protection

brought confidence to investors, which led to an intensification of research and technology flows.

Research in biotechnology has been supported in different countries in the region, resulting in the development of some new research institutions (universities and research centres). But the creation of biotechnology firms has not been supported to the same degree, so there has been only limited success in building local successful biotech industries. On the other hand, starting in the 1990s, large multinational corporations with large research budgets entered the markets of the largest countries in the region and began to play an increasingly important role as agents of biotechnology diffusion.<sup>9</sup>

As a consequence, even though the land area cultivated with GMOs has grown at an accelerated pace, this expansion has happened only for three crops (soybeans, corn, and cotton), two traits (herbicide resistant and insect resistant, or combinations of both) and eight countries—Argentina, Brazil, Bolivia, Colombia, Honduras, Mexico, Paraguay, and Uruguay—with a large concentration in Argentina and Brazil. Chile has allowed GM plants exclusively for seed production and export. All the GM crops launched commercially in the region have been developed by private multinational firms.

Although important investments have been made in research, no GM product developed by national innovation systems in Latin America has yet been transferred to producers in the region. This reveals that one important problem faced by Latin American innovation systems is the lack of interaction between institutions that generate knowledge and the users of the innovation. A new system of incentives is needed to encourage knowledge generators to embrace diverse demands and

propose effective solutions to the problems of producers and companies of different sizes.

This does not mean that technologies have not been produced by the innovation sector in Latin American countries. However, most of the biotechnology innovations produced by the public and private sectors in these countries are conventional applications of biotechnology (tissue culture, fermentation, and the use of molecular tools for breeding).

Countries with a recorded history of investment in human resources as well as innovation and technical change—namely, Argentina, Brazil, Cuba, and Mexico—have an enhanced capacity in terms of the number of techniques used and mastered. There have been some notable achievements in these countries in the development of genomics and some GM crops, but a problem arises in developing commercial applications for those technologies. Countries with an intermediate capacity—such as Colombia, Costa Rica, Chile, Peru, Uruguay, and the Bolivarian Republic of Venezuela—have the capacity to utilize conventional and modern techniques, but their capacities are geographically dispersed and highly concentrated in academic settings. In turn, the rest of the countries in Latin America—Bolivia, Dominican Republic, Ecuador, El Salvador, Guatemala, Honduras, Nicaragua, Panama, and Paraguay—have a poor innovation capacity for conventional biotechnology innovations and even less capacity for modern biotechnology.

Regulatory systems in the region are rather restrictive. Some countries (such as Mexico for corn between 1998 and 2009, as well as Ecuador and Peru declaring moratoria for planting all GM crops) have declared moratoria on the use of GM plants in their agriculture. Such precautionary

measures have proven to be ineffective because these countries import GM food products, but they erect barriers to the environmental release of seeds. This has established obstacles to the development of locally modified plants, which demotivates investments in innovation. There is an intense debate in Mexico about GM food production and its impact on the environment and the population. Thus it is necessary to strengthen the study of GMOs through multidisciplinary and committed work that can objectively demonstrate the challenges and feasibility of this type of production.

Regarding research, regional institutions working on agricultural biotechnology in Latin America cover a wide range of techniques, crops, and productivity limitations. This range reflects the wide diversity of genetic resources in the region and the notable efforts made by the research systems and organizations to address strategic regional and national crops and traits.

This diverse innovation portfolio has, however, led to a dispersion of efforts mainly because no concurrent significant increase in the level of human and financial resources is in place. Countries need to set priorities to focus their efforts and resources towards feasible programmes with stronger ties to farmers and firms.

In terms of the environmental and food safety evaluations needed to commercialize GM products, most countries require improvements to their regulatory bodies and oversight mechanisms. Even in those countries with an existing critical mass of mechanisms (institutions, regulations, infrastructure) to ensure biosafety, social and political pressures have caused the dissemination of technologies approved by the biosafety regulatory authorities to slow.

A faster response from regulatory authorities is required, because a poor capacity to conduct biosafety assessments, strongly influenced by the lack of political will to implement modern biotechnology applications, is demotivating investment by public and private sectors to boost R&D and biotechnology diffusion. Even if the institutional framework is complete, it is essential to assume that a major overhaul of the organization of the structures will be required for its implementation—the framework is currently extremely complex and bureaucratic, which contributes to the uneven diffusion of its benefits, since only a few actors have the qualifications to manage innovation in this environment.

In the case of intellectual property management, countries such as Argentina, Brazil, Chile, and Mexico make use of instruments and negotiation capacity. However, the highest shares of intellectual property protection instruments in these countries are held by non-residents. This suggests that more effective incentives for creative processes should be implemented. In most Latin American countries, agricultural research has taken a very academic route. The indicators are telling: while production of scientific articles has solidly increased in the last 10 years, the generation of intellectual property and effective technological solutions for producers represents a very small percentage of research results.

This relative scarcity of innovative solutions is the consequence of an incentive system for researchers that emphasizes academic production and sidesteps problems in the sector. More technologies are now urgently needed for the efficient use of water to improve land, correct pollution problems, increase production yield, and improve comprehensive farm management.

Moreover, a lack of reliability and quality of supplies means that successful industries resort to imports or to large local suppliers to obtain their supplies. No effort is made to develop new suppliers, which would generate market incentives to improve production. This is an opportunity for innovators.

Technological innovations are systematically incorporated by commercial agriculture producers, who resort to technological resources in other countries. They also turn to these other countries for technical support as well as for machinery, agrochemicals, and seed suppliers. Some local producers work by contract to export vegetables, and their relationship with a broker or their customers in the importing market gives them access to technological packages supplied by sales companies that act as intermediaries. In both cases, links with domestic institutions are scarce.

In some countries, public and some private financial organizations have various support schemes for farmers and companies, but they do not have effective instruments to finance technology development projects, create new businesses, or adopt technology. The requirements of these organizations often exclude a wide range of producers (small farmers), which can widen performance gaps.

A sound innovation policy requires that shared socioeconomic objectives provide the motivation for better articulation of the innovation system and the space for designing more effective policy instruments than what now exists.

The formulation of policies that raise the public's confidence and that successfully insert useful and sustainable biotechnology innovations will be a major challenge that countries in Latin America and the Caribbean will face in the near future.

### Challenges for agri-food biotechnology innovations: The case of Mexico

Mexico is equipped with knowledge and expertise in agricultural biotechnology—it has important research facilities at universities such as the National University of Mexico, the Center for Research and Advanced Studies of the National Polytechnic Institute, and the Metropolitan Autonomous University, as well as public research centres such as the Center for Research and Assistance in Technology and Design of the State of Jalisco; the Yucatan Center for Scientific Research; and the National Institute of Forestry, Agriculture and Livestock Research. Mexico also has regulatory systems in place to assess biotechnology products according to the country's Biosafety of GMOs Law. However, Mexico is at crossroads as a result of negative perceptions of GMO technology, including fears about the environmental impacts of genetically engineered crops that some opponents have spread among some sectors of society. This has erected additional barriers to new investors, and the number of Mexican biotechnology firms is low and concentrated in applying traditional techniques (fermentation, use of enzymes, tissue culture, and molecular breeding).

The most important GM crop produced in Mexico is cotton, which covers more than 90% of the planted area in the country. It is a success story because the use of chemical pesticides has been reduced by more than 50% and important cost advantages have been brought to producers.<sup>10</sup>

The second GM crop that has reached commercial release in Mexico is soybeans. Permits were granted in 2012 for production on 253,500 hectares. However, Mexican honey producers have expressed great concern, particularly since the European Court of Justice ruled that honey—which contains trace amounts of



pollen from genetically engineered crops authorized for human consumption in the European Union—must be labelled if the amount of genetically engineered pollen surpasses 0.9%. Because of this ruling, all honey shipments from Mexico must undergo laboratory testing to identify and quantify the type of genetically engineered presence.<sup>11</sup>

The Mexican government was about to grant permits for the commercial planting of GM corn in very specific areas that are distant to fields considered centres of origin and diversification for the crop. In September 2013, a federal judge responding to a legal action initiated by a consortium of activist groups effectively suspended the plantings of all GM corn in Mexico by placing a provisional injunction. After four years it is still not clear whether those permits will be granted. This lack of clarity is an obstacle not only for the commercial use of seeds developed by multinational firms but also for technologies generated by Mexican research groups.

This discussion highlights the role of institutions and policies in the diffusion and generation of new biotechnological innovations. It also shows that emphasis has to be given to the transfer of knowledge to commercial firms because they are a key factor in the development of agri-food biotechnology. Countries in Latin America and the Caribbean need new policies aimed not only at strengthening research capacities but also at translating research results into viable biotechnologies to solve some of the critical problems of agriculture.

## Conclusions

Research capacities created in Latin American countries need to translate into actual solutions to the problems of the agri-food sector. In order to achieve this goal, a new system of incentives is necessary to encourage knowledge generators to embrace diverse demands and propose effective solutions to the problems of producers and companies of different sizes.

Although the institutional framework that is essential for regulating new technologies, such as innovations in biotechnology, is complete, it still needs a fundamental overhaul of its structure so that it can be implemented. Currently the institutions are so complex and bureaucratic that only a few actors—primarily multinational firms—have the qualifications needed to navigate the system. The result is that the framework, instead of helping to diffuse the benefits of new technologies through all levels of the sector, ends up ensuring that their diffusion is uneven.

Innovation policy requires that shared socioeconomic objectives, such as those related to sustainability and more equitable development of the agri-food sector, provide the motivation for a better articulation of the innovation system and increasing the space for designing more effective policy instruments than now exists.

## Notes

- 1 Moreddu, 2016.
- 2 Costa and Jongen, 2006.
- 3 The *Oslo Manual* defines innovation as the implementation of a new or significantly improved product (good or service) or process, a new marketing method or a new organizational method in business practices, workplace organization or external relations (OECD and Eurostat, 2005).
- 4 OECD, 2013.
- 5 OECD, 2013, p. 13.

- 6 Food Insight, no date, available at [http://www.foodinsight.org/Background\\_on\\_Food\\_Biotechnology](http://www.foodinsight.org/Background_on_Food_Biotechnology).
- 7 To get a more precise view on biotech innovations, a review was conducted of recent biotechnology patents (2011–2017). There were 736 identified patents. The leading inventors are Monsanto Technology LLC, Pioneer Hi Bred Int., BASF Plant Science, Du Pont, and Syngenta. Together these firms have more than 50% of the patent files, which is an indicator of the high level of concentration of innovation.
- 8 Schaart et al., 2016.
- 9 Otero, 2008.
- 10 Solleiro et al., 2014.
- 11 Mexican honey producers filed a court injunction against the approval of GE soybeans for commercial production. This has led to a long legal procedure and the judge has ordered a temporary suspension of the permits arguing that the public consultation of the local communities was not adequate. 'As a result of this issue, approximately 15,000 hectares were not planted to GE soybeans in 2012 and there have been no more applications for commercial or pilot releases of GE soybeans during 2013 to 2015' (USDA FAS, 2015, p. 5).

## References

- Abrol, D. P. and U. Shankar. 2014. 'Pesticides, Food Safety and Integrated Pest Management'. In *Integrated Pest Management: Pesticide Problems, Vol. 3.*, eds. D. Pimentel and R. Peshin. Springer Netherlands: 167–199.
- Bechar, A. and C. Vigneault. 2017. 'Agricultural Robots for Field Operations. Part 2: Operations and Systems'. *Biosystems Engineering* 110: 20–28.
- Costa, A. I. A. and W. M. F. Jongen. 2006. 'New Insights into Consumer-Led Food Product Development'. *Trends in Food Science and Technology* 17: 457–65.
- Food Insight. No date. 'Background on Food Biotechnology'. Available at [http://www.foodinsight.org/Background\\_on\\_Food\\_Biotechnology](http://www.foodinsight.org/Background_on_Food_Biotechnology).
- Lee, S. Y., S. J. Lee, D. S. Choi, and H. S. Jin. 2015. 'Current Topics in Active and Intelligent Food Packaging for Preservation of Fresh Foods'. *Journal of the Science of Food and Agriculture* 95 (14): 2799–810.
- Lehmann, R. 2012. 'Future Internet and the Agri-Food Sector: State-of-the-Art in Literature and Research'. *Computers and Electronics in Agriculture* 89: 158–74.
- Magaña, S. C. 2014. Desarrollo de equipos, sensores e instrumentos para agricultura de precisión y labranza de conservación. Lecture presented at the ceremony to grant the Premio Innovagro (Innovagro Award), 24 April 2014, Cordoba University, Spain.

- Moreddu, C. 2016. 'Public-Private Partnerships for Agricultural Innovation: Lessons from Recent Experiences'. *OECD Food, Agriculture and Fisheries Papers* No. 92. Paris: OECD Publishing. Available at <http://dx.doi.org/10.1787/5jm55j9p9rmx-en>.
- OECD (Organisation for Economic Co-operation and Development). 2013. *Agricultural Innovation Systems: A Framework for Analysing the Role of the Government*. Paris: OECD Publishing. Available at <http://dx.doi.org/10.1787/9789264200593-en>.
- OECD and Eurostat (Organisation for Economic Co-operation and Development and Eurostat). 2005. *Oslo Manual: Guidelines for Collecting and Interpreting Innovation Data*, 3rd Edition. Paris: OECD Publishing.
- Otero, G. 2008. 'Neoliberal Globalism and the Biotechnology Revolution: Economic and Historical Context'. In *Food for the Few. Neoliberal Globalism and Biotechnology in Latin America*, ed. G. Otero, ed. Austin: University of Texas Press, 1–29.
- Schaart, J. G., C. C. Wiel, L. A. Lotz, and M. J. Smulders. 2016. 'Opportunities for Products of New Plant Breeding Techniques'. *Trends in Plant Science* 21 (5): 438–49.
- Solleiro, J. L., O. Díaz, and C. Gaona. 2014. Análisis de la cadena de valor en la producción de algodón en México [Analysis of the Value of Chain in Cotton Production in Mexico]. Mexico: FAO. Available at <http://docmia.es/d/98572>.
- USDA FAS (United States Department of Agriculture, Foreign Agricultural Service). 2015. *Agricultural Biotechnology Annual Mexico*. Mexico City: US Department of Agriculture. Available at <https://www.fas.usda.gov/data/mexico-agricultural-biotechnology-annual>.



## Enhancing Innovation in the Ugandan Agri-Food Sector: Progress, Constraints, and Possibilities

TRAVIS LYBBERT, Agricultural & Resource Economics, University of California Davis

KRITIKA SAXENA, Graduate Institute, Geneva

JULIUS ECURU, Uganda National Council for Science and Technology, Uganda

DICK KAWOBYA, University of South Carolina

SACHA WUNSCH-VINCENT, WIPO

Uganda's performance as an innovation economy has been improving consistently, particularly in comparison with other low-income and Sub-Saharan African countries. Since 2015, the Global Innovation Index (GII) has ranked Uganda as an 'innovation outperformer,' a title given to countries that, over a number of years including the two most recent, have been identified as innovation achievers and pillar outperformers.<sup>1</sup> This laudable progress stems from sustained economic growth coupled with a commitment to private-sector development and innovation policy reforms.<sup>2</sup> Though encouraging, this nascent progress will translate into real benefits for the broader Ugandan population only if policy makers understand and address specific constraints in the innovation systems of the agri-food sector—the largest sector in the Ugandan economy.

Agriculture is the backbone of Uganda's economy, employing about

73% of the country's labour force predominantly in rural areas, but it made up 27% of the country's GDP in 2014.<sup>3</sup> Given that many households in Uganda rely on agricultural production for their livelihoods, innovation in this sector can have direct and potent welfare effects. This potential is particularly striking given that the Ugandan agri-food sector is hampered by low productivity and profitability. Annual growth in agricultural output has also been lower than expected, declining from 7.9% in 2001 to 3% in 2014 and falling short of the 6% growth target for the per capita agricultural GDP set by the African governments under the Comprehensive Africa Agriculture Development Programme.<sup>4</sup>

Increasing agricultural productivity through improved technology and production practices has been a persistent priority at the national level. To be effective, this priority must prompt policy actions that

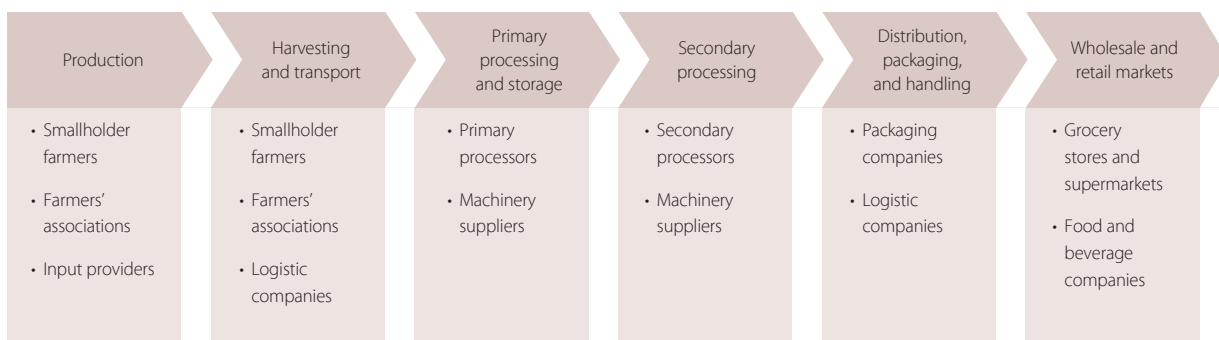
specifically and explicitly account for the underlying innovation systems that will ultimately generate real productivity improvements.

### Distinctive features of agri-food value chains in Africa

The agri-food value chain components range from the supply of agricultural inputs such as seeds by input suppliers, wholesalers, and retailer agro-dealers to farming activities such as planting, farming, and harvesting and to post-harvest activities such as bulking and processing of raw output, branding, and marketing of value-added agri-food products that reach end consumers (see Figure 1).

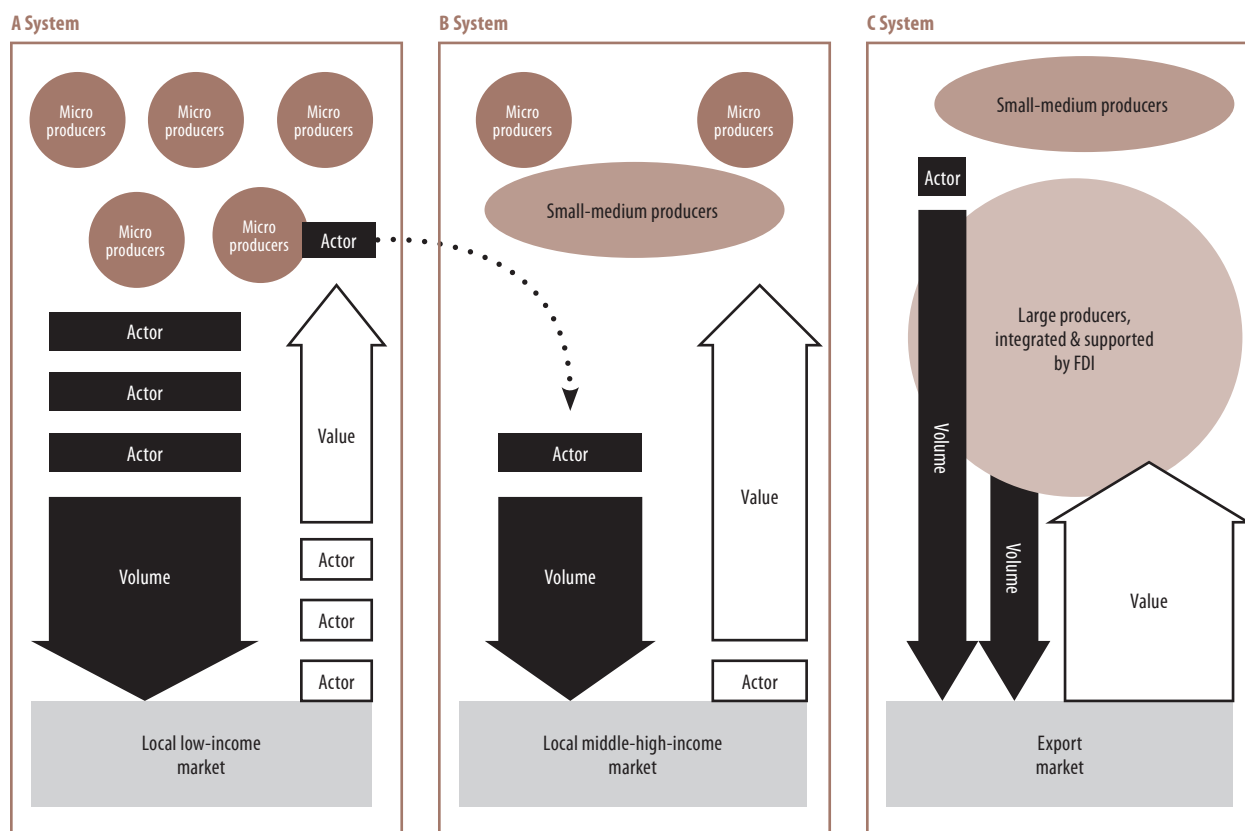
With these important dimensions in mind, it is easy to appreciate the marked heterogeneity that characterizes agricultural value chains in Africa. Indeed, this heterogeneity is often so pronounced that it results in three distinct and parallel systems of

Figure 1: Agriculture value chain with links between consumers and producers



Source: Authors, based on A.T. Kearney, 2016.

**Figure 2: Heterogeneity in production and marketing constraints: Three parallel agri-food value chains in developing countries**



Source: Adapted from Trienekens, 2011; originally from Ruben et al., 2007.

value chains. In the A system shown in Figure 2, local value chains consist of low-value-added staple foods; low-income and low-productivity farmers; and local, low-value-added spot markets. The B system comprises larger local farmers with access to improved input markets and products as well as higher-value crops; these farmers can tap into higher-value-added domestic agri-food markets. In the C system, much larger (often plantation-style) farms produce specialized products (often under production contracts) for high-value export markets and must therefore satisfy high international sanitary and phytosanitary standards. In developing countries, these systems typically operate in parallel, often with little interaction, further isolating the most vulnerable and least productive producers in the A system. These realities

are key to understanding how value chains operate in Uganda and what upgrading options exist for farmers trapped in less productive systems.

#### **Innovation constraints in African agri-food value chains**

The agricultural sub-systems described above often function in parallel with few links other than relying occasionally on another sub-system to balance demand and supply gaps. The existence of these heterogeneous sub-systems, which are only weakly connected, poses unique challenges for supporting innovation and upgrading of these value chains.<sup>5</sup>

In many African countries, producers are saddled with poor infrastructure, weak institutions, barriers to entry, coordination failures, and unfavourable social and political

conditions.<sup>6</sup> Although these hurdles may be surmounted individually in some cases, they can be pervasive and subject to substantial collective action problems, with the end result that they complicate the entire culture in which business activities take place.

Barriers to entry are a disadvantage to small-scale producers that have little capital to invest, use traditional techniques, and depend on family labour.<sup>7</sup> Such an environment causes difficulties in meeting product standards and makes it difficult to compete with larger-scale, more efficient, and more technologically sophisticated multinational corporations. Without market knowledge or competitive products, many small-scale producers fail to take advantage of larger markets or the techniques that could help them do so.

Furthermore, coordination failures are typically the result of a trust deficit or asymmetric relationships. Because of poor past performance, many value chains do not engender trusting relationships. This can lead to excessive risk mitigation, causing inefficiencies and reduced value addition.<sup>8</sup>

For commodities with low value added, such as raw agriculture staples, the terms of trade with Western countries are typically asymmetric. In such circumstances, Western partners capture only the high-value portion of the chain, thereby excluding small-scale farmers from participating in larger markets.<sup>9</sup>

These obstacles constrain the ability of system A and B value chain actors from innovating in a way that not only increases their agricultural productivity but also upgrades their systems.

### **Innovation constraints in the Ugandan agri-food sector**

Ugandan farms are typically small: Roughly half of Ugandan farmers own less than three acres of land, a quarter own three to five acres, and a quarter own more than five acres.<sup>10</sup> The total area of arable land planted with either seasonal or permanent tree crops has increased at an annual rate of over 2% over the past 20 years.<sup>11</sup> This increase in crop area, however, was outpaced by population growth, and crop area per capita declined nearly 25% during this period as a result.<sup>12</sup> These trends have contributed to an annual decline in both food and agricultural production per capita of about 2% since 2002.<sup>13</sup> Thus at both the national and household levels there is a pressing need to increase agricultural productivity in Uganda.

Mirroring the above challenges, Ugandan farmers face a host of constraints that limit their

ability and incentives to invest in their productivity. Among these constraints are unreliable growing conditions; natural disasters; liquidity constraints; high market risk and uninsured production; lack of access to high-quality agricultural inputs (only poor quality of agricultural inputs are available); lack of training, information, and awareness; limited output market opportunities; and few spillovers from public agricultural research and development (R&D). To the extent that farm-level constraints discourage farmers from adopting new technology, they also discourage private-sector investments in the development, distribution, and marketing of improved agricultural inputs and other technologies. Downstream markets for agricultural outputs are similarly suppressed by low on-farm productivity and concerns about the stability and quality of outputs. As a result, only one-third of agricultural production reaches market.<sup>14</sup> Key Ugandan agriculture innovation constraints at the value chain level are discussed in the next section.

#### **The low quality of agricultural inputs**

The low quality of agricultural inputs in Uganda has been documented in several recent studies.<sup>15</sup> Thirteen percent (nine out of the 67 fertilizer retailers surveyed) reported receiving low-quality supplies from wholesalers.<sup>16</sup> In practice, the poor quality appears to be a result of counterfeit or adulterated or generic versions of the supplies. The ubiquity of low-quality inputs seems to be more a result of weak enforcement of guidelines and regulations on input producers and dealers than the lack of technology to produce high-quality supplies. Better enforcement and the adherence to higher standards would help overcome this bottleneck. Additionally, institutional changes

aimed at improving the quality of agricultural inputs, markets, and supply chains are central to the innovation process. Importantly, such institutional changes make input suppliers more responsive to the needs of farmers because they increase competition in the market. In many cases, upstream innovation in inputs (e.g., improved germplasm) involves significant public-sector support, but the ultimate return on this public R&D investment is dependent on the efficiency and resilience of the input supply chains that deliver appropriate improved inputs to producers.

Constraints to public and private innovation in the agricultural input supply chain—in particular in the area of seeds, crops, and fertilizers—remains a bottleneck to improving the output of Ugandan agriculture. On the one hand, access to inferior inputs (e.g., counterfeit or ineffective fertilizer) remains a significant challenge where issues of quality and suitability prevail. On the other hand, the rise of new, sometimes domestic, hybrid seed varieties along with organizational innovations and improved distribution of agricultural inputs might offer novel possibilities.

#### **Imperfect financial markets**

In Uganda, the majority of rural households do not have access to credit. At the time of the 2005/06 Uganda National Household Survey, 24% of rural households had applied for credit from informal sources compared with 4.4% and 1.8% that had applied to micro-finance institutions and banks, respectively; only 15% and 12% of household heads have the capacity to borrow from micro-finance institutions and banks, respectively.<sup>17</sup> Following the conceptual framework of Boucher et al. (2009), of the non-borrowers in the 2008/09 Uganda Census of Agriculture, about half were credit

unconstrained, meaning that—given their production opportunities—they did not need a loan, did not borrow because of high interest rates, or could not profitably pay back the loan.<sup>18</sup> The other half of non-borrowers were credit constrained as a result of lack of collateral, lack of information about credit sources, negative past experiences with receiving credit, or unavailability of lending facilities.<sup>19</sup> Thus financial markets in rural Uganda should not only be equipped to provide finance to individual households in a community experiencing hardship but should also look critically at the demand for start-up capital or insurance against risk that is common across households in a community. Prices and market uncertainties contribute to low investment by making borrowing more uncertain and therefore less attractive. This environment of uncertainty inevitably affects household liquidity. Hybrid seeds and inorganic fertilizers that must be purchased each season are two technologies that are most likely to be affected by liquidity constraints at the household level. Furthermore, imperfect financial markets also impact the way labour is allocated across crops. The poorest households, which are less able to insure themselves against price risk, would tend to allocate less labour to high-return cash crop production, such as coffee production.<sup>20</sup>

#### **Information constraints and a weak knowledge base**

Information constraints and also, sometimes, a weak knowledge base among farmers are further bottlenecks.

Information constraints reduce productive investments by farmers by imposing constraints on (1) information about inputs/products and (2) information about practices/processes. Addressing this lack is the

focus of public- and private-sector initiatives as well as research and policy recommendations.<sup>21</sup>

Limited information on inputs and products, in turn, negatively affects decisions about what practices and processes to adopt. For example, researchers found that only 2% of farmers in their sample correctly identified the variety of maize that they were growing.<sup>22</sup> If farmers believe they are growing a different variety than the one they are actually planting, they may apply practices and technology appropriate to the wrong variety; this can affect their productivity, as has been shown among cowpea producers in Tanzania.<sup>23</sup>

Often farmers also lack the capabilities to assess the potential and practical use of new technology or innovation, leading to underinvestment and limited adoption of new technologies.

#### **Output markets, processing, and marketing**

Agricultural output markets (e.g., markets for coffee, maize, or mangos) can play an important role in facilitating agricultural innovation. They are the first and the most important link through which the farmers can access domestic agro-processors, neighbouring countries, or global markets via processor-exporters. However, output sold by farmers is often purchased by middlemen in the village or at the farm gate shortly after harvest.<sup>24</sup>

The interdependence between actors along this chain implies that downstream costs of market imperfections may be transferred upstream to farmers themselves. Because farmers make input investment decisions with an eye on the ultimate output markets, reforming agricultural output markets is an important way to increase farmers' use of improved inputs such as fertilizer.<sup>25</sup> The nascent rice value chain in Uganda provides

a concrete example of this dynamic. Since upland rice has only recently been introduced in the country, there are few rice mills and only one industrial agro-processor of rice in Uganda.<sup>26</sup> The costs of transporting rice between farms and these mills was one of the main factors driving over half of the farmers who had initially adopted this crop two years earlier to abandon growing NERICA rice.<sup>27</sup>

Relatedly, low levels of investment in Uganda's agriculture sector are in part due to coordination problems between producers and purchasers of agriculture products. Smallholder farmers face uncertain demand for output, which reduces their incentives and ability to invest in agricultural production. Agro-processors face uncertain quantity and quality of supply, which is exacerbated by potential suppliers' side-selling opportunities on agricultural spot markets.<sup>28</sup> In this way, uncertainty about demand and supply of commodities facing farmers and agro-processors, respectively, reduces their investment incentives. This agricultural investment trap results in only one-third of agricultural production reaching domestic and export markets.<sup>29</sup>

#### **Lacking spillovers from public agricultural R&D**

The public sector conducts the vast majority of agricultural R&D in Uganda, as in many least-developed and low-income countries. These investments focus primarily on technologies to improve agricultural productivity and sustainability. Yet a number of factors, including the lack of complementary investments and capacity, hamper spillovers from public research to private enterprises. These spillovers and the interactions and processes that generate them are complex and dynamic. It is critical



that researchers and policy makers better understand the drivers and challenges inherent in generating R&D spillovers, as well as the levels and direction of agricultural R&D.

### Creating an enabling environment for agri-food innovation in Uganda

Uganda's performance in previous editions of the GII attests to its growing focus on innovation as a driver of development in some of its key sectors. Within the agriculture sector, Uganda is prioritizing investments in modern biosciences, with a particular focus on disease diagnostics, vaccine development, crop productivity improvement, and value addition.<sup>30</sup> The government is also taking steps (though small) to improve institutional capacity, as evidenced by the growing importance of work of R&D institutions such as the National Coffee Research Institute (NaCORI) and others within the National Agricultural Research Organisation (NARO).

The growing focus and recent measures taken by the government for promoting innovations and value addition in agro-based industries is definitely a step in the right direction. However, to truly stimulate growth, the government needs to create an enabling environment for agri-food innovations by addressing obstacles that impede value addition and innovation in agri-food systems.

Among policy measures to encourage innovation, governments can establish intellectual property rights (IPR) and maintain the institutions that enable these rights to be used and enforced. An IPR regime encourages innovation by allowing inventors to recoup their investments through monopoly rents. The agricultural industry typically relies on patent protection, plant variety protection, and trademarks.

In the past decade, Uganda has taken some major strides towards establishing a well-functioning IPR regime in agriculture. The country recently introduced its Plant Variety Protection Act 2014 and became a signatory to the International Treaty on Plant Genetic Resources for Food and Agriculture, to which it acceded in 2003. It also enacted its Geographical Indications Act 2013, which provides protection and promotes the value of its indigenous and traditional agricultural produce. Enhancing the instruments available to both private and public players in the agri-food sector to create viable business opportunities based on innovation could be a policy priority. At the most basic level, firms will invest in innovation only if they have a defensible strategy for building and maintaining a reputation that attracts customers and differentiates high-quality products and services. The effective use of trademarks may therefore play a role in improved branding and longer-term investments in innovation. Uganda also enacted its Trademark Protection Act in 2010. Since then, compared with other forms of intellectual property (IP) protection—such as patents—the use of trademarks has increased rapidly. Furthermore, trademarks are emerging as the preferred form of protection in the agricultural and food and beverage sectors because the majority of trademark filings occur within these sectors.<sup>31</sup>

In order to provide institutional support for IP protection, Uganda has mandated by law two institutions for the formulation, administration, and enforcement of IPR. The Uganda Registration Services Bureau is mandated with the registration of IP instruments, and the Uganda National Council for Science and Technology is concerned with formulating the national science and

technology policy and protection of IPR. This demonstrates that Uganda has the basic framework it needs to promote formal agricultural investment in innovation.

However, to foster innovation in agriculture, Uganda needs to define its key innovation policy commitments in this sector and involve a larger actor base in the management and promotion of IPR. An ongoing World Intellectual Property Organization (WIPO) study will shed further light on the policy options available to Uganda for enhancing its IP regime and making it more inclusive for the agriculture sector (see Box 1).

Policies for supporting innovation include fostering an enabling environment and collective action. The former typically relates to the provision of public goods to address market failures in transportation, communication, and processing. However, policies can also focus on the small producers by aiming to integrate them into the market economy. Indeed, a strong agro-processing sector, which is linked to farmers, is an incentive for small producers to invest more to increase the productivity of their farms. These links with agro-processing rely on a combination of service provision, as mentioned above; facilitation of the private sector through financial services and fiscal policy; and an appropriate regulatory environment achieved through standards, regulations, and enforcement. Collective action offers the possibility of lower costs, a more reliable network, and potentially higher profits.<sup>32</sup> Umbrella organizations play a major role in marketing agricultural produce, providing access to training, and service delivery from external organizations.<sup>33</sup> They also provide an ideal environment for knowledge transfer and innovation as they link farmers

### Box 1: Innovation in the Agro-Based Industry in Uganda: Insights from coffee seed supply chains and tropical fruit processing

The Ugandan government has requested the Economics and Statistics Division (ESD) of the World Intellectual Property Organization (WIPO) to conduct a study on innovation in the agro-based industry in Uganda. Two value chains have emerged as promising and two focal links in these value chains have emerged as particularly relevant for this study:

**1. The seed/seedling supply chain in the coffee value chain.** Coffee has always been an important cash crop in the Ugandan agri-food sector. It has endured the booms and busts of the global coffee market as well as devastating diseases. Still, coffee yields continue to be low by international standards (e.g., Robusta coffee yields in Viet Nam are, on average, three to four times larger than yields of the same coffee in Uganda). Although there are several reasons for this, the quality and suitability to local agro-climatic conditions of the coffee varieties and the level of input usage play a central role. Getting high-quality and suitable seedlings to farmers may catalyse other investments. For example,

investment in several inputs (i.e., fertilizer, pesticides, and agronomic practices such as planting, spacing, and intercropping) is likely to be higher when a grower has planted the varieties best suited to his growing conditions (such as farm size, soil type, and climate). Thus providing better traceability and information along the seed supply chain could create more favourable incentives and induce more on-farm investment. This focus aligns well with the current agricultural agenda of the Ugandan government, which has set extremely ambitious coffee production goals for the next several years.

**2. Primary post-harvest processing—especially drying and juicing—in the tropical fruits value chain.** Nearly every Ugandan farmer grows tropical fruits of some kind. Although fruits such as mangos, pineapples, and bananas can be highly profitable, they are also perishable and costly to transport. Moreover, markets for unprocessed fruit are typically poorly integrated spatially and prices often fluctuate wildly. Immediately

after harvest prices can collapse locally, with a glut of perishable fruit in markets and roadside stalls. In this context, even rudimentary post-harvest processing technologies can add significant value; this has motivated innovative activities in the public and private sector among both formal and informal players. For example, the Food Technology Incubator at Makerere University has played an active role in developing and diffusing these technologies and in providing the marketing and distributional expertise required to form profitable small and medium-sized enterprises in this value chain.

#### Source

WIPO-Uganda study 'Innovation in the Agro-Based Industry in Uganda: An Empirical Study of Agricultural Innovation in a Least Developed Country'.

with similar interests. Finally, governments can also engage in the direct funding of agricultural R&D. Public-private partnerships also support R&D, education, technology transfer, and incremental problem solving.<sup>34</sup>

The ongoing WIPO-Uganda study titled 'Innovation in the Agro-Based Industry in Uganda: An Empirical Study of Agricultural Innovation in a Least Developed Country' (see Box 1) pays particular attention to the policy options that enhance spillovers from public R&D to private enterprise and to innovation and the productivity of the agri-food sector more broadly.<sup>35</sup> In particular, the study aims to understand how firm innovation processes could help translate public R&D into improved firm or household productivity and

social returns. On this basis, the study will apply existing findings to the case of Uganda, and then analyse how innovation and (formal and informal) IP, and related policies, affect returns on R&D investment.

The possibility of domestic spillovers to other sectors of the Ugandan economy is particularly important in this regard because these spillovers are central to the economic development and poverty alleviation process that can be unleashed by investment and innovation in the agri-food sector. For this reason, the WIPO-Uganda study will focus on domestic innovation relevant to domestic and regional agricultural varieties and market opportunities. A variety of specific policy solutions to questions that will likely emerge throughout the course of the study include (1)

ways to stimulate or import African domestic research and technology to solve local problems; (2) ways to use local brands, local techniques, local tools, local seeds, and local IP to improve the efficiency and dynamism of the agri-food sector; and (3) ways to transfer promising research, innovation, products, and even services that emerge from the Ugandan agri-food sector to neighbouring markets in the surrounding region.

#### Conclusions

Uganda has been taking several measures designed to improve its performance in the innovation rankings. The GII rankings for the period 2013 through 2016 show Uganda to be a consistent innovation outperformer in comparison to other economies

at the same level of development. However, for Uganda to translate this success to economy-wide gains, it needs to address constraints hampering innovation and productivity improvements in its agriculture sector. This chapter has outlined several factors that impede value addition and upgradation of its agriculture value chains. It has also highlighted some possibilities that could improve the country's agri-food innovation. The policy measures required for Uganda to improve its current innovation standing focus on enhancing its institutions to promote and protect IPR, foster innovation, and provide an enabling environment to cultivate collective action. The ongoing WIPO-Uganda study seeks to improve the understanding of the role of innovation and IPR in the Ugandan agriculture sector and will identify key policy responses that have the potential to enhance the impact of agricultural R&D for innovation and technology diffusion. It will offer policy recommendations and describe possible interventions for enhancing innovation and agribusiness in Uganda by providing empirical evidence from an analysis of innovation in the value chain of its key cash crop, coffee.

## Notes

- 1 'Innovation achievers' are countries for which GII scores are higher than expected, based on their level of economic development as measured by GDP per capita. 'Pillar outperformers' are countries that outperform their income group peers in four or more GII pillars.
- 2 Ecuru and Kawooya, 2015.
- 3 World Bank, 2016.
- 4 World Bank, 2016; Uganda Ministry of Agriculture, Animal Industry & Fisheries, 2010.
- 5 Trienekens, 2011.
- 6 Trienekens, 2011; Poulton and Macartney, 2012.
- 7 De Janvry and Sadoulet, 2005; Daviron and Gibbon, 2002.

- 8 Webber and Labaste, 2010.
  - 9 Kaplinsky et al., 2002.
  - 10 LSMS-ISA, 2012.
  - 11 FAOSTAT, 2014b.
  - 12 FAOSTAT, 2014a.
  - 13 FAOSTAT, 2015.
  - 14 World Bank, 2011.
  - 15 Ashour et al. 2016; Benson et al. 2012; Bold et al. 2015.
  - 16 Benson et al., 2012.
  - 17 Kasiye, 2007.
  - 18 Munyambonera et al., 2014
  - 19 Munyambonera et al., 2014.
  - 20 Vargas Hill, 2009.
  - 21 Benson et al., 2012; Jansen et al., 2013.
  - 22 Stevenson et al., 2016.
  - 23 Bulte et al., 2014.
  - 24 World Bank, 2015.
  - 25 Benson et al., 2012.
  - 26 World Bank, 2015.
  - 27 New Rice for Africa (NERICA) is a cultivar group of interspecific hybrid rice developed by the Africa Rice Center (AfricaRice) to improve the yield of African rice cultivars. Kijima et al., 2011.
  - 28 Like financial spot markets, in agriculture spot markets agricultural commodities are traded for immediate delivery.
  - 29 World Bank, 2011.
  - 30 Ecuru and Kawooya, 2015.
  - 31 WIPO, 2017.
  - 32 Dorward et al., 2008.
  - 33 Larsen et al., 2009.
  - 34 Hall, 2006.
  - 35 CDIP/14/7 Project on Intellectual Property and Socio-Economic Development (Phase 2): WIPO-Uganda study 'Innovation in the Agro-Based Industry in Uganda: An Empirical Study of Agricultural Innovation in a Least Developed Country'. Kampala and Geneva: Uganda National Council for Science and Technology, Uganda National Council for Science and Technology and, WIPO Economics and Statistics Division.
- References**
- A.T. Kearney. 2016. 'Africa's Agricultural Transformation Opportunity'. A.T. Kearney Limited U.K. Available at <https://www.atkearney.com/documents/10192/7167515/Africas+Agricultural+Transformation+Opportunity.pdf/8481675a-4942-42cf-a212-4135b85a16ac>.
- Ashour, M., L. Billings, D. Gilligan, J. B. Hoel, and N. Karachiwalla. 2016. 'Do Beliefs about Agriculture Inputs Counterfeiting Correspond with Actual Rates of Counterfeiting? Evidence from Uganda'. IFPRI Discussion Paper 1552. Washington, DC: International Food Policy Research Institute (IFPRI). Available at <http://ebrary.ifpri.org/cdm/ref/collection/p15738coll2/id/130598>
- Benson, T., P. Lubega, S. Bayite-Kasule, T. Mogues, and J. Nyachwo. 2012. 'The Supply of Inorganic Fertilizers to Smallholder Farmers in Uganda'. IFPRI Discussion Paper 01228. Available at <http://ebrary.ifpri.org/cdm/ref/collection/p15738coll2/id/127272>.
- Bold, T., K. C. Kaizzi, J. Svensson, and D. Yanagizawa-Drott. 2015. 'Low Quality, Low Returns, Low Adoption: Evidence from the Market for Fertilizer and Hybrid Seed in Uganda'. Faculty Research Working Paper Series, June 2015. RWP15-033. Boston: Harvard Kennedy School.
- Boucher, S.R. C. Guirking, and C. Trivelli. 2009. 'Direct Elicitation of Credit Constraints: Conceptual and Practical Issues with an Application to Peruvian Agriculture'. *Economic Development and Cultural Change* 57 (4): 609–40.
- Bulte, E. G. Beekman, S. Di Falco, J. Hella, and P. Lei. 2014. 'Behavioural Responses and the Impact of New Agricultural Technologies: Evidence from a Double-Blind Field Experiment in Tanzania'. *American Journal of Agricultural Economics* 96 (3): 813–30.
- Daviron, B., and P. Gibbon. 2002. 'Global Commodity Chains and the African Export Agriculture'. *Journal of Agrarian Change* 2: 137–61.
- De Janvry, A. and E. Sadoulet. 2005. 'Achieving Success in Rural Development: Toward Implementation of an Integral Approach'. *Agricultural Economics* 32 (1): 75–89.
- Dorward, A., J. Kydd, and C. Poulton. 2008. 'Traditional Domestic Markets and Marketing Systems for Agricultural Products'. Technical Report. Washington, DC: World Bank.
- Ecuru, J. and D. Kawooya., 2015. 'Effective Innovation Policies for Development: Uganda'. In *The Global Innovation Index 2015: Effective Innovation Policies for Development*, S. Dutta, B. Lanvin, and W. Sacha, eds. Fontainebleau, Ithaca, and Geneva: INSEAD, Cornell, and WIPO.
- FAOSTAT. 2014a. 'Arable land and land under permanent crops availability' (ratio per person). Available at <http://faostat.fao.org/site/377/default.aspx#ancor> and <http://faostat.fao.org/site/550/default.aspx#ancor>, accessed 1 December 2016.
- . 2014b. 'Evolution of arable land as % of total area'. FAOSTAT, FAO of the UN. Available at <http://faostat.fao.org/site/377/default.aspx#ancor>, accessed 1 December 2016.
- . 2015. 'Index of per capita production'. FAOSTAT, FAO of the UN. Available at: <http://faostat.fao.org/site/612/default.aspx#ancor>, accessed 1 December 2016.

- Hall, A. 2006. 'Public Private Sector Partnerships in an Agricultural System of Innovation: Concepts and Challenges'. Technical Report 2006-002. Maastricht: UNU-MERIT.
- Jansen, J. A., C. S. Wortmann, M. A. Stockton, and C. K. Kaizzi. 2013. 'Maximizing Net Returns to Financially Constrained Fertilizer Use'. *Agronomy Journal* 105 (3): 573–78.
- Kaplinsky, R. M. Morris, and J. Readman. 2002. 'The Globalization of Product Markets and Immiserizing Growth: Lessons from the South African Furniture Industry'. *World Development* 30 (7): 1159–77.
- Kasiry, K. 2007. 'Rural Credit Markets in Uganda: Evidence from the 2005/06 National Household Survey'. Paper submitted for the African Economic Conference 'Opportunities and Challenges of Development for Africa in the Global Arena', September. Available at [http://www.uneca.org/sites/default/files/uploaded-documents/AEC/2007/ibrahim\\_kasiry\\_0.pdf](http://www.uneca.org/sites/default/files/uploaded-documents/AEC/2007/ibrahim_kasiry_0.pdf).
- Kijima, Y., K. Otsuka, and D. Sserunkuuma. 2011. 'An Inquiry into Constraints on a Green Revolution in Sub-Saharan Africa: The Case of NERICA Rice in Uganda'. *World Development* 39 (1): 77–86.
- Larsen, K., R. Kim, and F. Theus. 2009. *Agribusiness and Innovation Systems in Africa*. World Bank Publications. Washington, DC: World Bank.
- LSMS-ISA (Living Standards Measurement Study – Integrated Surveys on Agriculture). 2012. 'Uganda 2011/12 National Panel Survey'. World Bank. Available at <http://econ.worldbank.org/WBSITE/EXTERNAL/EXTDEC/EXTRESEARCH/EXTLSMS/0,,contentMDK:23511127~menuPK:4196884~pagePK:64168445~piPK:64168309~theSitePK:3358997~isCURL:Y~isCURL:Y~isCURL:Y,00.html>.
- Mogues, T., and D. Rosario. 2015. 'The Political Economy of Public Expenditures in Agriculture: Applications of Concepts to Mozambique'. *South African Journal of Economics* 84 (1): 20–39.
- Munyambonera, E., D. Nampewo, A. Adong, and M. Mayanja. 2014. *Access and Use of Credit in Uganda: Unlocking the Dilemma of Financing Small Holder Farmers*. Economic Policy Research Centre, Research Series No. 109. Kampala, Uganda: Economic Policy Research Centre.
- Poulton, C., and J. Macartney. 2012. 'Can Public-Private Partnership Leverage Private Investment in Agricultural Value Chains in Africa? A Preliminary Review'. *World Development* 40 (1): 96–109.
- Ruben R., M. van Boekel, A. van Tilburg, and J. Trienekens, eds. 2007. *Tropical Food Chains: Governance Regimes for Quality Management*. The Netherlands: Wageningen Academic Publishers.
- Stevenson, J., T. Kilic, J. Ilukor, S. Gourlay, A. Killian, and J. Sserumaga. 2016. 'Genotyping Maize Varieties in Uganda. Consultative Group on International Agricultural Research, Independent Science and Partnership Council'. Presentation at the 2016 Annual Meeting of the American Agricultural Economics Association.
- Trienekens, J.H. 2011. 'Agricultural Value Chains in Developing Countries: A Framework for Analysis'. *International Food and Agribusiness Management Review* 14 (2): 51–82.
- Uganda Ministry of Agriculture, Animal Industry & Fisheries. 2010. 'Agriculture for Food and Income Security: Agriculture Sector Development Strategy and Investment Plan: 2010/11-2014/15'. Ministry of Agriculture, Animal Industry & Fisheries. Kampala: Government of Republic of Uganda.
- Vargas Hill, R. 2009. 'Using Stated Preferences and Beliefs to Identify the Impact of Risk on Poor Households'. *The Journal of Development Studies* 45 (2): 151–71.
- Webber, C.M., and C. Labaste. 2010. *Building Competitiveness in Africa's Agriculture: A Guide to Value Chain Concepts and Applications*. Washington, DC: World Bank.
- WIPO (World Intellectual Property Organization). 2017. 'Country Statistical Profile: Uganda.' [http://www.wipo.int/ipstats/en/statistics/country\\_profile/profile.jsp?code=UG](http://www.wipo.int/ipstats/en/statistics/country_profile/profile.jsp?code=UG), accessed 01 March 2017.
- World Bank. 2011. 'Agriculture for Inclusive Growth in Uganda: Inclusive Growth Policy Note 2.' Washington, DC: World Bank. Available at [http://siteresources.worldbank.org/INTDEBTDEPT/Resources/468980-1316457581843/CaseStudy\\_Uganda\\_01.pdf](http://siteresources.worldbank.org/INTDEBTDEPT/Resources/468980-1316457581843/CaseStudy_Uganda_01.pdf).
- . 2015. 'Project Appraisal Document on a Proposed Credit to the Republic of Uganda for an Agriculture Cluster Development Project'. Technical Report. Washington, DC: World Bank.
- . 2016. *World Development Indicators 2016*. Database. Washington, DC: World Bank. Available at <http://data.worldbank.org/indicator/NV.AGR.TOTL.ZS>.

# Special Section

Clusters



## Identifying and Ranking the World's Largest Clusters of Inventive Activity

KYLE BERGQUIST, CARSTEN FINK, and JULIO RAFFO, WIPO

The Global Innovation Index (GII) has traditionally focused on the innovation performance of countries. This focus is rooted in the recognition that innovation outcomes are determined by factors—such as national policies, laws and institutions, federal spending, and cultural ties—that operate at the level of countries as a whole. The country perspective will continue to be a central focus of the GII. However, this emphasis masks important differences in innovation performance within countries, because innovation activities tend to be geographically concentrated in specific clusters linked to a single city or a set of neighbouring cities.

Adopting a cluster perspective opens the door to better understanding the determinants of innovation performance that do not operate at the country level—such as physical and economic geography, sub-national policies and institutions, social networks, and local labour market linkages. The GII has long recognized that innovation hubs at the city or regional level tend to be drivers of innovation performance that deserve an in-depth analysis.<sup>1</sup> Unfortunately, gaining empirical insight into the comparative performance of individual innovation clusters is challenging. There is neither a generally accepted definition of what actually

constitutes an innovation cluster nor an ‘off-the-shelf’ list of such clusters (see the section on assessing regional innovation clusters in Chapter 1). In addition, the geographical boundaries of innovation clusters typically do not correspond to the geographical units for which governments or other entities collect statistical data.

Seeking to overcome these challenges, this special section presents an empirical approach to identifying and ranking the world's largest clusters of inventive activity on the basis of patent filings. Patent data offer rich information on the location of innovative activity. Many researchers have already made use of these data to study individual clusters or selected clusters within a particular region.<sup>2</sup> Our approach goes beyond existing work by identifying and ranking innovation clusters on an internationally comparable basis.

We present our empirical approach in several stages. We first describe the patent data that underlie our research and explain how we geocoded these data to enable the identification of clusters in the next section. We then describe the algorithm we employed to map clusters. Once identified, we discuss how we measured the size of the clusters and explore how sensitive the resulting top 100 rankings are to the algorithm's input parameters. We

finally present the key characteristics of the top 100 clusters as they emerge from patent data, and end with a few concluding remarks.

---

### Description of patent data

Patents protect inventions that are new, involve an inventive step, and are capable of industrial application. Innovators interested in obtaining exclusive rights for their inventions have to formally apply for protection at authoritative offices. The patent records of these offices thus offer rich—and otherwise rare—information on the nature of inventive activity. Nonetheless, it is important to point out at the outset that patent data provide only an incomplete and imperfect perspective on overall innovative activity. The well-known limitations of patent data include the following:<sup>3</sup>

- Patents (mostly) capture technological inventions and thus miss out on non-technological innovations—such as organizational or logistical advances—that can be an important source of productivity gains in an economy.
- Patents do not capture all technological inventions because inventors can also protect their

Comments and suggestions from Edward Harris, Yo Takagi, Sacha Wunsch-Vincent, Maryam Zehtabchi, and Hao Zhou are gratefully acknowledged. The views expressed here are those of the authors, and do not necessarily reflect those of the World Intellectual Property Organization or its member states.



inventions with trade secrets—another option for protecting inventions but not a perfect substitute.

- Some industries use the patent system more intensively than others, depending on the nature of relevant technologies and prevailing business strategies.<sup>4</sup>
- Some patents are more valuable and technologically important than others; indeed, research has pointed to a highly skewed distribution of patent value, with relatively few patents accounting for a high share of the overall value of patents.<sup>5</sup>

These limitations do not mean that patent data cannot usefully inform innovation research. However, they should be kept in mind when interpreting the cluster rankings described in this section.

For our investigation, we rely on patents published between 2011 and 2015 under the Patent Cooperation Treaty (PCT) System, which is operated by the World Intellectual Property Organization (WIPO). The PCT is an international cooperation agreement that patent applicants use when they seek patent protection internationally. The System came into force in 1978; by 2010, it had 142 members that together accounted for more than 98% of national and regional patent filings worldwide.<sup>6</sup> In a nutshell, by filing a patent application under the PCT, applicants can delay deciding whether and in which countries they would like to pursue exclusive rights for their inventions, thereby saving in fees and legal costs. In addition, the patent receives a first evaluation, which similarly helps applicants in their subsequent patent filing decisions.<sup>7</sup>

Our reliance on PCT filing data has two motivations. First, the PCT

System applies a single set of procedural rules to applicants from around the world and collects information based on uniform filing standards. This reduces potential biases that would arise if similar information was collected from different national sources applying different rules and standards. Second, PCT applications are likely to capture the most commercially valuable inventions. Patenting is a costly process, and the larger the number of jurisdictions in which a patent is sought, the greater the patenting cost. An applicant will seek international patent protection only if the underlying invention generates a sufficiently high return—one that is higher than for patents that are filed only domestically.<sup>8</sup>

On the downside, not all patent applications for which applicants pursue protection internationally go through the PCT System, and not every PCT application will eventually result in a granted patent.<sup>9</sup> Systemic differences in PCT use across countries, industries, and applicants may thus introduce a measurement bias, which—again—should be kept in mind when interpreting our cluster rankings.

#### Geocoding PCT inventor addresses

Between 2011 and 2015, approximately 950,000 applications were published under the PCT System. Each of these applications lists the names and addresses of the inventor(s) responsible for the invention described in the application. In total, these amount to 2.7 million addresses.

Previous work using patent data assigned inventors to districts, primarily on the basis of the postal codes included in their addresses.<sup>10</sup> However, this approach biases the identification and measurement of clusters because of the so-called modifiable areal unit

problem (MAUP)—the choice of district boundaries exerting a strong influence on the shape and size of clusters.<sup>11</sup> The MAUP bias would be compounded in our case, because we seek to identify clusters on an internationally comparable basis and the geographical units associated with postal codes, for example, differ substantially in both characteristics and size, both within and across countries.

For this reason, we geocoded inventor addresses at a higher level of accuracy—ideally at the rooftop level—using the returns of Google Maps. Although the quality of the returns varied, we were able to obtain highly accurate geo-coordinates for most inventors.<sup>12</sup> Table 1 presents a summary of the geocoding results for the top PCT-filing countries. If Google Maps could not identify a specific geocode associated with an address, it typically returned an approximate area where that address is found. Extrapolating this information we were able to categorize our results into different accuracy scores. For most countries, more than two-thirds of the returned geocodes were within a 100 metre accuracy radius and more than 90% of the returns were within a 25 kilometre radius, which is the accuracy threshold we employed for geocodes to be used for identifying clusters.<sup>13</sup> Since patent applications can list more than one inventor, the share of PCT filings with at least one inventor meeting the accuracy threshold is even higher.

#### Density-based cluster identification

Researchers have used a variety of methods to identify clusters from raw spatial data, depending on the nature of the data and the hypothesized forces giving rise to clustering. These methods range from pure visual identification to different kinds of technical algorithms.

**Table 1: Summary of geocoding results**

| Country                  | Addresses (%)              |                            |                            | Share of PCT filings covered by accurate geocodes (%) |
|--------------------------|----------------------------|----------------------------|----------------------------|---|
|                          | Geocode accuracy of ≤100 m | Geocode accuracy of ≤10 km | Geocode accuracy of ≤25 km |   |
| Australia                | 84.6                       | 96.6                       | 97.3                       | 97.9  |
| Austria                  | 92.5                       | 97.6                       | 98.9                       | 99.1  |
| Belgium                  | 54.8                       | 93.0                       | 95.4                       | 96.3  |
| Canada                   | 78.3                       | 95.6                       | 95.9                       | 96.8  |
| China                    | 25.4                       | 60.8                       | 94.9                       | 94.9  |
| Denmark                  | 92.2                       | 94.1                       | 94.1                       | 95.5  |
| Finland                  | 85.3                       | 92.1                       | 93.0                       | 95.2  |
| France                   | 85.2                       | 93.3                       | 94.2                       | 96.8  |
| Germany                  | 96.8                       | 97.9                       | 97.9                       | 98.7  |
| Hungary                  | 90.1                       | 91.4                       | 91.4                       | 94.5  |
| India                    | 60.6                       | 76.7                       | 77.5                       | 85.2  |
| Israel                   | 64.8                       | 79.2                       | 86.9                       | 80.1  |
| Italy                    | 83.5                       | 85.4                       | 85.4                       | 88.3  |
| Japan                    | 81.7                       | 89.9                       | 89.9                       | 91.3  |
| Malaysia                 | 76.0                       | 79.8                       | 79.8                       | 83.2  |
| Netherlands              | 96.9                       | 99.4                       | 99.5                       | 99.5  |
| Norway                   | 86.8                       | 94.4                       | 94.9                       | 95.5  |
| Korea, Rep.              | 34.7                       | 78.6                       | 89.4                       | 89.3  |
| Russian Federation       | 54.5                       | 90.2                       | 93.6                       | 96.1  |
| Singapore                | 78.1                       | 79.0                       | 79.0                       | 84.5  |
| Spain                    | 66.1                       | 96.0                       | 98.8                       | 98.8  |
| Sweden                   | 91.2                       | 92.0                       | 92.0                       | 94.8  |
| Switzerland              | 83.7                       | 97.7                       | 98.2                       | 98.5  |
| United Kingdom           | 70.7                       | 97.5                       | 97.8                       | 98.2  |
| United States of America | 83.0                       | 91.7                       | 97.5                       | 98.1  |

Source: WIPO IP Statistics Database, February 2017; Google Maps API, April 2017.

Having considered the alternative options,<sup>14</sup> we adopted the density-based algorithm for discovering clusters originally proposed by Ester et al. (1996), also referred to as the 'DBSCAN algorithm'. Two reasons determined this choice. First, this algorithm can account for inventor address points that do not belong to any cluster or 'noise points'. This is important for our dataset, because patenting can occur outside of any innovation cluster—by, say, single 'garage inventors'. Second, we are interested in descriptively measuring the innovation output of different localities, while initially being agnostic about what precisely drives

the formation of these clusters. The DBSCAN algorithm allows us to flexibly map clusters across countries with varying physical and economic geographies on the basis of the same density criteria.

We performed the DBSCAN algorithm on the geocoded inventor locations. In doing so, we treated multiple listings of the same address—for example, a single inventor being listed in multiple patent applications—as separate data points.

The DBSCAN algorithm requires two input parameters: the radius of the cluster-identifying circle around any given data point, and the minimum number of data

points within that circle required for them to be counted towards a cluster. The choice of these input parameters critically determines the shape and size of identified clusters. We tested various combinations of input parameters with three guiding criteria. First, we focused on identifying the world's largest innovation clusters, which calls for a relatively high-density threshold. Second, we visually inspected the resulting clusters to evaluate the extent to which they correspond to intuitive notions of existing clusters. Third, we made use of co-inventor relationships to evaluate the fit of the identified clusters. In particular, we gave preference to parameters that minimized the share of co-inventors outside the identified cluster but located within 160 kilometres of the cluster midpoint.

On the basis of these criteria, we settled on baseline input parameters of 13 kilometres (radius) and 2,000 (minimum number of data points), corresponding to a density of approximately five listed inventors per square kilometre.<sup>15</sup> With these parameter values, the DBSCAN algorithm identified 162 clusters in 25 countries.

Although most clusters were geographically separated from one another, a few were contiguous.<sup>16</sup> In order to decide whether to merge these contiguous clusters into one, we again made use of co-inventor relationships. In particular, we calculated the share of a cluster's co-inventors belonging to all the other clusters as well as to two noise categories—namely, co-inventors located within and beyond 80 kilometres of the cluster midpoint not belonging to any other cluster. We then merged two clusters if two conditions were met for at least one of the clusters: first, the minimum distance between any two points of the two clusters was less than 5 kilometres; and second,

the neighbouring cluster accounted for the largest share of co-inventors among all clusters worldwide plus the two noise categories. This procedure led to the merging of 16 contiguous clusters into eight distinct clusters, so that we ended up with 154 clusters for our ranking.<sup>17</sup>

### Measuring cluster size and sensitivity analysis

We measured the size of the identified clusters by the number of PCT applications associated with the data points in a given cluster. In doing so, we adopted a fractional counting approach, whereby counts reflect the share of a patent's inventors present in a particular cluster.<sup>18</sup> For example, a patent that lists three inventors in cluster A and one inventor in cluster B would contribute 0.75 to cluster A and 0.25 to cluster B.<sup>19</sup>

Table 1 in Annex 2 presents the resulting ranking of the top 100 clusters. The top 100 clusters account for 59.0% of all PCT filings in 2011–15, the period under consideration. We named clusters according to the main city or cities covered by the cluster. Tokyo–Yokohama—with a wide margin—emerges as the top-ranked cluster, followed by Shenzhen–Hong Kong (China), San Jose–San Francisco, Seoul, and Osaka–Kobe–Kyoto. These five clusters alone account for 23.9% of all PCT filings.

Figure 1 in Annex 1 depicts the location of the top-100 clusters on a world map, also showing the 'raw' inventor address data points. Figures 2–4 offer zoomed-in regional perspectives and Figures 5–7 depict the shape of the top-3 clusters.<sup>20</sup>

The distribution of clusters across countries is highly uneven. Seven countries feature four or more clusters in the top 100: the United States of America (USA, has 31), Germany (12), Japan (8), China (7), France

(5), Canada (4), and the Republic of Korea (4). An additional 16 countries host between one and three clusters.<sup>21</sup> Among middle-income economies other than China, India features three clusters and Malaysia and the Russian Federation each feature one. The top 100 do not include any cluster from Latin America and the Caribbean, Sub-Saharan Africa, or Northern Africa and Western Asia.

The distribution of clusters within countries is also uneven. Notably, in the case of the USA, fewer than half of the 50 states feature a cluster, while California (CA), New York (NY), and Texas (TX) each feature three or more. Finally, note that several clusters span more than one territory—most notable of these is the cluster located in the tri-border region around Basel.

How sensitive is the ranking presented in Table 1 in Annex 2 to different cluster-identifying input parameters? We tested different combinations of input parameters and compared the results to our baseline results. Two important insights emerged. First, although different input parameters influence the exact shape and size of the clusters, the resulting rankings were for the most part similar, with clusters moving up or down only a few ranks, especially for those in the top 30.<sup>22</sup> Tokyo–Yokohama consistently emerged as the top cluster. Second, two prominent (sets of) clusters were particularly sensitive to the chosen input parameters: New York and Frankfurt–Mannheim either emerged as broad clusters—as shown in Table 1 in Annex 2—or were divided into smaller clusters associated with the main population centres within those two clusters. These included Trenton, New Jersey (NJ); Newark, NJ; and Armonk, NY, for the former, and Wiesbaden,

Mannheim–Heidelberg, and Karlsruhe for the latter. Once divided, the smaller clusters had lower ranks, though Frankfurt and New York typically remained within the top 30.

### Cluster characteristics

As already mentioned, patent data provide rich information on the nature of inventive activity and we can exploit these data further to characterize the top 100 clusters. Table 2 in Annex 2 presents the largest patent filing entity, the main field of technology, the share of universities and public research organizations (PROs), the largest co-inventing cluster,<sup>23</sup> and the share of women inventors associated with each cluster.

For most clusters, the largest patent applicant is a company, although for several of them it is a university—most notably the Massachusetts Institute of Technology for the 8th ranked Boston–Cambridge cluster. Interestingly, several companies constitute the top applicant for more than one cluster. Ericsson stands out as the largest applicant in five different clusters. Siemens and Intel each appear as the top applicant in four different clusters.

There are pronounced differences in the share of PCT filings accounted for by a cluster's top applicant. For many clusters, this share stands below 10%, suggesting a high degree of applicant diversity. For others, this share is higher, pointing to a more concentrated distribution of applicants within clusters. Most notably, Philips accounts for 85% of the 18th ranked Eindhoven cluster, suggesting a cluster largely revolving around a single company.

Cluster diversity is also reflected in the share of the main technological field associated with a cluster's patent filings. For example, the 2nd ranked Shenzhen–Hong Kong (China)

cluster has a strong focus on digital communications, with around 41% of patent filings falling into this technology field. By contrast, the 1st ranked Tokyo–Yokohama cluster appears significantly more diversified, with its main technology field—electrical machinery, apparatus, and energy—accounting for only 6.3% of its PCT filings. The most prominent technology field among the top 100 clusters is medical technology—accounting for the top field in 17 clusters—followed by digital communication (16), pharmaceuticals (15), and computer technology (12). Overall, 18 different technology fields—out of a total of 35—feature as the top field in at least one cluster.

Interesting variation also exists in the prominence of universities and PROs among the top 100 clusters. For some clusters—in particular, Baltimore, Daejeon, Grenoble, Kuala Lumpur, and Singapore—universities and PROs account for more than one-third of PCT filings. In many others, inventive activity largely occurs in companies, with academic institutions accounting for negligible filing shares. Interestingly, many clusters featuring medical technology or pharmaceuticals as their top field have relatively high university and PRO shares, underlying the importance of science linkages in these two fields.

How do the top 100 clusters connect to one another? One way of answering this question is to look at co-inventors located outside a cluster's borders, specifically in the other 99 clusters. On this basis, Table 2 in Annex 2 identifies a cluster's most important partner cluster—defined as the cluster accounting for the largest share of external co-inventors. At least two interesting insights emerge. First, distance and cluster size—in line with the classic gravity model of economists—can in

many cases explain the identity of the top partner cluster. For example, Tokyo–Yokohama is the top partner cluster for all other clusters in Japan and Seoul is the top partner cluster for all other clusters in the Republic of Korea. Second, the San Jose–San Francisco cluster is by far the most collaborative cluster, emerging as the top partner in 24 cases, including 6 clusters located outside of the USA.

The value of the top partner's share of external co-inventors captures the diversity of partner clusters. The low share for San Jose–San Francisco confirms the high degree of partner diversity for this cluster. Conversely, many clusters in Japan and the Republic of Korea show high shares, pointing to a more confined set of partners—possibly influenced by language barriers.

The last column in Table 2 in Annex 2 presents the share of women inventors among all inventors located in a particular cluster. As can be seen, women inventors account for fewer than one-third of all inventors across all clusters. However, there is substantial variation in the extent of women's participation; among the top 10 clusters alone the share ranges from 5.6% for Nagoya to 28.9% for Shenzhen–Hong Kong (China). Overall, the patterns shown largely reflect prior insights on the participation of women inventors: clusters in China and the Republic of Korea tend to be relatively more gender equal, as are clusters for which the main field of technology is either pharmaceuticals or biotechnology.<sup>24</sup>

### Concluding remarks

This special section has described an empirical approach towards identifying and measuring the size of the world's largest clusters of inventive activity on the basis of international patent filings. It provides a fresh

perspective on the spatial agglomeration of innovative activity, relying on a globally harmonized set of criteria.

Notwithstanding the measurement progress offered by this approach, it is important to view the analysis presented here as a first step in a longer-term effort to better capture innovative activity at the sub-national level. Our approach relies exclusively on patent data, which are an imperfect metric for inventive activity and an even less perfect metric for innovative activity more broadly. In addition, although the identification and ranking of clusters is reasonably robust to different input parameter choices, the rankings should be used with due caution. Aside from Tokyo's top rank, they are best interpreted as orders of magnitude, with clusters moving up and down a few ranks depending on meaningful parameter choices.

For the future, we aim to improve and broaden the analysis presented here in at least three ways. First, we will seek to obtain more empirical insights into the forces giving rise to clustering and use these insights to refine our cluster identification approach. Second, we will analyse clusters at the level of specific technologies and industries. Finally, we will try to include other measures of innovative activity—such as scientific publications and the performance of universities and firms—in the analysis to obtain a more complete picture of the innovation taking place across the world's largest clusters.

### Notes

- 1 See especially the 2013 edition of the GII on the theme of 'Local Dynamics of Innovation'.
- 2 See, for example, Boix and Galletto, 2007.
- 3 See IPO (2015) for a practical guide on the value and limitations of patent information for empirical analysis and WIPO (2011) for additional background on the economics of the patent system.

- 4 See, for example, Hall and Ziedonis, 2001.
- 5 See, for example, Gambardella et al., 2008.
- 6 The four largest economies that were not party to the PCT System in 2010 were Saudi Arabia, Argentina, the Bolivarian Republic of Venezuela, and Pakistan. Saudi Arabia joined in 2013. An applicant from a non-member state can still file a PCT application if there is a co-applicant from a member state. However, non-membership generally has a negative effect on the participation of applicants from non-members in the System, which one should keep in mind when interpreting the rankings presented here. The 98% coverage figure is an estimate based on national patent filing statistics available in WIPO's IP Statistics Data Centre (<http://ipstats.wipo.int>).
- 7 See WIPO (2016) for a more detailed description of the PCT System.
- 8 For other empirical investigations relying on PCT data, see Miguelez and Fink (2013) and Lax-Martínez et al. (2016).
- 9 In 2015, so-called PCT national phase entries accounted for 57% of non-resident patent filings worldwide (WIPO, 2016). However, this figure understates the 'market share' of the PCT, because it does not account for PCT applications that do not see any subsequent national phase entry.
- 10 See, for example, Maraut et al., 2008.
- 11 See Oppenshaw (1983) for the seminal discussion of the MAUP.
- 12 For some jurisdictions, this required fine-tuning the address feeds—mainly by progressively removing information that seemingly confused the API's address matching algorithm, such as the applicant name or outdated postal codes.
- 13 The choice of this threshold partly reflects the reporting categories of the Google Maps API and the choice of cluster density parameters, as described in the next section.
- 14 For a recent review of clustering methodologies, see Sharma et al., 2016.
- 15 Since DBSCAN relies on latitude and longitude coordinates to calculate the distance between two points, the second (inverse) geodetic problem implies somewhat shorter distances the further away those points are from the equator.
- 16 The presence of contiguous clusters partly reflects the nature of the DBSCAN algorithm, because this method has difficulties accounting for obstacles—such as rivers or train tracks—that cut through a cluster. Imperfect geocodes—say, those with an accuracy radius of only 25 kilometres—may compound this problem because they often lead to the same geocode covering a large number of listed inventors. Our choice of a relatively large radius (13 kilometres) for DBSCAN minimizes but does not completely overcome these problems.
- 17 In particular, we merged Alzenau with Frankfurt–Mannheim, Karlsruhe with Frankfurt–Mannheim, Bonn with Cologne–Düsseldorf, two separate clusters in Houston clusters into a single entity, Södertälje with Stockholm, Takasaki with Tokyo–Yokohama, and Tsukuba with Tokyo–Yokohama. In addition, we merged Cheongju with Daejeon. Although Daejeon was only the second largest co-inventing cluster for Cheongju after Seoul, this largely reflects the strong presence of the Seoul cluster in the Republic of Korea. Indeed, all other identified clusters in the Republic of Korea feature Seoul as the largest co-inventing cluster (see Table 2 in Annex 2). It is also worth pointing out that the merging of clusters had a negligible influence on the overall ranking of clusters, because at least one of the merging entities was always small in size.
- 18 As alternative size measures, we also tested the simple count of listed inventors belong to a given cluster, and the (non-fractional) number of patents associated with those inventors. The resulting rankings correlated closely with the ranking relying on the fractional count for the top 35 clusters, though it led to several sizeable rank shifts for the remaining clusters that overall showed smaller differences in size scores. We report only rankings relying on fractional patent counts because this is the conceptually most appropriate size measure.
- 19 Our fractional counts ignore inventors for which we obtained inaccurate geocodes (> 25 kilometres). For example, if a patent has three inventors and the geocode for one inventor is inaccurate, we assigned 0.5 scores to the two inventors with accurate geocodes. However, given the small share of listed inventors and patents affected (see Table 1), the resulting measurement bias is likely to be small.
- 20 Note that the visualization of the Shenzhen–Hong Kong (China) cluster is somewhat misleading, as the relatively less accurate geocoding results for China (see Table 1) imply that many Chinese addresses are associated with the same geocode; in fact inventors located in Shenzhen account for a far higher share of cluster points than inventors located in Hong Kong (China).
- 21 This count of clusters assigns multi-territory clusters to the territory accounting for the largest share of PCT filings. Note that an additional two countries—Norway and Hungary—feature clusters that do not rank among the top 100.
- 22 For this sensitivity analysis, we ignored extreme parameter values that led to counter-intuitive results—such as mega-clusters spanning several hundred kilometres.
- 23 The 'largest co-inventing cluster' refers to the cluster that appears most often as the location of a listed co-inventor for patents associated with a primary cluster.
- 24 See Lax-Martínez et al., 2016.

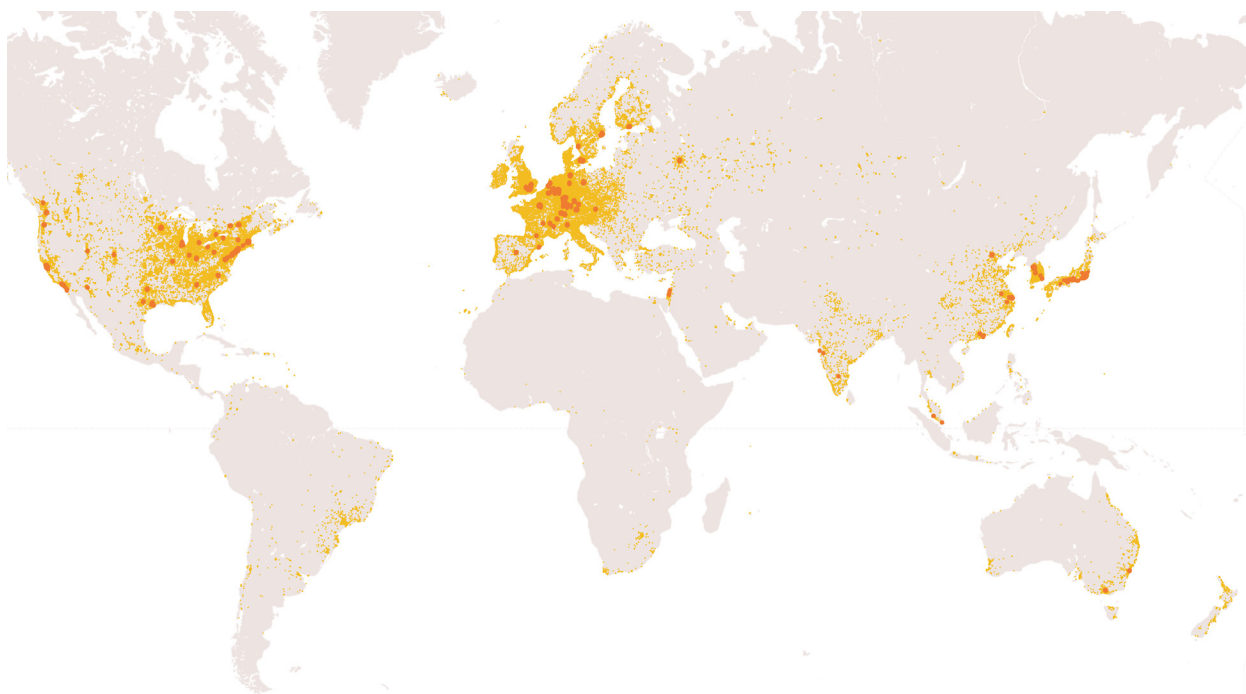
## References

- Boix, R. and V. Galletto. 2009. 'Innovation and Industrial Districts: A First Approach to the Measurement and Determinants of the I-District Effect'. *Regional Studies* 43 (9): 1117–33.
- Ester, M., H.-P. Kriegel, J. Sander, and X. Xu. 1996. 'A Density-Based Algorithm for Discovering Clusters in Large Spatial Databases with Noise'. Proceedings of the 2nd International Conference on Knowledge Discovery and Data Mining, Portland, Oregon, USA, 2–4 August 1996. 226–31.
- Gambardella, A., D. Harhoff, and B. Verspagen. 2008. 'The Value of European Patents'. *European Management Review* 5 (2): 69–84.
- Google Inc. 2017. Google Maps API. Google Developers. Available at <https://developers.google.com/maps/> (accessed April 2017).
- Hall, B. H. and R.H. Ziedonis. 2001. 'The Patent Paradox Revisited: An Empirical Study of Patenting in the U.S. Semiconductor Industry, 1979–1995'. *The Rand Journal of Economics* 32 (1): 101–28.
- IPO (Intellectual Property Office). 2015. *The Patent Guide: A Handbook for Analysing and Interpreting Patent Data*, 2nd edition. Newport, United Kingdom: Intellectual Property Office, © Crown Copyright 2015.
- Lax-Martínez, G. L., J. Raffo, and K. Saito. 2016. 'Identifying the Gender of PCT Inventors'. *Economic Research Working Paper* No. 33. Geneva: WIPO.
- Maraut, S., H. Dernis, C. Webb, V. Spiezia, and D. Guellec. 2008. 'The OECD REGPAT Database: A Presentation'. *Science, Technology, and Industry Working Papers* No. 2008/2. Paris: OECD.
- Miguelez, E. and C. Fink. 2013. 'Measuring the International Mobility of Inventors: A New Database'. *Economic Research Working Paper* No. 8. Geneva: WIPO.
- Oppenshaw, S. 1983. *The Modifiable Areal Unit Problem*. Norwich, England: Geobooks.
- Sharma, A., R. K. Gupta, and A. Tiwari. 2016. 'Improved Density Based Spatial Clustering of Applications of Noise Clustering Algorithm for Knowledge Discovery in Spatial Data'. *Mathematical Problems in Engineering*. Available at <http://dx.doi.org/10.1155/2016/1564516>.
- WIPO (World Intellectual Property Organization). 2011. *World Intellectual Property Report: The Changing Face of Innovation*. Geneva: WIPO.
- . 2016. *Patent Cooperation Treaty Yearly Review*. Geneva: WIPO.



## Maps of Clusters

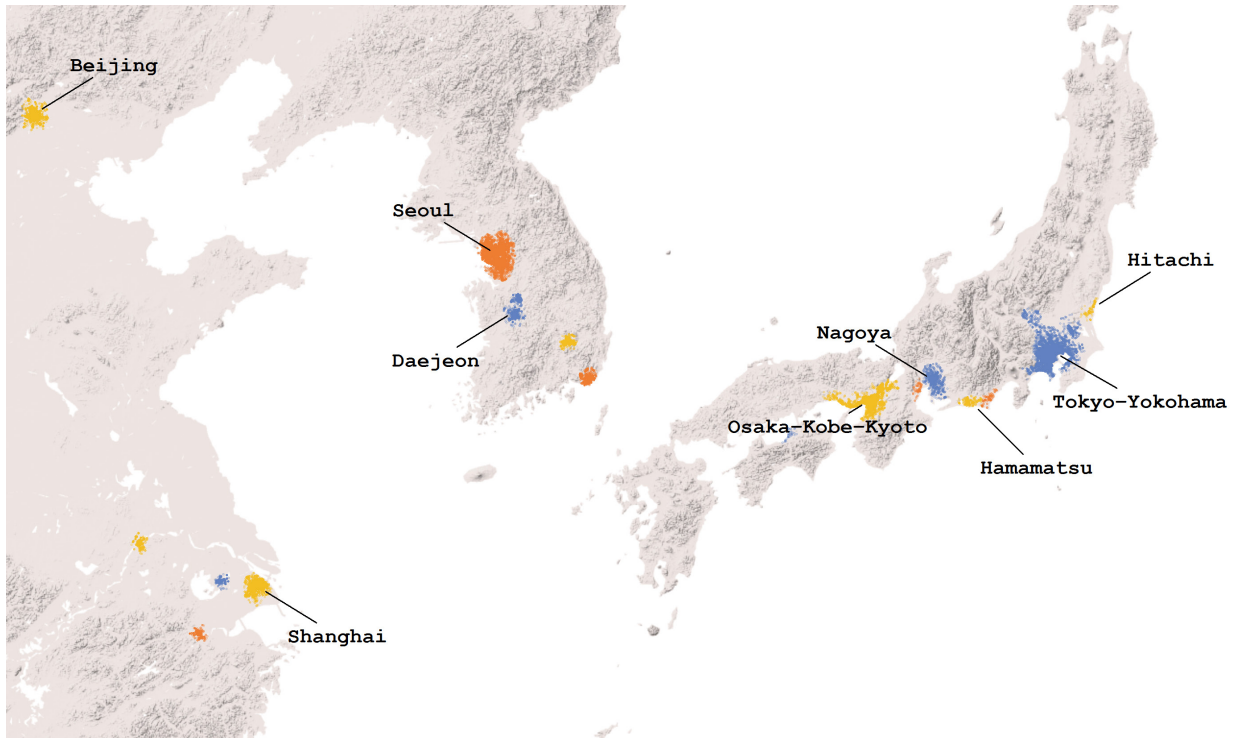
**Figure 1: Top 100 clusters worldwide**



Source: WIPO IP Statistics Database, February 2017; Google Maps API, April 2017.

Map data: Google, INEGI 2017.

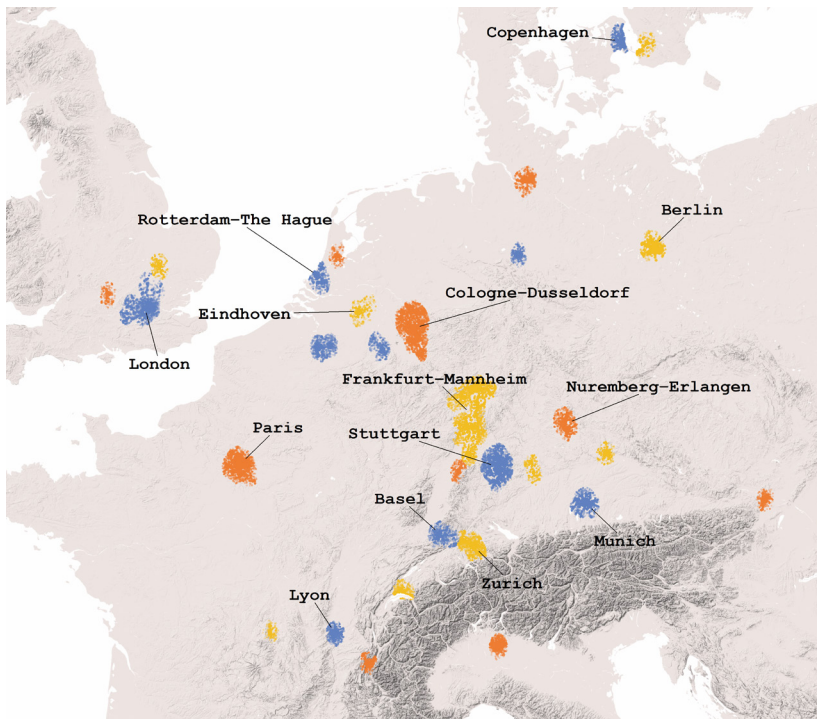
Note: Yellow colour represents noise; orange dots represent clusters.

**Figure 2: Regional clusters: Asia**

Source: WIPO IP Statistics Database, February 2017; Google Maps API, April 2017.

Map data: Google, SK telcom, ZENRIN 2017.

Note: Colours have been assigned based on the colour of the nearest neighbours (in order to make clear the distinction between any two clusters).

**Figure 3: Regional clusters: Europe**

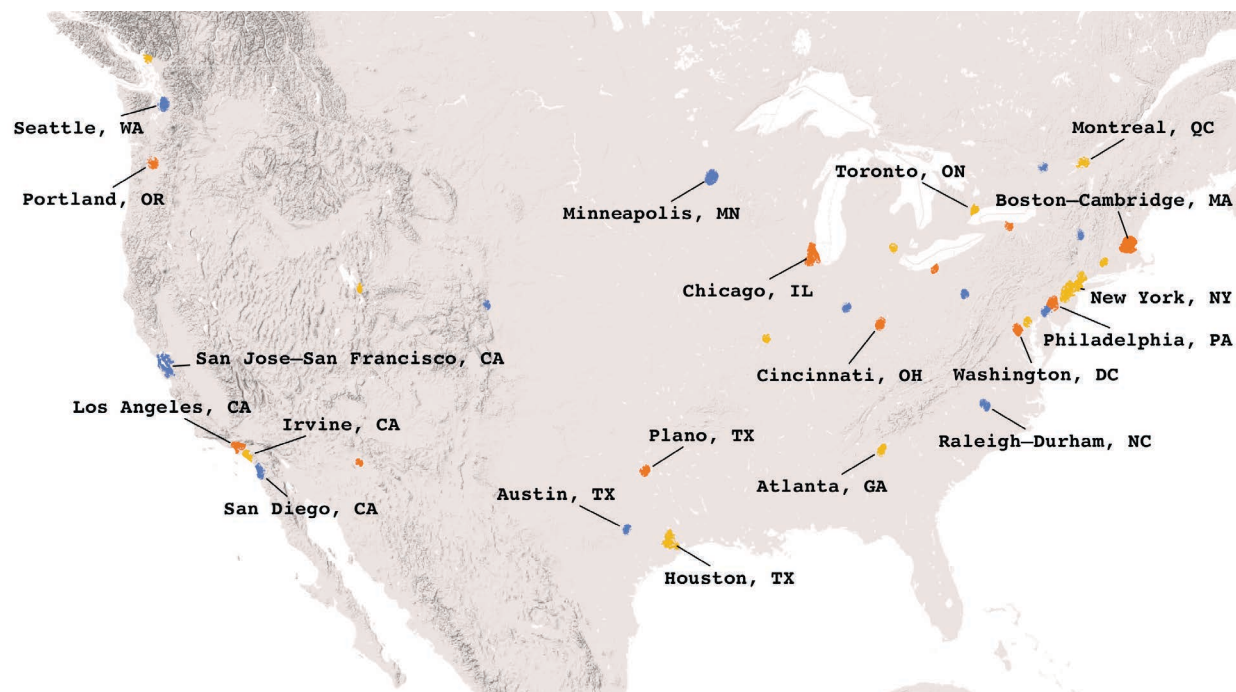
Source: WIPO IP Statistics Database, February 2017; Google Maps API, April 2017.

Map data: Google, Inst. Geogr. Nacional, GeoBasis-DE/BKG 2017.

Note: Colours have been assigned based on the colour of the nearest neighbours (in order to make clear the distinction between any two clusters).



Figure 4: Regional clusters: Northern America

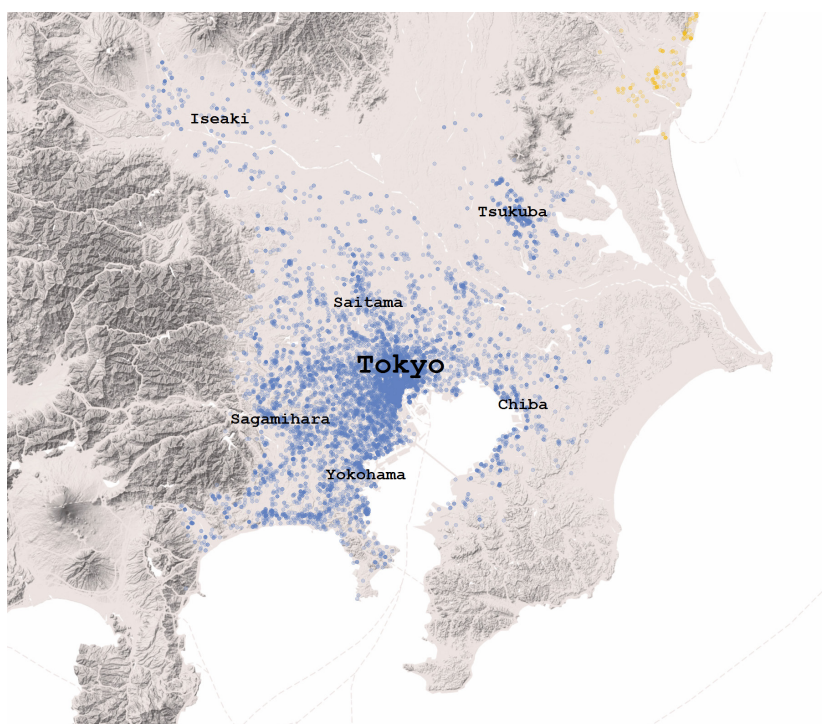


Source: WIPO IP Statistics Database, February 2017; Google Maps API, April 2017.

Map data: Google, INEGI 2017.

Note: Colours have been assigned based on the colour of the nearest neighbours (in order to make clear the distinction between any two clusters).

Figure 5: Top-ranked cluster: Tokyo-Yokohama



Source: WIPO IP Statistics Database, February 2017; Google Maps API, April 2017.

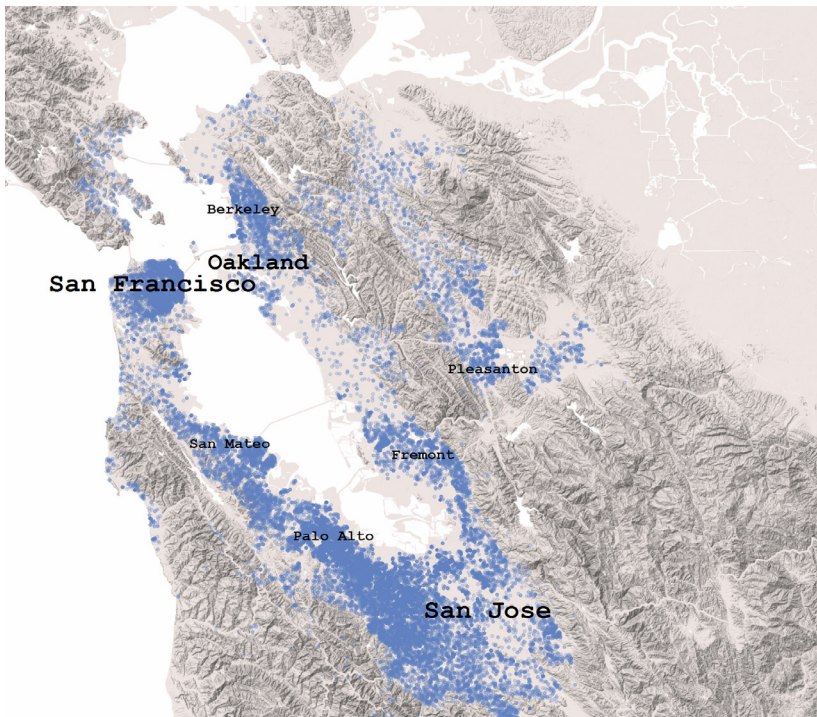
Map data: Google, ZENRIN 2017.

**Figure 6: Second-ranked cluster: Shenzhen–Hong Kong (China)**



Source: WIPO IP Statistics Database, February 2017; Google Maps API, April 2017.  
Map data: Google 2017.

**Figure 7: Third-ranked cluster: San Jose–San Francisco**



Source: WIPO IP Statistics Database, February 2017; Google Maps API, April 2017.  
Map data: Google 2017.

**Table 1: Cluster ranking**

| Rank | Cluster name               | Territory(ies)             | Number of PCT filings |
|------|----------------------------|----------------------------|-----------------------|
| 1    | Tokyo–Yokohama             | Japan                      | 94,079                |
| 2    | Shenzhen–Hong Kong (China) | China/Hong Kong (China)    | 41,218                |
| 3    | San Jose–San Francisco, CA | United States of America   | 34,324                |
| 4    | Seoul                      | Korea, Rep.                | 34,187                |
| 5    | Osaka–Kobe–Kyoto           | Japan                      | 23,512                |
| 6    | San Diego, CA              | United States of America   | 16,908                |
| 7    | Beijing                    | China                      | 15,185                |
| 8    | Boston–Cambridge, MA       | United States of America   | 13,819                |
| 9    | Nagoya                     | Japan                      | 13,515                |
| 10   | Paris                      | France                     | 13,461                |
| 11   | New York, NY               | United States of America   | 12,215                |
| 12   | Frankfurt–Mannheim         | Germany                    | 11,813                |
| 13   | Houston, TX                | United States of America   | 9,825                 |
| 14   | Stuttgart                  | Germany                    | 9,528                 |
| 15   | Seattle, WA                | United States of America   | 8,396                 |
| 16   | Cologne–Dusseldorf         | Germany                    | 7,957                 |
| 17   | Chicago, IL                | United States of America   | 7,789                 |
| 18   | Eindhoven                  | Netherlands/Belgium        | 7,222                 |
| 19   | Shanghai                   | China                      | 6,639                 |
| 20   | Munich                     | Germany                    | 6,578                 |
| 21   | London                     | United Kingdom             | 6,548                 |
| 22   | Tel Aviv                   | Israel                     | 5,659                 |
| 23   | Daejeon                    | Korea, Rep.                | 5,507                 |
| 24   | Stockholm                  | Sweden                     | 5,211                 |
| 25   | Los Angeles, CA            | United States of America   | 5,027                 |
| 26   | Minneapolis, MN            | United States of America   | 4,422                 |
| 27   | Portland, OR               | United States of America   | 4,146                 |
| 28   | Nuremberg–Erlangen         | Germany                    | 4,049                 |
| 29   | Irvine, CA                 | United States of America   | 3,965                 |
| 30   | Berlin                     | Germany                    | 3,632                 |
| 31   | Zurich                     | Switzerland/Germany        | 3,615                 |
| 32   | Philadelphia, PA           | United States of America   | 3,172                 |
| 33   | Plano, TX                  | United States of America   | 3,147                 |
| 34   | Helsinki–Espoo             | Finland                    | 3,045                 |
| 35   | Singapore                  | Singapore                  | 2,996                 |
| 36   | Basel                      | Switzerland/France/Germany | 2,804                 |
| 37   | Raleigh–Durham, NC         | United States of America   | 2,775                 |
| 38   | Hitachi                    | Japan                      | 2,648                 |
| 39   | Copenhagen                 | Denmark                    | 2,613                 |
| 40   | Hamamatsu                  | Japan                      | 2,496                 |
| 41   | Washington, DC             | United States of America   | 2,491                 |
| 42   | Cincinnati, OH             | United States of America   | 2,481                 |
| 43   | Bengaluru                  | India                      | 2,479                 |
| 44   | Sydney                     | Australia                  | 2,380                 |
| 45   | Rotterdam–The Hague        | Netherlands                | 2,235                 |
| 46   | Atlanta, GA                | United States of America   | 2,162                 |
| 47   | Montreal, QC               | Canada                     | 2,124                 |
| 48   | Toronto, ON                | Canada                     | 2,094                 |
| 49   | Austin, TX                 | United States of America   | 2,089                 |
| 50   | Lyon                       | France                     | 2,063                 |

*(Continued)*

**Table 1: Cluster ranking** *(continued)*

| Rank | Cluster name       | Territory(ies)              | Number of PCT filings |
|------|--------------------|-----------------------------|-----------------------|
| 51   | Wilmington, DL     | United States of America    | 2,046                 |
| 52   | Barcelona          | Spain                       | 2,003                 |
| 53   | Regensburg         | Germany                     | 2,001                 |
| 54   | Brussels–Leuven    | Belgium                     | 1,994                 |
| 55   | Cambridge          | United Kingdom              | 1,984                 |
| 56   | Grenoble           | France                      | 1,969                 |
| 57   | Moscow             | Russian Federation          | 1,915                 |
| 58   | Milan              | Italy                       | 1,909                 |
| 59   | Hamburg            | Germany                     | 1,870                 |
| 60   | Melbourne          | Australia                   | 1,799                 |
| 61   | Madrid             | Spain                       | 1,796                 |
| 62   | Malmö              | Sweden                      | 1,737                 |
| 63   | Guangzhou          | China                       | 1,670                 |
| 64   | Indianapolis, IN   | United States of America    | 1,596                 |
| 65   | Lausanne           | Switzerland/France          | 1,580                 |
| 66   | Ottawa, ON         | Canada                      | 1,560                 |
| 67   | Hartford, CT       | United States of America    | 1,540                 |
| 68   | Busan              | Korea, Rep.                 | 1,470                 |
| 69   | Gothenburg         | Sweden                      | 1,461                 |
| 70   | Rochester, NY      | United States of America    | 1,414                 |
| 71   | Vienna             | Austria                     | 1,403                 |
| 72   | Phoenix, AZ        | United States of America    | 1,378                 |
| 73   | Vancouver, BC      | Canada                      | 1,362                 |
| 74   | Heidenheim–Aalen   | Germany                     | 1,352                 |
| 75   | Cleveland, OH      | United States of America    | 1,346                 |
| 76   | Boulder, CO        | United States of America    | 1,319                 |
| 77   | Yokkaichi          | Japan                       | 1,318                 |
| 78   | Haifa              | Israel                      | 1,298                 |
| 79   | Salt Lake City, UT | United States of America    | 1,293                 |
| 80   | Ann Arbor, MI      | United States of America    | 1,289                 |
| 81   | Pittsburgh, PA     | United States of America    | 1,283                 |
| 82   | Aachen             | Germany/Netherlands/Belgium | 1,279                 |
| 83   | Shizuoka           | Japan                       | 1,241                 |
| 84   | Buhl               | Germany                     | 1,223                 |
| 85   | Hangzhou           | China                       | 1,213                 |
| 86   | Albany, NY         | United States of America    | 1,184                 |
| 87   | St. Louis, MO      | United States of America    | 1,138                 |
| 88   | Oxford             | United Kingdom              | 1,134                 |
| 89   | Baltimore, MD      | United States               | 1,089                 |
| 90   | Daegu              | Korea, Rep.                 | 1,085                 |
| 91   | Amsterdam          | Netherlands                 | 1,063                 |
| 92   | Kuala Lumpur       | Malaysia                    | 1,049                 |
| 93   | Clermont-Ferrand   | France                      | 1,041                 |
| 94   | Nanjing            | China                       | 1,030                 |
| 95   | Mumbai             | India                       | 1,012                 |
| 96   | Pune               | India                       | 1,006                 |
| 97   | Shikokuchuo        | Japan                       | 995                   |
| 98   | Toulouse           | France                      | 991                   |
| 99   | Hannover           | Germany                     | 979                   |
| 100  | Suzhou             | China                       | 956                   |

Notes: The number of PCT filings refers to the 2011–15 period. It represents the inventor fractional count of patents associated with a cluster, as explained in the text.

**Table 2: Cluster characteristics**

| Rank | Cluster name               | Largest applicant                     |                          | Main field of technology                |                          | Largest co-inventing top-100 cluster* |                           | Share of women inventors (%) <sup>†</sup> |
|------|----------------------------|---------------------------------------|--------------------------|---|--------------------------|---------------------------------------|---------------------------|---|
|      |                            | Applicant name                        | Share of PCT filings (%) | Field name                              | Share of PCT filings (%) | Partner name                          | Share of co-inventors (%) |   |
| 1    | Tokyo–Yokohama             | Mitsubishi Electric                   | 6.4                      | Electrical machinery, apparatus, energy | 6.3                      | Osaka–Kobe–Kyoto                      | 22.8                      | 8.5                                       |
| 2    | Shenzhen–Hong Kong (China) | ZTE Corporation                       | 32.4                     | Digital communication                   | 41.2                     | Beijing                               | 11.7                      | 28.9                                      |
| 3    | San Jose–San Francisco, CA | Google                                | 6.5                      | Computer technology                     | 18.3                     | Portland, OR                          | 5.3                       | 15.0                                      |
| 4    | Seoul                      | LG Electronics                        | 16.6                     | Digital communication                   | 10.4                     | Daejeon                               | 34.6                      | 27.5                                      |
| 5    | Osaka–Kobe–Kyoto           | Murata Manufacturing                  | 10.4                     | Electrical machinery, apparatus, energy | 8.3                      | Tokyo–Yokohama                        | 51.3                      | 8.6                                       |
| 6    | San Diego, CA              | Qualcomm                              | 56.1                     | Digital communication                   | 23.6                     | San Jose–San Francisco, CA            | 14.8                      | 16.9                                      |
| 7    | Beijing                    | BOE Technology Group                  | 14.1                     | Digital communication                   | 22.6                     | San Jose–San Francisco, CA            | 12.2                      | 31.3                                      |
| 8    | Boston–Cambridge, MA       | Massachusetts Institute of Technology | 6.1                      | Pharmaceuticals                         | 12.4                     | San Jose–San Francisco, CA            | 6.7                       | 17.4                                      |
| 9    | Nagoya                     | Toyota                                | 42.4                     | Transport                               | 13.0                     | Tokyo–Yokohama                        | 41.2                      | 5.6                                       |
| 10   | Paris                      | L'Oréal                               | 7.7                      | Transport                               | 8.1                      | Lyon                                  | 4.5                       | 18.9                                      |
| 11   | New York, NY               | IBM                                   | 4.2                      | Pharmaceuticals                         | 10.9                     | San Jose–San Francisco, CA            | 5.8                       | 20.0                                      |
| 12   | Frankfurt–Mannheim         | BASF                                  | 19.7                     | Organic fine chemistry                  | 7.2                      | Stuttgart                             | 7.8                       | 13.4                                      |
| 13   | Houston, TX                | Halliburton                           | 12.9                     | Civil engineering                       | 25.1                     | New York, NY                          | 4.0                       | 11.6                                      |
| 14   | Stuttgart                  | Robert Bosch                          | 47.7                     | Engines, pumps, turbines                | 11.3                     | Frankfurt–Mannheim                    | 12.6                      | 4.8                                       |
| 15   | Seattle, WA                | Microsoft                             | 41.9                     | Computer technology                     | 34.6                     | San Jose–San Francisco, CA            | 16.8                      | 13.2                                      |
| 16   | Cologne–Düsseldorf         | Henkel                                | 7.7                      | Basic materials chemistry               | 7.1                      | Frankfurt–Mannheim                    | 10.5                      | 13.7                                      |
| 17   | Chicago, IL                | Illinois Tool Works                   | 11.6                     | Digital communication                   | 7.4                      | San Jose–San Francisco, CA            | 4.8                       | 13.1                                      |
| 18   | Eindhoven                  | Philips                               | 84.9                     | Medical technology                      | 17.9                     | Rotterdam–The Hague                   | 7.2                       | 12.0                                      |
| 19   | Shanghai                   | Alcatel Lucent                        | 4.3                      | Digital communication                   | 9.5                      | New York, NY                          | 6.3                       | 30.2                                      |
| 20   | Munich                     | Siemens                               | 11.7                     | Transport                               | 8.0                      | Nuremberg–Erlangen                    | 4.4                       | 9.3                                       |
| 21   | London                     | Unilever                              | 6.1                      | Digital communication                   | 7.2                      | Cambridge                             | 7.9                       | 14.7                                      |
| 22   | Tel Aviv                   | Intel                                 | 4.1                      | Computer technology                     | 12.8                     | Haifa                                 | 22.3                      | 13.5                                      |
| 23   | Daejeon                    | LG Chem                               | 19.8                     | Electrical machinery, apparatus, energy | 10.7                     | Seoul                                 | 68.6                      | 27.3                                      |
| 24   | Stockholm                  | Ericsson                              | 44.1                     | Digital communication                   | 26.8                     | San Jose–San Francisco, CA            | 6.2                       | 10.3                                      |
| 25   | Los Angeles, CA            | University of California              | 8.4                      | Medical technology                      | 9.5                      | San Jose–San Francisco, CA            | 12.1                      | 15.0                                      |

(Continued)



Table 2: Cluster characteristics (continued)

| Rank | Cluster name        | Largest applicant          |                          | Main field of technology                |                          | Largest co-inventing top-100 cluster* |                           | Share of women inventors (%) <sup>†</sup> |
|------|---------------------|----------------------------|--------------------------|---|--------------------------|---------------------------------------|---------------------------|---|
|      |                     | Applicant name             | Share of PCT filings (%) | Field name                              | Share of PCT filings (%) | Partner name                          | Share of co-inventors (%) |   |
| 26   | Minneapolis, MN     | Medtronic                  | 14.1                     | Medical technology                      | 32.7                     | San Jose-San Francisco, CA            | 4.4                       | 12.1                                      |
| 27   | Portland, OR        | Intel                      | 49.1                     | Computer technology                     | 20.0                     | San Jose-San Francisco, CA            | 24.8                      | 14.0                                      |
| 28   | Nuremberg-Erlangen  | Siemens                    | 41.5                     | Electrical machinery, apparatus, energy | 11.5                     | Munich                                | 8.1                       | 4.7                                       |
| 29   | Irvine, CA          | Allergan                   | 8.0                      | Medical technology                      | 21.7                     | Los Angeles, CA                       | 13.9                      | 12.7                                      |
| 30   | Berlin              | Siemens                    | 12.7                     | Electrical machinery, apparatus, energy | 8.5                      | Cologne-Düsseldorf                    | 11.8                      | 11.6                                      |
| 31   | Zurich              | ABB Technology             | 6.3                      | Medical technology                      | 6.4                      | Basel                                 | 10.2                      | 10.4                                      |
| 32   | Philadelphia, PA    | University of Pennsylvania | 8.8                      | Pharmaceuticals                         | 15.9                     | New York, NY                          | 16.5                      | 19.6                                      |
| 33   | Plano, TX           | Halliburton                | 17.1                     | Civil engineering                       | 15.3                     | San Jose-San Francisco, CA            | 8.3                       | 11.9                                      |
| 34   | Helsinki-Espoo      | Nokia                      | 21.0                     | Digital communication                   | 19.6                     | Beijing                               | 6.4                       | 14.0                                      |
| 35   | Singapore           | A*STAR                     | 15.3                     | Medical technology                      | 4.9                      | San Jose-San Francisco, CA            | 6.8                       | 23.0                                      |
| 36   | Basel               | Hoffman-La Roche           | 10.6                     | Organic fine chemistry                  | 13.1                     | Zurich                                | 16.2                      | 16.0                                      |
| 37   | Raleigh-Durham, NC  | Cree                       | 11.1                     | Pharmaceuticals                         | 9.3                      | Frankfurt-Mannheim                    | 6.9                       | 15.7                                      |
| 38   | Hitachi             | Hitachi                    | 32.4                     | Electrical machinery, apparatus, energy | 19.9                     | Tokyo-Yokohama                        | 86.3                      | 7.1                                       |
| 39   | Copenhagen          | Novozymes                  | 10.4                     | Biotechnology                           | 11.1                     | Malmö                                 | 7.2                       | 17.2                                      |
| 40   | Hamamatsu           | NTN Corporation            | 25.1                     | Transport                               | 11.5                     | Tokyo-Yokohama                        | 43.1                      | 6.6                                       |
| 41   | Washington, DC      | US Department of HHS       | 11.6                     | Pharmaceuticals                         | 14.7                     | San Jose-San Francisco, CA            | 7.5                       | 19.4                                      |
| 42   | Cincinnati, OH      | Procter & Gamble           | 33.3                     | Medical technology                      | 25.7                     | Frankfurt-Mannheim                    | 4.7                       | 14.6                                      |
| 43   | Bengaluru           | Hewlett-Packard            | 9.2                      | Computer technology                     | 17.7                     | San Jose-San Francisco, CA            | 11.6                      | 14.8                                      |
| 44   | Sydney              | University of Sydney       | 4.5                      | Medical technology                      | 8.8                      | Melbourne                             | 10.0                      | 12.5                                      |
| 45   | Rotterdam-The Hague | TNO                        | 12.2                     | Other special machines                  | 5.6                      | Amsterdam                             | 8.4                       | 11.2                                      |
| 46   | Atlanta, GA         | Georgia Tech Research      | 7.1                      | Medical technology                      | 11.0                     | San Jose-San Francisco, CA            | 4.6                       | 19.0                                      |
| 47   | Montreal, QC        | Ericsson                   | 10.9                     | Digital communication                   | 11.9                     | New York, NY                          | 6.9                       | 15.4                                      |
| 48   | Toronto, ON         | University Health Network  | 3.0                      | Computer technology                     | 7.4                      | San Jose-San Francisco, CA            | 4.5                       | 12.6                                      |
| 49   | Austin, TX          | University of Texas System | 11.0                     | Computer technology                     | 19.6                     | San Jose-San Francisco, CA            | 15.3                      | 9.2                                       |
| 50   | Lyon                | IFP Energies Nouvelles     | 9.5                      | Organic fine chemistry                  | 8.0                      | Paris                                 | 13.8                      | 21.1                                      |
| 51   | Wilmington, DL      | Du Pont                    | 47.1                     | Basic materials chemistry               | 8.2                      | Philadelphia, PA                      | 21.1                      | 15.5                                      |
| 52   | Barcelona           | Hewlett-Packard            | 8.7                      | Pharmaceuticals                         | 9.4                      | Madrid                                | 7.6                       | 24.0                                      |

(Continued)

**Table 2: Cluster characteristics** (continued)

| Rank | Cluster name       | Largest applicant               |                          | Main field of technology                |                          | Largest co-inventing top-100 cluster* |                           | Share of women inventors (%) <sup>†</sup> |
|------|--------------------|---------------------------------|--------------------------|---|--------------------------|---------------------------------------|---------------------------|---|
|      |                    | Applicant name                  | Share of PCT filings (%) | Field name                              | Share of PCT filings (%) | Partner name                          | Share of co-inventors (%) |   |
| 53   | Regensburg         | Osrām Opto Semiconductors       | 36.7                     | Semiconductors                          | 25.8                     | Munich                                | 9.8                       | 6.7                                       |
| 54   | Brussels–Leuven    | Solvay                          | 4.7                      | Pharmaceuticals                         | 6.1                      | Frankfurt–Mannheim                    | 3.8                       | 17.6                                      |
| 55   | Cambridge          | Cambridge University            | 6.7                      | Computer technology                     | 8.1                      | London                                | 17.6                      | 14.9                                      |
| 56   | Grenoble           | CEA                             | 44.3                     | Semiconductors                          | 10.8                     | Paris                                 | 11.6                      | 16.0                                      |
| 57   | Moscow             | Siemens                         | 1.9                      | Pharmaceuticals                         | 6.1                      | San Jose–San Francisco, CA            | 1.8                       | 13.8                                      |
| 58   | Milan              | Pirelli                         | 8.5                      | Pharmaceuticals                         | 5.3                      | London                                | 1.5                       | 15.6                                      |
| 59   | Hamburg            | Henkel                          | 11.0                     | Organic fine chemistry                  | 14.1                     | Cologne–Düsseldorf                    | 5.8                       | 20.1                                      |
| 60   | Melbourne          | Monash University               | 5.1                      | Pharmaceuticals                         | 5.8                      | Sydney                                | 9.0                       | 15.2                                      |
| 61   | Madrid             | Telefonica                      | 13.3                     | Digital communication                   | 11.1                     | Barcelona                             | 9.0                       | 26.9                                      |
| 62   | Malmö              | Ericsson                        | 19.5                     | Digital communication                   | 12.6                     | Stockholm                             | 18.1                      | 9.5                                       |
| 63   | Guangzhou          | South China Univ. of Technology | 6.8                      | Computer technology                     | 6.8                      | Shenzhen–Hong Kong (China)            | 10.4                      | 29.2                                      |
| 64   | Indianapolis, IN   | Dow Agrosiences                 | 22.6                     | Basic materials chemistry               | 8.6                      | New York, NY                          | 3.4                       | 16.0                                      |
| 65   | Lausanne           | Nestec                          | 27.6                     | Food chemistry                          | 7.5                      | Zurich                                | 2.9                       | 17.4                                      |
| 66   | Ottawa, ON         | Huawei Technologies             | 16.6                     | Digital communication                   | 30.2                     | Plano, TX                             | 13.6                      | 17.4                                      |
| 67   | Hartford, CT       | United Technologies             | 65.7                     | Engines, pumps, turbines                | 39.6                     | Boston–Cambridge, MA                  | 4.9                       | 9.7                                       |
| 68   | Busan              | Pusan National University       | 5.6                      | Medical technology                      | 5.2                      | Seoul                                 | 48.6                      | 24.7                                      |
| 69   | Gothenburg         | Ericsson                        | 22.2                     | Digital communication                   | 9.4                      | Stockholm                             | 12.8                      | 11.4                                      |
| 70   | Rochester, NY      | Eastman Kodak                   | 38.2                     | Textile and paper machines              | 9.9                      | San Jose–San Francisco, CA            | 3.9                       | 15.4                                      |
| 71   | Vienna             | Technische Universität Wien     | 4.3                      | Pharmaceuticals                         | 7.8                      | Munich                                | 2.9                       | 12.7                                      |
| 72   | Phoenix, AZ        | Intel                           | 15.4                     | Semiconductors                          | 11.8                     | Portland, OR                          | 9.0                       | 13.0                                      |
| 73   | Vancouver, BC      | University of British Columbia  | 6.8                      | Pharmaceuticals                         | 5.5                      | San Jose–San Francisco, CA            | 8.9                       | 12.9                                      |
| 74   | Heidenheim–Aalen   | Carl Zeiss                      | 21.9                     | Optics                                  | 15.9                     | Stuttgart                             | 9.9                       | 5.7                                       |
| 75   | Cleveland, OH      | Cleveland Clinic Foundation     | 9.7                      | Medical technology                      | 11.1                     | New York, NY                          | 2.5                       | 11.2                                      |
| 76   | Boulder, CO        | University of Colorado          | 5.8                      | Medical technology                      | 11.6                     | San Jose–San Francisco, CA            | 8.6                       | 14.4                                      |
| 77   | Yokkaichi          | Autonetworks Technologies       | 39.1                     | Electrical machinery, apparatus, energy | 32.3                     | Tokyo–Yokohama                        | 33.8                      | 2.9                                       |
| 78   | Haifa              | Intel                           | 10.8                     | Medical technology                      | 18.6                     | Tel Aviv                              | 46.9                      | 12.9                                      |
| 79   | Salt Lake City, UT | University of Utah              | 14.9                     | Medical technology                      | 19.3                     | San Jose–San Francisco, CA            | 7.3                       | 10.8                                      |
| 80   | Ann Arbor, MI      | University of Michigan          | 27.3                     | Pharmaceuticals                         | 7.1                      | San Jose–San Francisco, CA            | 4.2                       | 14.1                                      |
| 81   | Pittsburgh, PA     | University of Pittsburgh        | 12.8                     | Medical technology                      | 9.0                      | Boston–Cambridge                      | 4.0                       | 14.0                                      |

(Continued)



**Table 2: Cluster characteristics** (continued)

| Rank | Cluster name     | Largest applicant             |                          | Main field of technology  |                          | Largest co-inventing top-100 cluster* |                           |   |
|------|------------------|-------------------------------|--------------------------|---------------------------|--------------------------|---------------------------------------|---------------------------|---|
|      |                  | Applicant name                | Share of PCT filings (%) | Field name                | Share of PCT filings (%) | Partner name                          | Share of co-inventors (%) | Share of women inventors (%) <sup>†</sup> |
| 82   | Aachen           | Ericsson                      | 13.3                     | Digital communication     | 9.0                      | Cologne–Düsseldorf                    | 16.7                      | 8.9                                       |
| 83   | Shizuoka         | Fujifilm                      | 48.1                     | Optics                    | 11.2                     | Tokyo–Yokohama                        | 41.2                      | 8.5                                       |
| 84   | Buhl             | Schaeffler Technologies       | 48.6                     | Mechanical elements       | 44.0                     | Frankfurt–Mannheim                    | 28.0                      | 3.6                                       |
| 85   | Hangzhou         | Alibaba Group                 | 26.5                     | Computer technology       | 16.9                     | Shanghai                              | 12.2                      | 27.1                                      |
| 86   | Albany, NY       | General Electric              | 55.0                     | Semiconductors            | 9.9                      | New York, NY                          | 9.6                       | 13.0                                      |
| 87   | St. Louis, MO    | Monsanto Technologies         | 11.5                     | Biotechnology             | 10.4                     | Seattle, WA                           | 6.6                       | 17.4                                      |
| 88   | Oxford           | Oxford University Limited     | 27.6                     | Pharmaceuticals           | 8.3                      | London                                | 15.8                      | 18.1                                      |
| 89   | Baltimore, MD    | Johns Hopkins University      | 45.3                     | Pharmaceuticals           | 15.0                     | Washington, DC                        | 13.0                      | 20.7                                      |
| 90   | Daegu            | Kyungpook National University | 12.1                     | Medical technology        | 7.7                      | Seoul                                 | 51.1                      | 26.3                                      |
| 91   | Amsterdam        | Shell                         | 29.1                     | Basic materials chemistry | 8.6                      | Rotterdam–The Hague                   | 13.6                      | 13.8                                      |
| 92   | Kuala Lumpur     | Mimos Berhad                  | 50.0                     | Computer technology       | 11.4                     | Houston, TX                           | 8.0                       | 25.5                                      |
| 93   | Clermont-Ferrand | Michelin                      | 74.1                     | Transport                 | 26.3                     | Paris                                 | 13.0                      | 17.0                                      |
| 94   | Nanjing          | Southeast University          | 10.1                     | Digital communication     | 8.7                      | Beijing                               | 10.1                      | 31.5                                      |
| 95   | Mumbai           | Piramal Enterprises           | 6.7                      | Organic fine chemistry    | 15.4                     | Bengaluru                             | 11.1                      | 16.8                                      |
| 96   | Pune             | CSIR                          | 23.2                     | Organic fine chemistry    | 15.7                     | San Jose–San Francisco, CA            | 9.8                       | 12.4                                      |
| 97   | Shikokuchuo      | Unicharm Corporation          | 90.0                     | Medical technology        | 52.3                     | Tokyo–Yokohama                        | 34.5                      | 15.5                                      |
| 98   | Toulouse         | Continental                   | 10.1                     | Transport                 | 10.0                     | Paris                                 | 13.8                      | 19.2                                      |
| 99   | Hannover         | Continental                   | 14.3                     | Transport                 | 15.3                     | Cologne–Düsseldorf                    | 4.1                       | 8.1                                       |
| 100  | Suzhou           | Ecovacs Robotics              | 7.7                      | Furniture, games          | 7.9                      | Shanghai                              | 9.5                       | 25.4                                      |

Notes: PCT filing shares refer to the 2011–15 period and are based on fractional counts, as explained in the text. The identification of technology fields relies on the WIPO technology concordance table linking International Patent Classification (IPC) symbols with 35 fields of technology (available at <http://www.wipo.int/ipstats/en/>). The identification of universities and public research organizations (PROs) relies on keyword-based searches of PCT applicant names, which encompasses all types of educational and public research entities, including universities, colleges, polytechnics, and university hospitals; it also takes account of the different languages used by PCT applicant names. Patent records may show different names for the same applicant. WIPO carries out a name cleaning and harmonization process based on keyword searching and manual verification. This process takes historical changes into account, but not company structure; in other words, subsidiaries or applicants sharing a common parent company are not consolidated. In the table presented here, the colloquial name of the applicant is used where appropriate and may differ from the actual name listed in the application, or from WIPO's cleaned and harmonized name.

\*The largest co-inventing top-100 cluster refers to the cluster hosting the highest share of co-inventors. The share of co-inventors is relative to the total number of co-inventors located outside the cluster in question.

<sup>†</sup>The identification of women inventors relies on the name dictionary described in Lax-Martinez et al. (2016). With this dictionary, we can attribute gender for more than 90% of listed inventors for each cluster except for Beijing, Bengaluru, Guangzhou, Hangzhou, Kuala Lumpur, Seoul, Shanghai, and Suzhou, for which we attribute gender for 84–90% of listed inventors. The share of women inventors is calculated on the basis of listed inventors, so inventors listed in multiple applications are counted multiple times. The calculation ignores inventors whose gender could not be attributed.

# Appendices



# Appendix I

Country/Economy Profiles



# Country/Economy Profiles

The following tables provide detailed profiles for each of the 127 economies in the Global Innovation Index 2017. They are constructed around three sections.

**1** Five key indicators at the beginning of each profile are intended to put the economy into context. They present the population in millions,<sup>1</sup> GDP in US\$ billions, and GDP per capita in PPP current international dollars.<sup>2</sup> The fourth indicator categorizes the economy into income group and the fifth indicates its geographical region.<sup>3</sup>

**2** The next section provides the economy's scores and rankings on the Global Innovation Index (GII), the Innovation Output Sub-Index, the Innovation Input Sub-Index, and the Innovation Efficiency Ratio.

The GII ranking for the 2016 edition comes next. Because there is one less economy in 2017 than in 2016 (four dropped out and three were added), and because of adjustments made to the GII framework every year and other technical factors not directly related to actual performance (missing data, updates of data, etc.), the GII rankings are not directly comparable from one year to the next. Please refer to Annex 2 of Chapter 1 for details.

Scores are normalized in the 0–100 range except for the Innovation Efficiency Ratio, for which scores revolve around the number 1 (this index is calculated as the ratio between the Output and Input Sub-Indices).

by three-digit numbers. For example, *indicator 1.3.1, ease of starting a business*, appears under *sub-pillar 1.3, Business environment*, which in turn appears under *pillar 1, Institutions*.

The 2017 GII includes 81 indicators and three types of data. Composite indicators are identified with an asterisk (\*), survey questions from the World Economic Forum's Executive Opinion Survey are identified with a dagger (†), and the remaining indicators are all hard data series.

For hard data, the original value is provided (except for indicators in sub-pillar 7.3, for which the raw data were provided under the condition that only the normalized scores be published). Normalized scores in the 0–100 range are provided for everything else (index and survey data, sub-pillars, pillars, and indices).

When data are either not available or out of date (the cutoff year is 2007, with the exceptions of indicators 2.2.2, 5.1.2, 6.2.5, and 7.2.4; see Appendix III for more details), 'n/a' is used. The year of each data point is indicated in the Data Tables shown in Appendix II. To the right of the indicator title, a clock symbol indicates that the country's data for that indicator are older than the base year. More details, including the year of the data in question, are available in Appendix II.

| Albania                 |  |
|-------------------------|--|
| <b>1</b> Key indicators | 2.1 Innovation Index                           |
| Population (millions)   | 2.2 Ease of patenting (invented innovation)*   |
| GDP (US\$ billion)      | 2.3 Market capitalization (% of GDP)           |
| GDP per capita (PPP)    | 2.4 Innovation capital (% of GDP)              |
| Income group            | 2.5 Innovation capital growth (% of GDP)       |
| Region                  | 2.6 Innovation capital per worker (% of GDP)   |
|                         | 2.7 Innovation capital per worker (% of GDP)   |
|                         | 2.8 Innovation capital per worker (% of GDP)   |
|                         | 2.9 Innovation capital per worker (% of GDP)   |
|                         | 2.10 Innovation capital per worker (% of GDP)  |
|                         | 2.11 Innovation capital per worker (% of GDP)  |
|                         | 2.12 Innovation capital per worker (% of GDP)  |
|                         | 2.13 Innovation capital per worker (% of GDP)  |
|                         | 2.14 Innovation capital per worker (% of GDP)  |
|                         | 2.15 Innovation capital per worker (% of GDP)  |
|                         | 2.16 Innovation capital per worker (% of GDP)  |
|                         | 2.17 Innovation capital per worker (% of GDP)  |
|                         | 2.18 Innovation capital per worker (% of GDP)  |
|                         | 2.19 Innovation capital per worker (% of GDP)  |
|                         | 2.20 Innovation capital per worker (% of GDP)  |
|                         | 2.21 Innovation capital per worker (% of GDP)  |
|                         | 2.22 Innovation capital per worker (% of GDP)  |
|                         | 2.23 Innovation capital per worker (% of GDP)  |
|                         | 2.24 Innovation capital per worker (% of GDP)  |
|                         | 2.25 Innovation capital per worker (% of GDP)  |
|                         | 2.26 Innovation capital per worker (% of GDP)  |
|                         | 2.27 Innovation capital per worker (% of GDP)  |
|                         | 2.28 Innovation capital per worker (% of GDP)  |
|                         | 2.29 Innovation capital per worker (% of GDP)  |
|                         | 2.30 Innovation capital per worker (% of GDP)  |
|                         | 2.31 Innovation capital per worker (% of GDP)  |
|                         | 2.32 Innovation capital per worker (% of GDP)  |
|                         | 2.33 Innovation capital per worker (% of GDP)  |
|                         | 2.34 Innovation capital per worker (% of GDP)  |
|                         | 2.35 Innovation capital per worker (% of GDP)  |
|                         | 2.36 Innovation capital per worker (% of GDP)  |
|                         | 2.37 Innovation capital per worker (% of GDP)  |
|                         | 2.38 Innovation capital per worker (% of GDP)  |
|                         | 2.39 Innovation capital per worker (% of GDP)  |
|                         | 2.40 Innovation capital per worker (% of GDP)  |
|                         | 2.41 Innovation capital per worker (% of GDP)  |
|                         | 2.42 Innovation capital per worker (% of GDP)  |
|                         | 2.43 Innovation capital per worker (% of GDP)  |
|                         | 2.44 Innovation capital per worker (% of GDP)  |
|                         | 2.45 Innovation capital per worker (% of GDP)  |
|                         | 2.46 Innovation capital per worker (% of GDP)  |
|                         | 2.47 Innovation capital per worker (% of GDP)  |
|                         | 2.48 Innovation capital per worker (% of GDP)  |
|                         | 2.49 Innovation capital per worker (% of GDP)  |
|                         | 2.50 Innovation capital per worker (% of GDP)  |
|                         | 2.51 Innovation capital per worker (% of GDP)  |
|                         | 2.52 Innovation capital per worker (% of GDP)  |
|                         | 2.53 Innovation capital per worker (% of GDP)  |
|                         | 2.54 Innovation capital per worker (% of GDP)  |
|                         | 2.55 Innovation capital per worker (% of GDP)  |
|                         | 2.56 Innovation capital per worker (% of GDP)  |
|                         | 2.57 Innovation capital per worker (% of GDP)  |
|                         | 2.58 Innovation capital per worker (% of GDP)  |
|                         | 2.59 Innovation capital per worker (% of GDP)  |
|                         | 2.60 Innovation capital per worker (% of GDP)  |
|                         | 2.61 Innovation capital per worker (% of GDP)  |
|                         | 2.62 Innovation capital per worker (% of GDP)  |
|                         | 2.63 Innovation capital per worker (% of GDP)  |
|                         | 2.64 Innovation capital per worker (% of GDP)  |
|                         | 2.65 Innovation capital per worker (% of GDP)  |
|                         | 2.66 Innovation capital per worker (% of GDP)  |
|                         | 2.67 Innovation capital per worker (% of GDP)  |
|                         | 2.68 Innovation capital per worker (% of GDP)  |
|                         | 2.69 Innovation capital per worker (% of GDP)  |
|                         | 2.70 Innovation capital per worker (% of GDP)  |
|                         | 2.71 Innovation capital per worker (% of GDP)  |
|                         | 2.72 Innovation capital per worker (% of GDP)  |
|                         | 2.73 Innovation capital per worker (% of GDP)  |
|                         | 2.74 Innovation capital per worker (% of GDP)  |
|                         | 2.75 Innovation capital per worker (% of GDP)  |
|                         | 2.76 Innovation capital per worker (% of GDP)  |
|                         | 2.77 Innovation capital per worker (% of GDP)  |
|                         | 2.78 Innovation capital per worker (% of GDP)  |
|                         | 2.79 Innovation capital per worker (% of GDP)  |
|                         | 2.80 Innovation capital per worker (% of GDP)  |
|                         | 2.81 Innovation capital per worker (% of GDP)  |
|                         | 2.82 Innovation capital per worker (% of GDP)  |
|                         | 2.83 Innovation capital per worker (% of GDP)  |
|                         | 2.84 Innovation capital per worker (% of GDP)  |
|                         | 2.85 Innovation capital per worker (% of GDP)  |
|                         | 2.86 Innovation capital per worker (% of GDP)  |
|                         | 2.87 Innovation capital per worker (% of GDP)  |
|                         | 2.88 Innovation capital per worker (% of GDP)  |
|                         | 2.89 Innovation capital per worker (% of GDP)  |
|                         | 2.90 Innovation capital per worker (% of GDP)  |
|                         | 2.91 Innovation capital per worker (% of GDP)  |
|                         | 2.92 Innovation capital per worker (% of GDP)  |
|                         | 2.93 Innovation capital per worker (% of GDP)  |
|                         | 2.94 Innovation capital per worker (% of GDP)  |
|                         | 2.95 Innovation capital per worker (% of GDP)  |
|                         | 2.96 Innovation capital per worker (% of GDP)  |
|                         | 2.97 Innovation capital per worker (% of GDP)  |
|                         | 2.98 Innovation capital per worker (% of GDP)  |
|                         | 2.99 Innovation capital per worker (% of GDP)  |
|                         | 2.100 Innovation capital per worker (% of GDP) |

For further details, see Appendix III, Sources and Definitions, and Appendix IV, Technical Notes.

**4** To the far right of each column, a solid circle indicates that an indicator is one of the strengths of the country/economy in question, and a hollow circle indicates that it is a weakness.

All ranks of 1, 2, and 3 are highlighted as strengths, except in particular instances at the sub-pillar level where strengths and weaknesses are not signaled when the desired minimum indicator coverage (DMC) is not met for that sub-pillar.<sup>4</sup> For the remaining indicators, strengths and weaknesses of a particular economy are based on the percentage of economies with scores that fall below its score (i.e., percent ranks).

- For a given economy, strengths (●) are those scores with percent ranks greater than the 10th largest percent rank among the 81 indicators in that economy.
- Similarly, for that economy, weaknesses (○) are those scores with percent ranks lower than the 10th smallest percent rank among the 81 indicators in that economy.

In addition, this year countries with a sub-pillar that does not meet the DMC, independently of whether it is signaled as a strength/weakness, will show the rank for that sub-pillar within brackets. Those that have more than one sub-pillar that fails to meet the DMC in the same pillar will also show the ranks of the pillar where these are located within brackets.

Percent ranks embed more information than ranks and allow for comparisons of ranks of series with missing data and ties in ranks. Examples

from the Russian Federation (Russia) illustrate this point:

1. Strengths for Russia are all indicators with percent ranks equal to or above 0.83 (10th largest percent rank for Russia); weaknesses are all indicators with percent ranks equal to or below 0.26 (Russia's 10th smallest percent rank).
2. Russia ranks 22nd out of 127 economies in 6.1.5, *citable documents H index*, with a percent rank of 0.83; this indicator is a strength for Russia.
3. Russia ranks 25th in 2.3.4, *QS university rankings*, but with a percent rank of 0.81, this indicator is not a strength for Russia.
4. The rank of 48 (percent rank of 0.24) in 7.2.3, *global entertainment and media market*, is a weakness for Russia. By contrast, the rank of 47 for Senegal in 5.2.1 *university/industry research collaboration* is a strength for Senegal (with a percent rank of 0.62, this is above the cutoff for strengths for Senegal, which is 0.57).

Percent ranks are not reported in the Country/Economy Profiles but they are presented in the Data Tables (Appendix II).

### Notes

- 1 Data are from the United Nations, Department of Economic and Social Affairs, Population Division, *World Population Prospects: The 2015 Revision*.
- 2 Data for GDP and GDP per capita are from the International Monetary Fund *World Economic Outlook 2016* database.

- 3 Countries/economies are classified according to the World Bank Income Group (July 2016; see <https://blogs.worldbank.org/opendata/new-country-classifications-2016>) and special classification based on the online version of the United Nations publication *Standard Country or Area Codes for Statistical Use*, originally published as Series M, No. 49, and now commonly referred to as the M49 standard (April 2017; see <https://unstats.un.org/unsd/methodology/m49/>). These are: EUR = Europe; NAC = Northern America; LCN = Latin America and the Caribbean; CSA = Central and Southern Asia; SEAO = South East Asia, East Asia, and Oceania; NAWA = Northern Africa and Western Asia; SSF = Sub-Saharan Africa.
- 4 Data stringency requirements are used in the attribution of strengths and weaknesses at the sub-pillar level. When countries do not meet a data minimum coverage (DMC) requirement at the sub-pillar level (for sub-pillars with two indicators, the DMC is 1; for three it is 2; for four it is 2; and for five it is 3), they are not attributed a strength or weakness at the sub-pillar either. Furthermore, if the country in question does not meet the DMC requirements at the sub-pillar level, but still obtains a ranking higher than or equal to 10 or a ranking equal to or lower than 100 at the sub-pillar level, for caution this rank is put in brackets. This procedure is to ensure that incomplete data coverage does not lead to erroneous conclusions about strengths or weaknesses, or particularly about strong or weak sub-pillar rankings.



## Index of Country/Economy Profiles

| Country/Economy                | Page | Country/Economy         | Page | Country/Economy   | Page | Country/Economy               | Page |
|--------------------------------|------|-------------------------|------|-------------------|------|-------------------------------|------|
| Albania.....                   | 185  | Dominican Republic..... | 217  | Lebanon.....      | 249  | Russian Federation.....       | 281  |
| Algeria.....                   | 186  | Ecuador.....            | 218  | Lithuania.....    | 250  | Rwanda.....                   | 282  |
| Argentina.....                 | 187  | Egypt.....              | 219  | Luxembourg.....   | 251  | Saudi Arabia.....             | 283  |
| Armenia.....                   | 188  | El Salvador.....        | 220  | Madagascar.....   | 252  | Senegal.....                  | 284  |
| Australia.....                 | 189  | Estonia.....            | 221  | Malawi.....       | 253  | Serbia.....                   | 285  |
| Austria.....                   | 190  | Ethiopia.....           | 222  | Malaysia.....     | 254  | Singapore.....                | 286  |
| Azerbaijan.....                | 191  | Finland.....            | 223  | Mali.....         | 255  | Slovakia.....                 | 287  |
| Bahrain.....                   | 192  | France.....             | 224  | Malta.....        | 256  | Slovenia.....                 | 288  |
| Bangladesh.....                | 193  | Georgia.....            | 225  | Mauritius.....    | 257  | South Africa.....             | 289  |
| Belarus.....                   | 194  | Germany.....            | 226  | Mexico.....       | 258  | Spain.....                    | 290  |
| Belgium.....                   | 195  | Greece.....             | 227  | Moldova, Rep..... | 259  | Sri Lanka.....                | 291  |
| Benin.....                     | 196  | Guatemala.....          | 228  | Mongolia.....     | 260  | Sweden.....                   | 292  |
| Bolivia, Plurinational St..... | 197  | Guinea.....             | 229  | Montenegro.....   | 261  | Switzerland.....              | 293  |
| Bosnia and Herzegovina.....    | 198  | Honduras.....           | 230  | Morocco.....      | 262  | Tajikistan.....               | 294  |
| Botswana.....                  | 199  | Hong Kong (China).....  | 231  | Mozambique.....   | 263  | Tanzania, United Rep.....     | 295  |
| Brazil.....                    | 200  | Hungary.....            | 232  | Namibia.....      | 264  | Thailand.....                 | 296  |
| Brunei Darussalam.....         | 201  | Iceland.....            | 233  | Nepal.....        | 265  | TFYR of Macedonia.....        | 297  |
| Bulgaria.....                  | 202  | India.....              | 234  | Netherlands.....  | 266  | Togo.....                     | 298  |
| Burkina Faso.....              | 203  | Indonesia.....          | 235  | New Zealand.....  | 267  | Trinidad and Tobago.....      | 299  |
| Burundi.....                   | 204  | Iran, Islamic Rep.....  | 236  | Niger.....        | 268  | Tunisia.....                  | 300  |
| Cambodia.....                  | 205  | Ireland.....            | 237  | Nigeria.....      | 269  | Turkey.....                   | 301  |
| Cameroon.....                  | 206  | Israel.....             | 238  | Norway.....       | 270  | Uganda.....                   | 302  |
| Canada.....                    | 207  | Italy.....              | 239  | Oman.....         | 271  | Ukraine.....                  | 303  |
| Chile.....                     | 208  | Jamaica.....            | 240  | Pakistan.....     | 272  | United Arab Emirates.....     | 304  |
| China.....                     | 209  | Japan.....              | 241  | Panama.....       | 273  | United Kingdom.....           | 305  |
| Colombia.....                  | 210  | Jordan.....             | 242  | Paraguay.....     | 274  | United States of America..... | 306  |
| Costa Rica.....                | 211  | Kazakhstan.....         | 243  | Peru.....         | 275  | Uruguay.....                  | 307  |
| Côte d'Ivoire.....             | 212  | Kenya.....              | 244  | Philippines.....  | 276  | Viet Nam.....                 | 308  |
| Croatia.....                   | 213  | Korea, Rep.....         | 245  | Poland.....       | 277  | Yemen.....                    | 309  |
| Cyprus.....                    | 214  | Kuwait.....             | 246  | Portugal.....     | 278  | Zambia.....                   | 310  |
| Czech Republic.....            | 215  | Kyrgyzstan.....         | 247  | Qatar.....        | 279  | Zimbabwe.....                 | 311  |
| Denmark.....                   | 216  | Latvia.....             | 248  | Romania.....      | 280  |                               |      |



**Key indicators**

|                            |                     |
|----------------------------|---------------------|
| Population (millions)..... | 2.9                 |
| GDP (US\$ billions).....   | 12.1                |
| GDP per capita, PPP\$..... | 11,300.8            |
| Income group.....          | Upper-middle income |
| Region.....                | Europe              |

|  | Score 0–100<br>or value (hard data) | Rank      |
|--|-------------------------------------|-----------|
| <b>Global Innovation Index (out of 127).....</b> | <b>28.9</b>                         | <b>93</b> |
| Innovation Output Sub-Index.....                 | 15.7                                | 115 ○     |
| Innovation Input Sub-Index.....                  | 42.0                                | 70        |
| Innovation Efficiency Ratio.....                 | 0.4                                 | 122 ○     |
| Global Innovation Index 2016 (out of 128).....   | 28.4                                | 92        |

**1 Institutions.....63.3 62**

|   |      |      |
|---|------|------|
| 1.1 Political environment.....                        | 57.7 | 50   |
| 1.1.1 Political stability & safety*.....              | 72.5 | 45   |
| 1.1.2 Government effectiveness*.....                  | 42.9 | 69   |
| 1.2 Regulatory environment.....                       | 56.3 | 80   |
| 1.2.1 Regulatory quality*.....                        | 47.2 | 65   |
| 1.2.2 Rule of law*.....                               | 28.9 | 82   |
| 1.2.3 Cost of redundancy dismissal, salary weeks..... | 20.8 | 87   |
| 1.3 Business environment.....                         | 75.9 | 43   |
| 1.3.1 Ease of starting a business*.....               | 91.7 | 39 ● |
| 1.3.2 Ease of resolving insolvency*.....              | 65.0 | 40 ● |
| 1.3.3 Ease of paying taxes*.....                      | 71.0 | 73   |

**2 Human capital & research.....23.5 91**

|  |       |       |
|--|-------|-------|
| 2.1 Education.....   | 39.0  | 92    |
| 2.1.1 Expenditure on education, % GDP.....                   | 3.5   | 91    |
| 2.1.2 Gov't expenditure/pupil, secondary, % GDP/cap.....     | 5.9   | 104 ○ |
| 2.1.3 School life expectancy, years.....                     | 15.5  | 35 ●  |
| 2.1.4 PISA scales in reading, maths, & science.....          | 415.2 | 57    |
| 2.1.5 Pupil-teacher ratio, secondary.....                    | 13.5  | 53    |
| 2.2 Tertiary education.....                                  | 30.2  | 81    |
| 2.2.1 Tertiary enrolment, % gross.....                       | 58.1  | 44    |
| 2.2.2 Graduates in science & engineering, %.....             | 16.8  | 73    |
| 2.2.3 Tertiary inbound mobility, %.....                      | 1.7   | 74    |
| 2.3 Research & development (R&D).....                        | 1.3   | 101   |
| 2.3.1 Researchers, FTE/mn pop. <sup>Ⓔ</sup> .....            | 157.3 | 80    |
| 2.3.2 Gross expenditure on R&D, % GDP <sup>Ⓔ</sup> .....     | 0.2   | 95    |
| 2.3.3 Global R&D companies, avg. expend. top 3, mn \$US..... | 0.0   | 43 ○  |
| 2.3.4 QS university ranking, average score top 3*.....       | 0.0   | 75 ○  |

**3 Infrastructure.....46.4 66**

|  |         |      |
|--|---------|------|
| 3.1 Information & communication technologies (ICTs).....     | 52.5    | 74   |
| 3.1.1 ICT access*.....                                       | 47.3    | 87   |
| 3.1.2 ICT use*.....  | 38.8    | 71   |
| 3.1.3 Government's online service*.....                      | 59.4    | 67   |
| 3.1.4 E-participation*.....                                  | 64.4    | 54   |
| 3.2 General infrastructure.....                              | 34.2    | 77   |
| 3.2.1 Electricity output, kWh/cap.....                       | 1,634.6 | 83   |
| 3.2.2 Logistics performance*.....                            | 16.2    | 110  |
| 3.2.3 Gross capital formation, % GDP.....                    | 28.8    | 24 ● |
| 3.3 Ecological sustainability.....                           | 52.5    | 38 ● |
| 3.3.1 GDP/unit of energy use.....                            | 12.5    | 22 ● |
| 3.3.2 Environmental performance*.....                        | 74.4    | 57   |
| 3.3.3 ISO 14001 environmental certificates/bn PPP\$ GDP..... | 3.2     | 31 ● |

**4 Market sophistication.....51.7 41**

|   |      |    |
|---|------|----|
| 4.1 Credit.....                                     | 28.8 | 82 |
| 4.1.1 Ease of getting credit*.....                  | 65.0 | 40 |
| 4.1.2 Domestic credit to private sector, % GDP..... | 35.5 | 90 |
| 4.1.3 Microfinance gross loans, % GDP.....          | 0.5  | 35 |

|   |      |       |
|---|------|-------|
| 4.2 Investment.....                                     | 71.7 | [4]   |
| 4.2.1 Ease of protecting minority investors*.....       | 71.7 | 19 ●  |
| 4.2.2 Market capitalization, % GDP.....                 | n/a  | n/a   |
| 4.2.3 Venture capital deals/bn PPP\$ GDP.....           | n/a  | n/a   |
| 4.3 Trade, competition, & market scale.....             | 54.6 | 95    |
| 4.3.1 Applied tariff rate, weighted mean, %.....        | 1.1  | 15 ●  |
| 4.3.2 Intensity of local competition <sup>†</sup> ..... | 58.3 | 107 ○ |
| 4.3.3 Domestic market scale, bn PPP\$.....              | 34.2 | 105   |

**5 Business sophistication.....25.3 102**

|   |      |       |
|---|------|-------|
| 5.1 Knowledge workers.....  | 23.3 | 103   |
| 5.1.1 Knowledge-intensive employment, % <sup>Ⓔ</sup> .....          | 16.0 | 85    |
| 5.1.2 Firms offering formal training, % firms.....                  | 23.8 | 66    |
| 5.1.3 GERD performed by business, % of GDP.....                     | n/a  | n/a   |
| 5.1.4 GERD financed by business, % <sup>Ⓔ</sup> .....               | 3.3  | 81    |
| 5.1.5 Females employed w/advanced degrees, % total.....             | 9.2  | 65    |
| 5.2 Innovation linkages.....  | 20.8 | 101   |
| 5.2.1 University/industry research collaboration <sup>†</sup> ..... | 33.9 | 96    |
| 5.2.2 State of cluster development <sup>†</sup> .....               | 32.9 | 110 ○ |
| 5.2.3 GERD financed by abroad, % <sup>Ⓔ</sup> .....                 | 7.4  | 54    |
| 5.2.4 JV-strategic alliance deals/bn PPP\$ GDP.....                 | n/a  | n/a   |
| 5.2.5 Patent families 2+ offices/bn PPP\$ GDP.....                  | 0.0  | 90    |
| 5.3 Knowledge absorption.....                                       | 31.8 | 69    |
| 5.3.1 Intellectual property payments, % total trade.....            | 0.6  | 54    |
| 5.3.2 High-tech imports less re-imports, % total trade.....         | 4.3  | 114 ○ |
| 5.3.3 ICT services imports, % total trade.....                      | 1.5  | 42    |
| 5.3.4 FDI net inflows, % GDP.....                                   | 9.1  | 13 ●  |
| 5.3.5 Research talent, % in business enterprise.....                | n/a  | n/a   |

**6 Knowledge & technology outputs.....11.4 118 ○**

|   |       |       |
|---|-------|-------|
| 6.1 Knowledge creation.....                                       | 2.0   | 120 ○ |
| 6.1.1 Patents by origin/bn PPP\$ GDP.....                         | 0.4   | 78    |
| 6.1.2 PCT patent applications/bn PPP\$ GDP <sup>Ⓔ</sup> .....     | 0.1   | 72    |
| 6.1.3 Utility models by origin/bn PPP\$ GDP <sup>Ⓔ</sup> .....    | 0.0   | 60 ○  |
| 6.1.4 Scientific & technical articles/bn PPP\$ GDP.....           | 5.2   | 98    |
| 6.1.5 Citable documents H index.....                              | 1.8   | 120 ○ |
| 6.2 Knowledge impact.....   | 12.5  | 114 ○ |
| 6.2.1 Growth rate of PPP\$ GDP/worker, %.....                     | (2.7) | 106 ○ |
| 6.2.2 New businesses/th pop. 15–64 <sup>Ⓔ</sup> .....             | 1.1   | 65    |
| 6.2.3 Computer software spending, % GDP.....                      | 0.1   | 86    |
| 6.2.4 ISO 9001 quality certificates/bn PPP\$ GDP.....             | 8.5   | 40 ●  |
| 6.2.5 High- & medium-high-tech manufactures, % <sup>Ⓔ</sup> ..... | 0.1   | 88    |
| 6.3 Knowledge diffusion.....                                      | 19.6  | 83    |
| 6.3.1 Intellectual property receipts, % total trade.....          | 0.0   | 69    |
| 6.3.2 High-tech exports less re-exports, % total trade.....       | 0.4   | 91    |
| 6.3.3 ICT services exports, % total trade.....                    | 2.8   | 37 ●  |
| 6.3.4 FDI net outflows, % GDP.....                                | 0.5   | 66    |

**7 Creative outputs.....20.0 100**

|  |      |       |
|--|------|-------|
| 7.1 Intangible assets.....   | 27.6 | 114 ○ |
| 7.1.1 Trademarks by origin/bn PPP\$ GDP.....                       | 26.5 | 77    |
| 7.1.2 Industrial designs by origin/bn PPP\$ GDP <sup>Ⓔ</sup> ..... | 0.4  | 82    |
| 7.1.3 ICTs & business model creation <sup>†</sup> .....            | 49.6 | 102   |
| 7.1.4 ICTs & organizational model creation <sup>†</sup> .....      | 32.6 | 118 ○ |
| 7.2 Creative goods & services.....                                 | 5.7  | 104   |
| 7.2.1 Cultural & creative services exports, % of total trade.....  | 0.0  | 65    |
| 7.2.2 National feature films/mn pop. 15–69.....                    | 3.3  | 54    |
| 7.2.3 Global ent. & media market/th pop. 15–69.....                | n/a  | n/a   |
| 7.2.4 Printing & publishing manufactures, %.....                   | n/a  | n/a   |
| 7.2.5 Creative goods exports, % total trade.....                   | 0.1  | 88    |
| 7.3 Online creativity.....   | 19.2 | 65    |
| 7.3.1 Generic top-level domains (TLDs)/th pop. 15–69.....          | 7.3  | 45    |
| 7.3.2 Country-code TLDs/th pop. 15–69.....                         | 1.3  | 74    |
| 7.3.3 Wikipedia edits/mn pop. 15–69 <sup>Ⓔ</sup> .....             | 5.1  | 60    |
| 7.3.4 Video uploads on YouTube/pop. 15–69.....                     | n/a  | n/a   |

**NOTES:** ● indicates a strength; ○ a weakness; \* an index; † a survey question.

Ⓔ indicates that the country's data are older than the base year; see Appendix II for details, including the year of the data, at <http://globalinnovationindex.org>.

Square brackets indicate that the data minimum coverage (DMC) requirements were not met at the sub-pillar or pillar level; see page 181 of this appendix for details.

## Algeria

## Key indicators

|                            |                                  |
|----------------------------|----------------------------------|
| Population (millions)..... | 40.4                             |
| GDP (US\$ billions).....   | 168.3                            |
| GDP per capita, PPP\$..... | 14,503.9                         |
| Income group.....          | Upper-middle income              |
| Region.....                | Northern Africa and Western Asia |

|  | Score 0–100<br>or value (hard data) | Rank       |
|--|-------------------------------------|------------|
| <b>Global Innovation Index (out of 127).....</b> | <b>24.3</b>                         | <b>108</b> |
| Innovation Output Sub-Index.....                 | 15.6                                | 117        |
| Innovation Input Sub-Index.....                  | 33.1                                | 105        |
| Innovation Efficiency Ratio.....                 | 0.5                                 | 111        |
| Global Innovation Index 2016 (out of 128).....   | 24.5                                | 113        |

**1 Institutions.....47.0 103**

|   |      |       |
|---|------|-------|
| 1.1 Political environment.....                        | 33.8 | 108   |
| 1.1.1 Political stability & safety*.....              | 38.5 | 111   |
| 1.1.2 Government effectiveness*.....                  | 29.1 | 95    |
| 1.2 Regulatory environment.....                       | 47.6 | 106   |
| 1.2.1 Regulatory quality*.....                        | 12.2 | 125 ○ |
| 1.2.2 Rule of law*.....                               | 15.1 | 112   |
| 1.2.3 Cost of redundancy dismissal, salary weeks..... | 17.3 | 71    |
| 1.3 Business environment.....                         | 59.7 | 99    |
| 1.3.1 Ease of starting a business*.....               | 77.5 | 106   |
| 1.3.2 Ease of resolving insolvency*.....              | 47.7 | 68    |
| 1.3.3 Ease of paying taxes*.....                      | 54.0 | 108   |

**2 Human capital & research.....25.8 86**

|  |       |       |
|--|-------|-------|
| 2.1 Education.....   | 41.4  | 83    |
| 2.1.1 Expenditure on education, % GDP <sup>Ⓐ</sup> .....     | 4.3   | 70    |
| 2.1.2 Gov't expenditure/pupil, secondary, % GDP/cap.....     | n/a   | n/a   |
| 2.1.3 School life expectancy, years <sup>Ⓐ</sup> .....       | 14.4  | 60 ●  |
| 2.1.4 PISA scales in reading, maths, & science.....          | 361.7 | 69    |
| 2.1.5 Pupil-teacher ratio, secondary.....                    | n/a   | n/a   |
| 2.2 Tertiary education.....                                  | 35.9  | 63 ●  |
| 2.2.1 Tertiary enrolment, % gross.....                       | 36.9  | 70    |
| 2.2.2 Graduates in science & engineering, %.....             | 27.6  | 17 ●  |
| 2.2.3 Tertiary inbound mobility, %.....                      | 0.6   | 88    |
| 2.3 Research & development (R&D).....                        | 0.0   | 115 ○ |
| 2.3.1 Researchers, FTE/mn pop.....                           | n/a   | n/a   |
| 2.3.2 Gross expenditure on R&D, % GDP.....                   | n/a   | n/a   |
| 2.3.3 Global R&D companies, avg. expend. top 3, mn \$US..... | 0.0   | 43 ○  |
| 2.3.4 QS university ranking, average score top 3*.....       | 0.0   | 75 ○  |

**3 Infrastructure.....42.3 79**

|  |         |       |
|--|---------|-------|
| 3.1 Information & communication technologies (ICTs).....     | 24.5    | 113   |
| 3.1.1 ICT access*.....                                       | 50.3    | 82    |
| 3.1.2 ICT use*.....  | 29.2    | 89    |
| 3.1.3 Government's online service*.....                      | 6.5     | 125 ○ |
| 3.1.4 E-participation*.....                                  | 11.9    | 122   |
| 3.2 General infrastructure.....                              | 59.6    | 8 ●   |
| 3.2.1 Electricity output, kWh/cap.....                       | 1,650.2 | 82    |
| 3.2.2 Logistics performance*.....                            | 32.7    | 75    |
| 3.2.3 Gross capital formation, % GDP.....                    | 47.8    | 1 ●   |
| 3.3 Ecological sustainability.....                           | 42.8    | 74    |
| 3.3.1 GDP/unit of energy use.....                            | 10.0    | 48 ●  |
| 3.3.2 Environmental performance*.....                        | 70.3    | 76    |
| 3.3.3 ISO 14001 environmental certificates/bn PPP\$ GDP..... | 0.2     | 110   |

**4 Market sophistication.....29.5 122**

|   |      |       |
|---|------|-------|
| 4.1 Credit.....                                     | 8.8  | 125 ○ |
| 4.1.1 Ease of getting credit*.....                  | 10.0 | 124 ○ |
| 4.1.2 Domestic credit to private sector, % GDP..... | 21.6 | 110   |
| 4.1.3 Microfinance gross loans, % GDP.....          | n/a  | n/a   |

|   |       |       |
|---|-------|-------|
| 4.2 Investment.....                                     | 22.8  | 124   |
| 4.2.1 Ease of protecting minority investors*.....       | 33.3  | 124 ○ |
| 4.2.2 Market capitalization, % GDP.....                 | n/a   | n/a   |
| 4.2.3 Venture capital deals/bn PPP\$ GDP.....           | 0.0   | 81    |
| 4.3 Trade, competition, & market scale.....             | 56.7  | 85    |
| 4.3.1 Applied tariff rate, weighted mean, %.....        | 8.3   | 108   |
| 4.3.2 Intensity of local competition <sup>†</sup> ..... | 46.3  | 123 ○ |
| 4.3.3 Domestic market scale, bn PPP\$.....              | 609.4 | 33 ●  |

**5 Business sophistication.....21.0 119**

|  |      |      |
|--|------|------|
| 5.1 Knowledge workers.....   | 16.6 | 115  |
| 5.1.1 Knowledge-intensive employment, % <sup>Ⓐ</sup> .....             | 10.0 | 95   |
| 5.1.2 Firms offering formal training, % firms <sup>Ⓐ</sup> .....       | 17.3 | 83   |
| 5.1.3 GERD performed by business, % of GDP.....                        | n/a  | n/a  |
| 5.1.4 GERD financed by business, %.....                                | n/a  | n/a  |
| 5.1.5 Females employed w/advanced degrees, % total <sup>Ⓐ</sup> .....  | 4.6  | 78   |
| 5.2 Innovation linkages.....   | 19.6 | 111  |
| 5.2.1 University/industry research collaboration <sup>†</sup> .....    | 28.5 | 108  |
| 5.2.2 State of cluster development <sup>†</sup> .....                  | 34.2 | 105  |
| 5.2.3 GERD financed by abroad, %.....                                  | n/a  | n/a  |
| 5.2.4 JV-strategic alliance deals/bn PPP\$ GDP.....                    | 0.0  | 107  |
| 5.2.5 Patent families 2+ offices/bn PPP\$ GDP.....                     | 0.0  | 101  |
| 5.3 Knowledge absorption.....  | 26.9 | 91   |
| 5.3.1 Intellectual property payments, % total trade <sup>Ⓐ</sup> ..... | 0.2  | 81   |
| 5.3.2 High-tech imports less re-imports, % total trade.....            | 11.7 | 25 ● |
| 5.3.3 ICT services imports, % total trade <sup>Ⓐ</sup> .....           | 0.3  | 110  |
| 5.3.4 FDI net inflows, % GDP.....                                      | 0.4  | 118  |
| 5.3.5 Research talent, % in business enterprise.....                   | n/a  | n/a  |

**6 Knowledge & technology outputs.....14.4 107**

|  |       |       |
|--|-------|-------|
| 6.1 Knowledge creation.....  | 3.8   | 101   |
| 6.1.1 Patents by origin/bn PPP\$ GDP.....                              | 0.2   | 101   |
| 6.1.2 PCT patent applications/bn PPP\$ GDP.....                        | 0.0   | 97    |
| 6.1.3 Utility models by origin/bn PPP\$ GDP.....                       | n/a   | n/a   |
| 6.1.4 Scientific & technical articles/bn PPP\$ GDP.....                | 5.4   | 97    |
| 6.1.5 Citable documents H index.....                                   | 7.2   | 81    |
| 6.2 Knowledge impact.....  | 27.4  | 81    |
| 6.2.1 Growth rate of PPP\$ GDP/worker, %.....                          | 2.0   | 37 ●  |
| 6.2.2 New businesses/th pop. 15–64.....                                | 0.6   | 83    |
| 6.2.3 Computer software spending, % GDP.....                           | 0.0   | 124 ○ |
| 6.2.4 ISO 9001 quality certificates/bn PPP\$ GDP.....                  | 1.0   | 109   |
| 6.2.5 High- & medium-high-tech manufactures, % <sup>Ⓐ</sup> .....      | 0.3   | 39 ●  |
| 6.3 Knowledge diffusion.....   | 12.2  | 124   |
| 6.3.1 Intellectual property receipts, % total trade <sup>Ⓐ</sup> ..... | 0.0   | 104   |
| 6.3.2 High-tech exports less re-exports, % total trade.....            | 0.0   | 125 ○ |
| 6.3.3 ICT services exports, % total trade <sup>Ⓐ</sup> .....           | 0.3   | 112   |
| 6.3.4 FDI net outflows, % GDP.....                                     | (0.0) | 112   |

**7 Creative outputs.....16.7 116**

|  |      |       |
|--|------|-------|
| 7.1 Intangible assets.....   | 26.0 | 120   |
| 7.1.1 Trademarks by origin/bn PPP\$ GDP.....                       | 24.9 | 79    |
| 7.1.2 Industrial designs by origin/bn PPP\$ GDP <sup>Ⓐ</sup> ..... | 1.5  | 52 ●  |
| 7.1.3 ICTs & business model creation <sup>†</sup> .....            | 45.2 | 115   |
| 7.1.4 ICTs & organizational model creation <sup>†</sup> .....      | 29.6 | 120   |
| 7.2 Creative goods & services.....                                 | 5.7  | 105   |
| 7.2.1 Cultural & creative services exports, % of total trade.....  | 0.0  | 84    |
| 7.2.2 National feature films/mn pop. 15–69.....                    | n/a  | n/a   |
| 7.2.3 Global ent. & media market/th pop. 15–69.....                | 1.1  | 55    |
| 7.2.4 Printing & publishing manufactures, % <sup>Ⓐ</sup> .....     | 1.2  | 49 ●  |
| 7.2.5 Creative goods exports, % total trade.....                   | 0.0  | 125 ○ |
| 7.3 Online creativity.....   | 9.0  | 101   |
| 7.3.1 Generic top-level domains (TLDs)/th pop. 15–69.....          | 0.5  | 107   |
| 7.3.2 Country-code TLDs/th pop. 15–69.....                         | 0.1  | 110   |
| 7.3.3 Wikipedia edits/mn pop. 15–69 <sup>Ⓐ</sup> .....             | 3.0  | 99    |
| 7.3.4 Video uploads on YouTube/pop. 15–69.....                     | 6.5  | 66    |

NOTES: ● indicates a strength; ○ a weakness; \* an index; † a survey question.

Ⓐ indicates that the country's data are older than the base year; see Appendix II for details, including the year of the data, at <http://globalinnovationindex.org>.

Square brackets indicate that the data minimum coverage (DMC) requirements were not met at the sub-pillar or pillar level; see page 181 of this appendix for details.

## Key indicators

|                            |                                 |
|----------------------------|---------------------------------|
| Population (millions)..... | 43.8                            |
| GDP (US\$ billions).....   | 541.7                           |
| GDP per capita, PPP\$..... | 22,553.6                        |
| Income group.....          | Upper-middle income             |
| Region.....                | Latin America and the Caribbean |

|  | Score 0–100<br>or value (hard data) | Rank      |
|--|-------------------------------------|-----------|
| <b>Global Innovation Index (out of 127).....</b> | <b>32.0</b>                         | <b>76</b> |
| Innovation Output Sub-Index.....                 | 22.6                                | 81        |
| Innovation Input Sub-Index.....                  | 41.4                                | 72        |
| Innovation Efficiency Ratio.....                 | 0.5                                 | 94        |
| Global Innovation Index 2016 (out of 128).....   | 30.2                                | 81        |

**1 Institutions.....46.4 109**

|   |      |       |
|---|------|-------|
| 1.1 Political environment.....                        | 51.1 | 68    |
| 1.1.1 Political stability & safety*.....              | 62.2 | 66    |
| 1.1.2 Government effectiveness*.....                  | 39.9 | 77    |
| 1.2 Regulatory environment.....                       | 36.3 | 118 ○ |
| 1.2.1 Regulatory quality*.....                        | 17.7 | 119 ○ |
| 1.2.2 Rule of law*.....                               | 15.9 | 111   |
| 1.2.3 Cost of redundancy dismissal, salary weeks..... | 30.3 | 117 ○ |
| 1.3 Business environment.....                         | 51.7 | 118 ○ |
| 1.3.1 Ease of starting a business*.....               | 73.6 | 115 ○ |
| 1.3.2 Ease of resolving insolvency*.....              | 41.9 | 87    |
| 1.3.3 Ease of paying taxes*.....                      | 39.8 | 122 ○ |

**2 Human capital & research.....42.6 34 ●**

|  |         |      |
|--|---------|------|
| 2.1 Education.....   | 57.4    | 34 ● |
| 2.1.1 Expenditure on education, % GDP.....                   | 5.5     | 30 ● |
| 2.1.2 Gov't expenditure/pupil, secondary, % GDP/cap.....     | 22.2    | 43   |
| 2.1.3 School life expectancy, years.....                     | 17.3    | 16 ● |
| 2.1.4 PISA scales in reading, maths, & science.....          | 468.9   | 39   |
| 2.1.5 Pupil-teacher ratio, secondary <sup>Ⓐ</sup> .....      | 12.2    | 43   |
| 2.2 Tertiary education.....                                  | 40.9    | 44   |
| 2.2.1 Tertiary enrolment, % gross <sup>Ⓐ</sup> .....         | 82.9    | 11 ● |
| 2.2.2 Graduates in science & engineering, %.....             | 14.1    | 89   |
| 2.2.3 Tertiary inbound mobility, %.....                      | n/a     | n/a  |
| 2.3 Research & development (R&D).....                        | 29.5    | 37   |
| 2.3.1 Researchers, FTE/mn pop. <sup>Ⓐ</sup> .....            | 1,202.1 | 44   |
| 2.3.2 Gross expenditure on R&D, % GDP <sup>Ⓐ</sup> .....     | 0.6     | 55   |
| 2.3.3 Global R&D companies, avg. expend. top 3, mn \$US..... | 43.6    | 35 ● |
| 2.3.4 QS university ranking, average score top 3*.....       | 46.0    | 28 ● |

**3 Infrastructure.....46.6 65**

|  |         |     |
|--|---------|-----|
| 3.1 Information & communication technologies (ICTs).....     | 64.0    | 49  |
| 3.1.1 ICT access*.....                                       | 67.7    | 58  |
| 3.1.2 ICT use*.....  | 54.5    | 52  |
| 3.1.3 Government's online service*.....                      | 71.0    | 43  |
| 3.1.4 E-participation*.....                                  | 62.7    | 59  |
| 3.2 General infrastructure.....                              | 28.2    | 96  |
| 3.2.1 Electricity output, kWh/cap.....                       | 3,286.6 | 59  |
| 3.2.2 Logistics performance*.....                            | 41.6    | 65  |
| 3.2.3 Gross capital formation, % GDP.....                    | 16.5    | 106 |
| 3.3 Ecological sustainability.....                           | 47.6    | 51  |
| 3.3.1 GDP/unit of energy use.....                            | 9.3     | 56  |
| 3.3.2 Environmental performance*.....                        | 79.8    | 43  |
| 3.3.3 ISO 14001 environmental certificates/bn PPP\$ GDP..... | 1.6     | 55  |

**4 Market sophistication.....37.7 104**

|   |      |       |
|---|------|-------|
| 4.1 Credit.....                                     | 18.3 | 116 ○ |
| 4.1.1 Ease of getting credit*.....                  | 50.0 | 72    |
| 4.1.2 Domestic credit to private sector, % GDP..... | 14.7 | 117 ○ |
| 4.1.3 Microfinance gross loans, % GDP.....          | 0.0  | 78 ○  |

|   |       |       |
|---|-------|-------|
| 4.2 Investment.....                                     | 32.4  | 100   |
| 4.2.1 Ease of protecting minority investors*.....       | 61.7  | 50    |
| 4.2.2 Market capitalization, % GDP.....                 | 9.6   | 77 ○  |
| 4.2.3 Venture capital deals/bn PPP\$ GDP.....           | 0.0   | 78    |
| 4.3 Trade, competition, & market scale.....             | 62.6  | 59    |
| 4.3.1 Applied tariff rate, weighted mean, %.....        | 7.4   | 106   |
| 4.3.2 Intensity of local competition <sup>†</sup> ..... | 57.1  | 112 ○ |
| 4.3.3 Domestic market scale, bn PPP\$.....              | 879.4 | 25 ●  |

**5 Business sophistication.....33.6 59**

|   |      |       |
|---|------|-------|
| 5.1 Knowledge workers.....  | 46.8 | 42    |
| 5.1.1 Knowledge-intensive employment, % <sup>Ⓐ</sup> .....            | 23.9 | 61    |
| 5.1.2 Firms offering formal training, % firms <sup>Ⓐ</sup> .....      | 63.6 | 5 ●   |
| 5.1.3 GERD performed by business, % of GDP <sup>Ⓐ</sup> .....         | 0.1  | 59    |
| 5.1.4 GERD financed by business, % <sup>Ⓐ</sup> .....                 | 26.5 | 55    |
| 5.1.5 Females employed w/advanced degrees, % total <sup>Ⓐ</sup> ..... | 16.4 | 34    |
| 5.2 Innovation linkages.....  | 17.0 | 119 ○ |
| 5.2.1 University/industry research collaboration <sup>†</sup> .....   | 40.4 | 68    |
| 5.2.2 State of cluster development <sup>†</sup> .....                 | 37.2 | 94    |
| 5.2.3 GERD financed by abroad, % <sup>Ⓐ</sup> .....                   | 0.6  | 91 ○  |
| 5.2.4 JV-strategic alliance deals/bn PPP\$ GDP.....                   | 0.0  | 98    |
| 5.2.5 Patent families 2+ offices/bn PPP\$ GDP.....                    | 0.1  | 67    |
| 5.3 Knowledge absorption.....   | 37.1 | 44    |
| 5.3.1 Intellectual property payments, % total trade.....              | 2.6  | 7 ●   |
| 5.3.2 High-tech imports less re-imports, % total trade.....           | 13.4 | 17 ●  |
| 5.3.3 ICT services imports, % total trade.....                        | 1.4  | 47    |
| 5.3.4 FDI net inflows, % GDP.....                                     | 1.6  | 93    |
| 5.3.5 Research talent, % in business enterprise <sup>Ⓐ</sup> .....    | 6.2  | 72    |

**6 Knowledge & technology outputs.....17.6 89**

|   |       |      |
|---|-------|------|
| 6.1 Knowledge creation.....                                 | 9.5   | 67   |
| 6.1.1 Patents by origin/bn PPP\$ GDP.....                   | 0.6   | 71   |
| 6.1.2 PCT patent applications/bn PPP\$ GDP.....             | n/a   | n/a  |
| 6.1.3 Utility models by origin/bn PPP\$ GDP.....            | 0.1   | 45   |
| 6.1.4 Scientific & technical articles/bn PPP\$ GDP.....     | 9.6   | 68   |
| 6.1.5 Citable documents H index.....                        | 25.3  | 35 ● |
| 6.2 Knowledge impact.....                                   | 23.0  | 98   |
| 6.2.1 Growth rate of PPP\$ GDP/worker, %.....               | (0.2) | 90   |
| 6.2.2 New businesses/th pop. 15–64.....                     | 0.4   | 89   |
| 6.2.3 Computer software spending, % GDP.....                | 0.2   | 68   |
| 6.2.4 ISO 9001 quality certificates/bn PPP\$ GDP.....       | 8.0   | 42   |
| 6.2.5 High- & medium-high-tech manufactures, %.....         | n/a   | n/a  |
| 6.3 Knowledge diffusion.....                                | 20.4  | 73   |
| 6.3.1 Intellectual property receipts, % total trade.....    | 0.2   | 35   |
| 6.3.2 High-tech exports less re-exports, % total trade..... | 2.0   | 56   |
| 6.3.3 ICT services exports, % total trade.....              | 2.3   | 48   |
| 6.3.4 FDI net outflows, % GDP.....                          | 0.2   | 83   |

**7 Creative outputs.....27.6 80**

|   |      |       |
|---|------|-------|
| 7.1 Intangible assets.....  | 36.6 | 90    |
| 7.1.1 Trademarks by origin/bn PPP\$ GDP.....                      | 59.0 | 37    |
| 7.1.2 Industrial designs by origin/bn PPP\$ GDP.....              | 1.1  | 58    |
| 7.1.3 ICTs & business model creation <sup>†</sup> .....           | 46.6 | 114 ○ |
| 7.1.4 ICTs & organizational model creation <sup>†</sup> .....     | 48.5 | 80    |
| 7.2 Creative goods & services.....                                | 12.9 | 78    |
| 7.2.1 Cultural & creative services exports, % of total trade..... | 0.4  | 31    |
| 7.2.2 National feature films/mn pop. 15–69.....                   | 6.2  | 31    |
| 7.2.3 Global ent. & media market/th pop. 15–69.....               | 13.4 | 29    |
| 7.2.4 Printing & publishing manufactures, %.....                  | n/a  | n/a   |
| 7.2.5 Creative goods exports, % total trade.....                  | 0.1  | 86    |
| 7.3 Online creativity.....  | 24.4 | 52    |
| 7.3.1 Generic top-level domains (TLDs)/th pop. 15–69.....         | 3.1  | 65    |
| 7.3.2 Country-code TLDs/th pop. 15–69.....                        | 5.8  | 45    |
| 7.3.3 Wikipedia edits/mn pop. 15–69.....                          | 5.3  | 53    |
| 7.3.4 Video uploads on YouTube/pop. 15–69.....                    | 37.4 | 35    |

NOTES: ● indicates a strength; ○ a weakness; \* an index; † a survey question.

Ⓐ indicates that the country's data are older than the base year; see Appendix II for details, including the year of the data, at <http://globalinnovationindex.org>.

Square brackets indicate that the data minimum coverage (DMC) requirements were not met at the sub-pillar or pillar level; see page 181 of this appendix for details.

## Armenia

## Key indicators

|                            |                                  |
|----------------------------|----------------------------------|
| Population (millions)..... | 3.0                              |
| GDP (US\$ billions).....   | 10.8                             |
| GDP per capita, PPP\$..... | 8,467.9                          |
| Income group.....          | Lower-middle income              |
| Region.....                | Northern Africa and Western Asia |

|  | Score 0–100<br>or value (hard data) | Rank      |
|--|-------------------------------------|-----------|
| <b>Global Innovation Index (out of 127).....</b> | <b>35.7</b>                         | <b>59</b> |
| Innovation Output Sub-Index.....                 | 31.6                                | 47        |
| Innovation Input Sub-Index.....                  | 39.7                                | 82        |
| Innovation Efficiency Ratio.....                 | 0.8                                 | 17 ●      |
| Global Innovation Index 2016 (out of 128).....   | 35.1                                | 60        |

|   |             |           |
|---|-------------|-----------|
| <b>1 Institutions.....</b>                            | <b>61.9</b> | <b>63</b> |
| 1.1 Political environment.....                        | 47.7        | 74        |
| 1.1.1 Political stability & safety*.....              | 56.8        | 78        |
| 1.1.2 Government effectiveness*.....                  | 38.7        | 79        |
| 1.2 Regulatory environment.....                       | 66.5        | 55        |
| 1.2.1 Regulatory quality*.....                        | 48.5        | 61        |
| 1.2.2 Rule of law*.....                               | 29.4        | 80        |
| 1.2.3 Cost of redundancy dismissal, salary weeks..... | 11.0        | 38        |
| 1.3 Business environment.....                         | 71.5        | 61        |
| 1.3.1 Ease of starting a business*.....               | 96.1        | 9 ●       |
| 1.3.2 Ease of resolving insolvency*.....              | 46.1        | 71        |
| 1.3.3 Ease of paying taxes*.....                      | 72.5        | 67        |

|  |             |            |
|--|-------------|------------|
| <b>2 Human capital &amp; research.....</b>                   | <b>19.4</b> | <b>103</b> |
| 2.1 Education.....   | 28.9        | 110        |
| 2.1.1 Expenditure on education, % GDP.....                   | 2.8         | 103 ○      |
| 2.1.2 Gov't expenditure/pupil, secondary, % GDP/cap.....     | 15.0        | 82         |
| 2.1.3 School life expectancy, years.....                     | 13.2        | 67         |
| 2.1.4 PISA scales in reading, maths, & science.....          | n/a         | n/a        |
| 2.1.5 Pupil-teacher ratio, secondary.....                    | n/a         | n/a        |
| 2.2 Tertiary education.....                                  | 27.5        | 88         |
| 2.2.1 Tertiary enrolment, % gross.....                       | 44.3        | 60         |
| 2.2.2 Graduates in science & engineering, %.....             | 14.1        | 90 ○       |
| 2.2.3 Tertiary inbound mobility, %.....                      | 4.1         | 47         |
| 2.3 Research & development (R&D).....                        | 1.8         | 95         |
| 2.3.1 Researchers, FTE/mn pop.....                           | n/a         | n/a        |
| 2.3.2 Gross expenditure on R&D, % GDP.....                   | 0.2         | 83         |
| 2.3.3 Global R&D companies, avg. expend. top 3, mn \$US..... | 0.0         | 43 ○       |
| 2.3.4 QS university ranking, average score top 3*.....       | 0.0         | 75 ○       |

|  |             |           |
|--|-------------|-----------|
| <b>3 Infrastructure.....</b>                                 | <b>39.0</b> | <b>91</b> |
| 3.1 Information & communication technologies (ICTs).....     | 49.9        | 79        |
| 3.1.1 ICT access*.....                                       | 65.7        | 62        |
| 3.1.2 ICT use*.....  | 38.5        | 72        |
| 3.1.3 Government's online service*.....                      | 42.8        | 96        |
| 3.1.4 E-participation*.....                                  | 52.5        | 82        |
| 3.2 General infrastructure.....                              | 23.4        | 112 ○     |
| 3.2.1 Electricity output, kWh/cap.....                       | 2,574.8     | 68        |
| 3.2.2 Logistics performance*.....                            | 6.6         | 121 ○     |
| 3.2.3 Gross capital formation, % GDP.....                    | 20.6        | 76        |
| 3.3 Ecological sustainability.....                           | 43.7        | 68        |
| 3.3.1 GDP/unit of energy use.....                            | 7.7         | 74        |
| 3.3.2 Environmental performance*.....                        | 81.6        | 37        |
| 3.3.3 ISO 14001 environmental certificates/bn PPP\$ GDP..... | 0.1         | 115 ○     |

|   |             |           |
|---|-------------|-----------|
| <b>4 Market sophistication.....</b>                 | <b>50.5</b> | <b>46</b> |
| 4.1 Credit.....                                     | 59.1        | 16 ●      |
| 4.1.1 Ease of getting credit*.....                  | 75.0        | 19 ●      |
| 4.1.2 Domestic credit to private sector, % GDP..... | 45.7        | 75        |
| 4.1.3 Microfinance gross loans, % GDP.....          | 4.8         | 7 ●       |

|   |      |       |
|---|------|-------|
| 4.2 Investment.....                                     | 40.2 | 62    |
| 4.2.1 Ease of protecting minority investors*.....       | 60.0 | 52    |
| 4.2.2 Market capitalization, % GDP <sup>Ⓔ</sup> .....   | 1.2  | 85 ○  |
| 4.2.3 Venture capital deals/bn PPP\$ GDP.....           | n/a  | n/a   |
| 4.3 Trade, competition, & market scale.....             | 52.2 | 101   |
| 4.3.1 Applied tariff rate, weighted mean, %.....        | 2.5  | 59    |
| 4.3.2 Intensity of local competition <sup>†</sup> ..... | 63.5 | 86    |
| 4.3.3 Domestic market scale, bn PPP\$.....              | 26.6 | 112 ○ |

|   |             |           |
|---|-------------|-----------|
| <b>5 Business sophistication.....</b>                               | <b>27.7</b> | <b>85</b> |
| 5.1 Knowledge workers.....  | 37.0        | 65        |
| 5.1.1 Knowledge-intensive employment, %.....                        | 31.1        | 46        |
| 5.1.2 Firms offering formal training, % firms.....                  | 16.2        | 84 ○      |
| 5.1.3 GERD performed by business, % of GDP.....                     | n/a         | n/a       |
| 5.1.4 GERD financed by business, %.....                             | n/a         | n/a       |
| 5.1.5 Females employed w/advanced degrees, % total.....             | 14.5        | 42        |
| 5.2 Innovation linkages.....  | 19.1        | 114 ○     |
| 5.2.1 University/industry research collaboration <sup>†</sup> ..... | 36.9        | 86        |
| 5.2.2 State of cluster development <sup>†</sup> .....               | 38.9        | 89        |
| 5.2.3 GERD financed by abroad, %.....                               | 2.3         | 74        |
| 5.2.4 JV-strategic alliance deals/bn PPP\$ GDP.....                 | 0.0         | 70        |
| 5.2.5 Patent families 2+ offices/bn PPP\$ GDP.....                  | 0.5         | 37        |
| 5.3 Knowledge absorption.....                                       | 27.1        | 90        |
| 5.3.1 Intellectual property payments, % total trade.....            | n/a         | n/a       |
| 5.3.2 High-tech imports less re-imports, % total trade.....         | 5.1         | 109       |
| 5.3.3 ICT services imports, % total trade.....                      | 0.9         | 73        |
| 5.3.4 FDI net inflows, % GDP.....                                   | 2.8         | 66        |
| 5.3.5 Research talent, % in business enterprise.....                | n/a         | n/a       |

|   |             |           |
|---|-------------|-----------|
| <b>6 Knowledge &amp; technology outputs.....</b>                  | <b>25.7</b> | <b>50</b> |
| 6.1 Knowledge creation.....                                       | 28.9        | 32        |
| 6.1.1 Patents by origin/bn PPP\$ GDP.....                         | 4.5         | 25 ●      |
| 6.1.2 PCT patent applications/bn PPP\$ GDP.....                   | 0.3         | 45        |
| 6.1.3 Utility models by origin/bn PPP\$ GDP.....                  | 2.1         | 13 ●      |
| 6.1.4 Scientific & technical articles/bn PPP\$ GDP.....           | 29.0        | 26 ●      |
| 6.1.5 Citable documents H index.....                              | 9.9         | 62        |
| 6.2 Knowledge impact.....   | 24.2        | 91        |
| 6.2.1 Growth rate of PPP\$ GDP/worker, %.....                     | 2.4         | 31        |
| 6.2.2 New businesses/th pop. 15–64.....                           | 1.5         | 55        |
| 6.2.3 Computer software spending, % GDP.....                      | 0.1         | 88        |
| 6.2.4 ISO 9001 quality certificates/bn PPP\$ GDP.....             | 1.1         | 107       |
| 6.2.5 High- & medium-high-tech manufactures, % <sup>Ⓔ</sup> ..... | 0.0         | 97 ○      |
| 6.3 Knowledge diffusion.....                                      | 24.0        | 57        |
| 6.3.1 Intellectual property receipts, % total trade.....          | n/a         | n/a       |
| 6.3.2 High-tech exports less re-exports, % total trade.....       | 0.3         | 93        |
| 6.3.3 ICT services exports, % total trade.....                    | 3.5         | 22 ●      |
| 6.3.4 FDI net outflows, % GDP.....                                | 0.2         | 88        |

|   |             |           |
|---|-------------|-----------|
| <b>7 Creative outputs.....</b>                                    | <b>37.5</b> | <b>44</b> |
| 7.1 Intangible assets.....  | 49.1        | 41        |
| 7.1.1 Trademarks by origin/bn PPP\$ GDP.....                      | 107.4       | 11 ●      |
| 7.1.2 Industrial designs by origin/bn PPP\$ GDP.....              | 1.2         | 56        |
| 7.1.3 ICTs & business model creation <sup>†</sup> .....           | 59.0        | 68        |
| 7.1.4 ICTs & organizational model creation <sup>†</sup> .....     | 54.6        | 58        |
| 7.2 Creative goods & services.....                                | 26.1        | 43        |
| 7.2.1 Cultural & creative services exports, % of total trade..... | 0.3         | 35        |
| 7.2.2 National feature films/mn pop. 15–69.....                   | 16.6        | 8 ●       |
| 7.2.3 Global ent. & media market/th pop. 15–69.....               | n/a         | n/a       |
| 7.2.4 Printing & publishing manufactures, % <sup>Ⓔ</sup> .....    | 1.8         | 25        |
| 7.2.5 Creative goods exports, % total trade.....                  | 0.4         | 60        |
| 7.3 Online creativity.....  | 25.7        | 48        |
| 7.3.1 Generic top-level domains (TLDs)/th pop. 15–69.....         | 2.8         | 68        |
| 7.3.2 Country-code TLDs/th pop. 15–69.....                        | 4.9         | 51        |
| 7.3.3 Wikipedia edits/mn pop. 15–69.....                          | 7.2         | 7 ●       |
| 7.3.4 Video uploads on YouTube/pop. 15–69.....                    | n/a         | n/a       |

NOTES: ● indicates a strength; ○ a weakness; \* an index; † a survey question.

Ⓔ indicates that the country's data are older than the base year; see Appendix II for details, including the year of the data, at <http://globalinnovationindex.org>.

Square brackets indicate that the data minimum coverage (DMC) requirements were not met at the sub-pillar or pillar level; see page 181 of this appendix for details.

## Key indicators

|                            |   |
|----------------------------|---|
| Population (millions)..... | 24.3                                    |
| GDP (US\$ billions).....   | 1,256.6                                 |
| GDP per capita, PPP\$..... | 47,389.1                                |
| Income group.....          | High income                             |
| Region.....                | South East Asia, East Asia, and Oceania |

|  | Score 0–100<br>or value (hard data) | Rank      |
|--|-------------------------------------|-----------|
| <b>Global Innovation Index (out of 127).....</b> | <b>51.8</b>                         | <b>23</b> |
| Innovation Output Sub-Index.....                 | 39.1                                | 30        |
| Innovation Input Sub-Index.....                  | 64.6                                | 12        |
| Innovation Efficiency Ratio.....                 | 0.6                                 | 76 ○      |
| Global Innovation Index 2016 (out of 128).....   | 53.1                                | 19        |

**1 Institutions..... 87.4 14**

|   |      |     |
|---|------|-----|
| 1.1 Political environment.....                        | 83.9 | 17  |
| 1.1.1 Political stability & safety*.....              | 85.7 | 24  |
| 1.1.2 Government effectiveness*.....                  | 82.2 | 15  |
| 1.2 Regulatory environment.....                       | 91.2 | 11  |
| 1.2.1 Regulatory quality*.....                        | 88.1 | 8   |
| 1.2.2 Rule of law*.....                               | 92.7 | 13  |
| 1.2.3 Cost of redundancy dismissal, salary weeks..... | 12.0 | 43  |
| 1.3 Business environment.....                         | 86.9 | 16  |
| 1.3.1 Ease of starting a business*.....               | 96.5 | 7 ● |
| 1.3.2 Ease of resolving insolvency*.....              | 78.7 | 20  |
| 1.3.3 Ease of paying taxes*.....                      | 85.6 | 23  |

**2 Human capital & research..... 60.2 9**

|  |         |      |
|--|---------|------|
| 2.1 Education.....   | 58.6    | 26   |
| 2.1.1 Expenditure on education, % GDP.....                     | 5.3     | 41   |
| 2.1.2 Gov't expenditure/pupil, secondary, % GDP/cap.....       | 16.9    | 66 ○ |
| 2.1.3 School life expectancy, years.....                       | 20.5    | 1 ●  |
| 2.1.4 PISA scales in reading, maths, & science.....            | 502.3   | 19   |
| 2.1.5 Pupil-teacher ratio, secondary.....                      | n/a     | n/a  |
| 2.2 Tertiary education.....                                    | 58.1    | 10   |
| 2.2.1 Tertiary enrolment, % gross <sup>Ⓢ</sup> .....           | 90.3    | 3 ●  |
| 2.2.2 Graduates in science & engineering, % <sup>Ⓢ</sup> ..... | 15.9    | 79 ○ |
| 2.2.3 Tertiary inbound mobility, % <sup>Ⓢ</sup> .....          | 18.3    | 6 ●  |
| 2.3 Research & development (R&D).....                          | 64.0    | 13   |
| 2.3.1 Researchers, FTE/mn pop. <sup>Ⓢ</sup> .....              | 4,530.7 | 15   |
| 2.3.2 Gross expenditure on R&D, % GDP <sup>Ⓢ</sup> .....       | 2.2     | 16   |
| 2.3.3 Global R&D companies, avg. expend. top 3, mn \$US.....   | 68.6    | 19   |
| 2.3.4 QS university ranking, average score top 3*.....         | 81.6    | 7 ●  |

**3 Infrastructure..... 64.8 7 ●**

|  |          |      |
|--|----------|------|
| 3.1 Information & communication technologies (ICTs).....     | 88.9     | 4 ●  |
| 3.1.1 ICT access*.....                                       | 82.3     | 20   |
| 3.1.2 ICT use*.....  | 77.0     | 15   |
| 3.1.3 Government's online service*.....                      | 97.8     | 2 ●  |
| 3.1.4 E-participation*.....                                  | 98.3     | 2 ●  |
| 3.2 General infrastructure.....                              | 53.7     | 12   |
| 3.2.1 Electricity output, kWh/cap.....                       | 10,388.2 | 13   |
| 3.2.2 Logistics performance*.....                            | 80.0     | 19   |
| 3.2.3 Gross capital formation, % GDP.....                    | 24.9     | 45   |
| 3.3 Ecological sustainability.....                           | 51.8     | 41   |
| 3.3.1 GDP/unit of energy use.....                            | 8.2      | 67 ○ |
| 3.3.2 Environmental performance*.....                        | 87.2     | 13   |
| 3.3.3 ISO 14001 environmental certificates/bn PPP\$ GDP..... | 3.9      | 26   |

**4 Market sophistication..... 65.3 9**

|   |       |     |
|---|-------|-----|
| 4.1 Credit.....                                     | 72.5  | 5 ● |
| 4.1.1 Ease of getting credit*.....                  | 90.0  | 5 ● |
| 4.1.2 Domestic credit to private sector, % GDP..... | 137.6 | 13  |
| 4.1.3 Microfinance gross loans, % GDP.....          | n/a   | n/a |

|   |         |     |
|---|---------|-----|
| 4.2 Investment.....                                     | 45.2    | 40  |
| 4.2.1 Ease of protecting minority investors*.....       | 58.3    | 62  |
| 4.2.2 Market capitalization, % GDP.....                 | 88.6    | 13  |
| 4.2.3 Venture capital deals/bn PPP\$ GDP.....           | 0.1     | 22  |
| 4.3 Trade, competition, & market scale.....             | 78.2    | 13  |
| 4.3.1 Applied tariff rate, weighted mean, %.....        | 1.9     | 53  |
| 4.3.2 Intensity of local competition <sup>†</sup> ..... | 81.9    | 6 ● |
| 4.3.3 Domestic market scale, bn PPP\$.....              | 1,188.8 | 19  |

**5 Business sophistication..... 45.4 27**

|   |      |      |
|---|------|------|
| 5.1 Knowledge workers.....  | 67.5 | 10   |
| 5.1.1 Knowledge-intensive employment, % <sup>Ⓢ</sup> .....            | 44.9 | 13   |
| 5.1.2 Firms offering formal training, % firms.....                    | n/a  | n/a  |
| 5.1.3 GERD performed by business, % of GDP <sup>Ⓢ</sup> .....         | 1.2  | 17   |
| 5.1.4 GERD financed by business, % <sup>Ⓢ</sup> .....                 | 61.9 | 9    |
| 5.1.5 Females employed w/advanced degrees, % total <sup>Ⓢ</sup> ..... | 22.6 | 16   |
| 5.2 Innovation linkages.....  | 32.0 | 52   |
| 5.2.1 University/industry research collaboration <sup>†</sup> .....   | 54.5 | 32   |
| 5.2.2 State of cluster development <sup>†</sup> .....                 | 49.6 | 42   |
| 5.2.3 GERD financed by abroad, % <sup>Ⓢ</sup> .....                   | 1.6  | 80 ○ |
| 5.2.4 JV-strategic alliance deals/bn PPP\$ GDP.....                   | 0.2  | 7    |
| 5.2.5 Patent families 2+ offices/bn PPP\$ GDP.....                    | 1.0  | 28   |
| 5.3 Knowledge absorption.....   | 36.6 | 48   |
| 5.3.1 Intellectual property payments, % total trade.....              | 1.4  | 20   |
| 5.3.2 High-tech imports less re-imports, % total trade.....           | 11.5 | 28   |
| 5.3.3 ICT services imports, % total trade.....                        | 1.0  | 69 ○ |
| 5.3.4 FDI net inflows, % GDP.....                                     | 3.2  | 53   |
| 5.3.5 Research talent, % in business enterprise <sup>Ⓢ</sup> .....    | 27.9 | 46 ○ |

**6 Knowledge & technology outputs..... 32.1 34**

|   |      |      |
|---|------|------|
| 6.1 Knowledge creation.....                                       | 34.3 | 25   |
| 6.1.1 Patents by origin/bn PPP\$ GDP.....                         | 2.0  | 45   |
| 6.1.2 PCT patent applications/bn PPP\$ GDP.....                   | 1.5  | 22   |
| 6.1.3 Utility models by origin/bn PPP\$ GDP.....                  | 1.0  | 27   |
| 6.1.4 Scientific & technical articles/bn PPP\$ GDP.....           | 48.7 | 9    |
| 6.1.5 Citable documents H index.....                              | 63.6 | 10   |
| 6.2 Knowledge impact.....   | 44.0 | 19   |
| 6.2.1 Growth rate of PPP\$ GDP/worker, %.....                     | 0.8  | 62 ○ |
| 6.2.2 New businesses/th pop. 15–64.....                           | 14.9 | 5 ●  |
| 6.2.3 Computer software spending, % GDP.....                      | 0.3  | 51   |
| 6.2.4 ISO 9001 quality certificates/bn PPP\$ GDP.....             | 12.0 | 32   |
| 6.2.5 High- & medium-high-tech manufactures, % <sup>Ⓢ</sup> ..... | 0.3  | 49   |
| 6.3 Knowledge diffusion.....                                      | 17.9 | 96 ○ |
| 6.3.1 Intellectual property receipts, % total trade.....          | 0.3  | 31   |
| 6.3.2 High-tech exports less re-exports, % total trade.....       | 2.0  | 55   |
| 6.3.3 ICT services exports, % total trade.....                    | 0.8  | 89 ○ |
| 6.3.4 FDI net outflows, % GDP.....                                | 0.1  | 91 ○ |

**7 Creative outputs..... 46.1 24**

|   |      |      |
|---|------|------|
| 7.1 Intangible assets.....  | 50.3 | 36   |
| 7.1.1 Trademarks by origin/bn PPP\$ GDP.....                                    | 70.8 | 25   |
| 7.1.2 Industrial designs by origin/bn PPP\$ GDP.....                            | 2.5  | 41   |
| 7.1.3 ICTs & business model creation <sup>†</sup> .....                         | 68.5 | 35   |
| 7.1.4 ICTs & organizational model creation <sup>†</sup> .....                   | 64.8 | 28   |
| 7.2 Creative goods & services.....  | 27.4 | 38   |
| 7.2.1 Cultural & creative services exports, % of total trade <sup>Ⓢ</sup> ..... | 0.3  | 38   |
| 7.2.2 National feature films/mn pop. 15–69.....                                 | 1.9  | 61 ○ |
| 7.2.3 Global ent. & media market/th pop. 15–69.....                             | 63.9 | 8    |
| 7.2.4 Printing & publishing manufactures, % <sup>Ⓢ</sup> .....                  | 2.1  | 19   |
| 7.2.5 Creative goods exports, % total trade.....                                | 0.8  | 48   |
| 7.3 Online creativity.....  | 56.2 | 12   |
| 7.3.1 Generic top-level domains (TLDs)/th pop. 15–69.....                       | 63.6 | 9    |
| 7.3.2 Country-code TLDs/th pop. 15–69.....                                      | 52.8 | 14   |
| 7.3.3 Wikipedia edits/mn pop. 15–69.....  | 6.6  | 24   |
| 7.3.4 Video uploads on YouTube/pop. 15–69.....                                  | 44.8 | 23   |

NOTES: ● indicates a strength; ○ a weakness; \* an index; † a survey question.

Ⓢ indicates that the country's data are older than the base year; see Appendix II for details, including the year of the data, at <http://globalinnovationindex.org>.

Square brackets indicate that the data minimum coverage (DMC) requirements were not met at the sub-pillar or pillar level; see page 181 of this appendix for details.



## Austria

## Key indicators

|                            |             |
|----------------------------|-------------|
| Population (millions)..... | 8.6         |
| GDP (US\$ billions).....   | 387.3       |
| GDP per capita, PPP\$..... | 47,249.9    |
| Income group.....          | High income |
| Region.....                | Europe      |

|  | Score 0–100<br>or value (hard data) | Rank      |
|--|-------------------------------------|-----------|
| <b>Global Innovation Index (out of 127).....</b> | <b>53.1</b>                         | <b>20</b> |
| Innovation Output Sub-Index.....                 | 43.3                                | 21        |
| Innovation Input Sub-Index.....                  | 62.9                                | 18        |
| Innovation Efficiency Ratio.....                 | 0.7                                 | 41        |
| Global Innovation Index 2016 (out of 128).....   | 52.6                                | 20        |

**1 Institutions.....87.1 15**

|   |      |      |
|---|------|------|
| 1.1 Political environment.....                        | 86.3 | 14   |
| 1.1.1 Political stability & safety*.....              | 92.6 | 8 ●  |
| 1.1.2 Government effectiveness*.....                  | 80.0 | 19   |
| 1.2 Regulatory environment.....                       | 93.0 | 9 ●  |
| 1.2.1 Regulatory quality*.....                        | 78.7 | 17   |
| 1.2.2 Rule of law*.....                               | 93.5 | 10 ● |
| 1.2.3 Cost of redundancy dismissal, salary weeks..... | 8.0  | 1 ●  |
| 1.3 Business environment.....                         | 82.0 | 27   |
| 1.3.1 Ease of starting a business*.....               | 83.7 | 85 ○ |
| 1.3.2 Ease of resolving insolvency*.....              | 78.9 | 19   |
| 1.3.3 Ease of paying taxes*.....                      | 83.4 | 37   |

**2 Human capital & research.....61.0 8 ●**

|  |         |      |
|--|---------|------|
| 2.1 Education.....   | 59.7    | 24   |
| 2.1.1 Expenditure on education, % GDP.....                   | 5.6     | 29   |
| 2.1.2 Gov't expenditure/pupil, secondary, % GDP/cap.....     | 27.5    | 17   |
| 2.1.3 School life expectancy, years.....                     | 16.0    | 31   |
| 2.1.4 PISA scales in reading, maths, & science.....          | 492.2   | 25   |
| 2.1.5 Pupil-teacher ratio, secondary.....                    | 9.6     | 22   |
| 2.2 Tertiary education.....                                  | 66.0    | 2 ●  |
| 2.2.1 Tertiary enrolment, % gross.....                       | 81.5    | 13   |
| 2.2.2 Graduates in science & engineering, %.....             | 27.9    | 15   |
| 2.2.3 Tertiary inbound mobility, %.....                      | 15.9    | 10 ● |
| 2.3 Research & development (R&D).....                        | 57.5    | 18   |
| 2.3.1 Researchers, FTE/mn pop.....                           | 4,955.0 | 11   |
| 2.3.2 Gross expenditure on R&D, % GDP.....                   | 3.1     | 5 ●  |
| 2.3.3 Global R&D companies, avg. expend. top 3, mn \$US..... | 51.7    | 27   |
| 2.3.4 QS university ranking, average score top 3*.....       | 46.3    | 26   |

**3 Infrastructure.....63.0 16**

|  |         |      |
|--|---------|------|
| 3.1 Information & communication technologies (ICTs).....     | 82.4    | 16   |
| 3.1.1 ICT access*.....                                       | 83.5    | 15   |
| 3.1.2 ICT use*.....  | 66.7    | 27   |
| 3.1.3 Government's online service*.....                      | 91.3    | 11 ● |
| 3.1.4 E-participation*.....                                  | 88.1    | 14   |
| 3.2 General infrastructure.....                              | 51.5    | 19   |
| 3.2.1 Electricity output, kWh/cap.....                       | 7,206.5 | 27   |
| 3.2.2 Logistics performance*.....                            | 94.1    | 7 ●  |
| 3.2.3 Gross capital formation, % GDP.....                    | 22.5    | 61 ○ |
| 3.3 Ecological sustainability.....                           | 55.1    | 29   |
| 3.3.1 GDP/unit of energy use.....                            | 11.2    | 32   |
| 3.3.2 Environmental performance*.....                        | 86.6    | 18   |
| 3.3.3 ISO 14001 environmental certificates/bn PPP\$ GDP..... | 3.0     | 33   |

**4 Market sophistication.....53.1 30**

|   |      |      |
|---|------|------|
| 4.1 Credit.....                                     | 47.2 | 36   |
| 4.1.1 Ease of getting credit*.....                  | 60.0 | 55 ○ |
| 4.1.2 Domestic credit to private sector, % GDP..... | 87.0 | 35   |
| 4.1.3 Microfinance gross loans, % GDP.....          | n/a  | n/a  |

|   |       |      |
|---|-------|------|
| 4.2 Investment.....                               | 40.2  | 63 ○ |
| 4.2.1 Ease of protecting minority investors*..... | 65.0  | 31   |
| 4.2.2 Market capitalization, % GDP.....           | 25.5  | 56 ○ |
| 4.2.3 Venture capital deals/bn PPP\$ GDP.....     | 0.1   | 25   |
| 4.3 Trade, competition, & market scale.....       | 72.0  | 29   |
| 4.3.1 Applied tariff rate, weighted mean, %.....  | 1.6   | 23   |
| 4.3.2 Intensity of local competition†.....        | 76.5  | 22   |
| 4.3.3 Domestic market scale, bn PPP\$.....        | 415.9 | 43   |

**5 Business sophistication.....50.3 19**

|   |      |       |
|---|------|-------|
| 5.1 Knowledge workers.....                                  | 63.3 | 17    |
| 5.1.1 Knowledge-intensive employment, %.....                | 40.6 | 23    |
| 5.1.2 Firms offering formal training, % firms.....          | n/a  | n/a   |
| 5.1.3 GERD performed by business, % of GDP.....             | 2.2  | 5 ●   |
| 5.1.4 GERD financed by business, %.....                     | 52.5 | 18    |
| 5.1.5 Females employed w/advanced degrees, % total.....     | 16.0 | 36    |
| 5.2 Innovation linkages.....                                | 43.7 | 23    |
| 5.2.1 University/industry research collaboration†.....      | 63.6 | 15    |
| 5.2.2 State of cluster development†.....                    | 63.8 | 18    |
| 5.2.3 GERD financed by abroad, %.....                       | 16.0 | 28    |
| 5.2.4 JV-strategic alliance deals/bn PPP\$ GDP.....         | 0.0  | 52 ○  |
| 5.2.5 Patent families 2+ offices/bn PPP\$ GDP.....          | 4.9  | 14    |
| 5.3 Knowledge absorption.....                               | 43.9 | 24    |
| 5.3.1 Intellectual property payments, % total trade.....    | 0.8  | 44    |
| 5.3.2 High-tech imports less re-imports, % total trade..... | 9.3  | 50    |
| 5.3.3 ICT services imports, % total trade.....              | 1.9  | 24    |
| 5.3.4 FDI net inflows, % GDP.....                           | 0.5  | 114 ○ |
| 5.3.5 Research talent, % in business enterprise.....        | 63.7 | 7 ●   |

**6 Knowledge & technology outputs.....38.2 21**

|   |      |      |
|---|------|------|
| 6.1 Knowledge creation.....                                 | 42.7 | 18   |
| 6.1.1 Patents by origin/bn PPP\$ GDP.....                   | 10.4 | 11 ● |
| 6.1.2 PCT patent applications/bn PPP\$ GDP.....             | 3.4  | 13   |
| 6.1.3 Utility models by origin/bn PPP\$ GDP.....            | 1.4  | 19   |
| 6.1.4 Scientific & technical articles/bn PPP\$ GDP.....     | 36.1 | 18   |
| 6.1.5 Citable documents H index.....                        | 42.8 | 17   |
| 6.2 Knowledge impact.....                                   | 37.8 | 40   |
| 6.2.1 Growth rate of PPP\$ GDP/worker, %.....               | 0.2  | 79 ○ |
| 6.2.2 New businesses/th pop. 15–64.....                     | 0.7  | 80 ○ |
| 6.2.3 Computer software spending, % GDP.....                | 0.6  | 14   |
| 6.2.4 ISO 9001 quality certificates/bn PPP\$ GDP.....       | 11.0 | 34   |
| 6.2.5 High- & medium-high-tech manufactures, %.....         | 0.4  | 15   |
| 6.3 Knowledge diffusion.....                                | 34.1 | 29   |
| 6.3.1 Intellectual property receipts, % total trade.....    | 0.4  | 25   |
| 6.3.2 High-tech exports less re-exports, % total trade..... | 9.2  | 22   |
| 6.3.3 ICT services exports, % total trade.....              | 2.9  | 32   |
| 6.3.4 FDI net outflows, % GDP.....                          | 1.8  | 38   |

**7 Creative outputs.....48.3 17**

|  |      |      |
|--|------|------|
| 7.1 Intangible assets.....   | 54.9 | 24   |
| 7.1.1 Trademarks by origin/bn PPP\$ GDP.....                       | 61.1 | 34   |
| 7.1.2 Industrial designs by origin/bn PPP\$ GDP.....               | 7.9  | 15   |
| 7.1.3 ICTs & business model creation†.....                         | 72.9 | 26   |
| 7.1.4 ICTs & organizational model creation†.....                   | 67.1 | 25   |
| 7.2 Creative goods & services.....                                 | 33.9 | 23   |
| 7.2.1 Cultural & creative services exports, % of total tradeⓈ..... | 1.1  | 12   |
| 7.2.2 National feature films/mn pop. 15–69.....                    | 6.5  | 28   |
| 7.2.3 Global ent. & media market/th pop. 15–69.....                | 65.3 | 7    |
| 7.2.4 Printing & publishing manufactures, %.....                   | 1.3  | 42 ○ |
| 7.2.5 Creative goods exports, % total trade.....                   | 1.2  | 40   |
| 7.3 Online creativity.....   | 49.6 | 18   |
| 7.3.1 Generic top-level domains (TLDs)/th pop. 15–69.....          | 36.9 | 19   |
| 7.3.2 Country-code TLDs/th pop. 15–69.....                         | 61.4 | 11 ● |
| 7.3.3 Wikipedia edits/mn pop. 15–69.....                           | 6.7  | 19   |
| 7.3.4 Video uploads on YouTube/pop. 15–69.....                     | 34.9 | 41 ○ |

NOTES: ● indicates a strength; ○ a weakness; \* an index; † a survey question.

Ⓢ indicates that the country's data are older than the base year; see Appendix II for details, including the year of the data, at <http://globalinnovationindex.org>.

Square brackets indicate that the data minimum coverage (DMC) requirements were not met at the sub-pillar or pillar level; see page 181 of this appendix for details.

## Key indicators

|                            |                                  |
|----------------------------|----------------------------------|
| Population (millions)..... | 9.9                              |
| GDP (US\$ billions).....   | 35.7                             |
| GDP per capita, PPP\$..... | 17,993.4                         |
| Income group.....          | Upper-middle income              |
| Region.....                | Northern Africa and Western Asia |

|  | Score 0–100<br>or value (hard data) | Rank      |
|--|-------------------------------------|-----------|
| <b>Global Innovation Index (out of 127).....</b> | <b>30.6</b>                         | <b>82</b> |
| Innovation Output Sub-Index.....                 | 20.5                                | 89        |
| Innovation Input Sub-Index.....                  | 40.7                                | 78        |
| Innovation Efficiency Ratio.....                 | 0.5                                 | 103       |
| Global Innovation Index 2016 (out of 128).....   | 29.6                                | 85        |

**1 Institutions..... 55.9 74**

|   |      |      |
|---|------|------|
| 1.1 Political environment.....                        | 41.6 | 90   |
| 1.1.1 Political stability & safety*.....              | 47.1 | 97   |
| 1.1.2 Government effectiveness*.....                  | 36.2 | 84   |
| 1.2 Regulatory environment.....                       | 50.8 | 96   |
| 1.2.1 Regulatory quality*.....                        | 35.6 | 85   |
| 1.2.2 Rule of law*.....                               | 21.8 | 97   |
| 1.2.3 Cost of redundancy dismissal, salary weeks..... | 21.7 | 90   |
| 1.3 Business environment.....                         | 75.3 | 47   |
| 1.3.1 Ease of starting a business*.....               | 97.7 | 5 ●  |
| 1.3.2 Ease of resolving insolvency*.....              | 44.8 | 78   |
| 1.3.3 Ease of paying taxes*.....                      | 83.5 | 35 ● |

**2 Human capital & research..... 17.9 108**

|  |      |       |
|--|------|-------|
| 2.1 Education.....   | 18.0 | [125] |
| 2.1.1 Expenditure on education, % GDP.....                   | 2.6  | 108 ○ |
| 2.1.2 Gov't expenditure/pupil, secondary, % GDP/cap.....     | n/a  | n/a   |
| 2.1.3 School life expectancy, years.....                     | n/a  | n/a   |
| 2.1.4 PISA scales in reading, maths, & science.....          | n/a  | n/a   |
| 2.1.5 Pupil-teacher ratio, secondary.....                    | n/a  | n/a   |
| 2.2 Tertiary education.....                                  | 29.1 | 84    |
| 2.2.1 Tertiary enrolment, % gross.....                       | 25.5 | 89    |
| 2.2.2 Graduates in science & engineering, %.....             | 22.0 | 46    |
| 2.2.3 Tertiary inbound mobility, %.....                      | 2.1  | 67    |
| 2.3 Research & development (R&D).....                        | 6.5  | 70    |
| 2.3.1 Researchers, FTE/mn pop.....                           | n/a  | n/a   |
| 2.3.2 Gross expenditure on R&D, % GDP.....                   | 0.2  | 87    |
| 2.3.3 Global R&D companies, avg. expend. top 3, mn \$US..... | 0.0  | 43 ○  |
| 2.3.4 QS university ranking, average score top 3*.....       | 14.7 | 56    |

**3 Infrastructure..... 50.5 50**

|  |         |      |
|--|---------|------|
| 3.1 Information & communication technologies (ICTs).....     | 65.2    | 47   |
| 3.1.1 ICT access*.....                                       | 67.8    | 57   |
| 3.1.2 ICT use*.....  | 57.0    | 45   |
| 3.1.3 Government's online service*.....                      | 68.1    | 47   |
| 3.1.4 E-participation*.....                                  | 67.8    | 47   |
| 3.2 General infrastructure.....                              | 36.5    | 68   |
| 3.2.1 Electricity output, kWh/cap.....                       | 2,592.0 | 65   |
| 3.2.2 Logistics performance* <sup>Ⓢ</sup> .....              | 17.8    | 107  |
| 3.2.3 Gross capital formation, % GDP.....                    | 29.8    | 19 ● |
| 3.3 Ecological sustainability.....                           | 49.9    | 47   |
| 3.3.1 GDP/unit of energy use.....                            | 10.9    | 39   |
| 3.3.2 Environmental performance*.....                        | 83.8    | 31 ● |
| 3.3.3 ISO 14001 environmental certificates/bn PPP\$ GDP..... | 0.4     | 89   |

**4 Market sophistication..... 55.3 23 ●**

|   |      |      |
|---|------|------|
| 4.1 Credit.....                                     | 43.4 | 43   |
| 4.1.1 Ease of getting credit*.....                  | 40.0 | 98   |
| 4.1.2 Domestic credit to private sector, % GDP..... | 38.5 | 84   |
| 4.1.3 Microfinance gross loans, % GDP.....          | 4.3  | 10 ● |

|   |       |       |
|---|-------|-------|
| 4.2 Investment.....                                     | 65.0  | [13]  |
| 4.2.1 Ease of protecting minority investors*.....       | 65.0  | 31 ●  |
| 4.2.2 Market capitalization, % GDP.....                 | n/a   | n/a   |
| 4.2.3 Venture capital deals/bn PPP\$ GDP.....           | n/a   | n/a   |
| 4.3 Trade, competition, & market scale.....             | 57.6  | 80    |
| 4.3.1 Applied tariff rate, weighted mean, %.....        | 5.2   | 92    |
| 4.3.2 Intensity of local competition <sup>†</sup> ..... | 58.6  | 106 ○ |
| 4.3.3 Domestic market scale, bn PPP\$.....              | 167.9 | 64    |

**5 Business sophistication..... 23.8 110 ○**

|  |      |       |
|--|------|-------|
| 5.1 Knowledge workers.....   | 29.0 | 88    |
| 5.1.1 Knowledge-intensive employment, %.....                           | 23.4 | 62    |
| 5.1.2 Firms offering formal training, % firms.....                     | 20.2 | 75    |
| 5.1.3 GERD performed by business, % of GDP <sup>Ⓢ</sup> .....          | 0.0  | 77    |
| 5.1.4 GERD financed by business, % <sup>Ⓢ</sup> .....                  | 30.5 | 50    |
| 5.1.5 Females employed w/advanced degrees, % total <sup>Ⓢ</sup> .....  | 12.9 | 50    |
| 5.2 Innovation linkages.....   | 20.1 | 107   |
| 5.2.1 University/industry research collaboration <sup>†</sup> .....    | 42.7 | 52    |
| 5.2.2 State of cluster development <sup>†</sup> .....                  | 45.2 | 65    |
| 5.2.3 GERD financed by abroad, % <sup>Ⓢ</sup> .....                    | 0.2  | 97 ○  |
| 5.2.4 JV-strategic alliance deals/bn PPP\$ GDP.....                    | 0.0  | 67    |
| 5.2.5 Patent families 2+ offices/bn PPP\$ GDP.....                     | 0.1  | 74    |
| 5.3 Knowledge absorption.....  | 22.3 | 112 ○ |
| 5.3.1 Intellectual property payments, % total trade <sup>Ⓢ</sup> ..... | 0.1  | 97    |
| 5.3.2 High-tech imports less re-imports, % total trade.....            | 3.1  | 121 ○ |
| 5.3.3 ICT services imports, % total trade.....                         | 0.7  | 83    |
| 5.3.4 FDI net inflows, % GDP.....                                      | 5.7  | 24 ●  |
| 5.3.5 Research talent, % in business enterprise.....                   | n/a  | n/a   |

**6 Knowledge & technology outputs..... 15.4 104**

|  |       |       |
|--|-------|-------|
| 6.1 Knowledge creation.....  | 3.3   | 108   |
| 6.1.1 Patents by origin/bn PPP\$ GDP.....                              | 1.3   | 59    |
| 6.1.2 PCT patent applications/bn PPP\$ GDP.....                        | 0.0   | 99 ○  |
| 6.1.3 Utility models by origin/bn PPP\$ GDP <sup>Ⓢ</sup> .....         | 0.1   | 46    |
| 6.1.4 Scientific & technical articles/bn PPP\$ GDP.....                | 3.2   | 108   |
| 6.1.5 Citable documents H index.....                                   | 3.3   | 109   |
| 6.2 Knowledge impact.....  | 16.7  | 109   |
| 6.2.1 Growth rate of PPP\$ GDP/worker, %.....                          | (0.7) | 95    |
| 6.2.2 New businesses/th pop. 15–64.....                                | 1.0   | 71    |
| 6.2.3 Computer software spending, % GDP.....                           | 0.1   | 97    |
| 6.2.4 ISO 9001 quality certificates/bn PPP\$ GDP.....                  | 1.4   | 101   |
| 6.2.5 High- & medium-high-tech manufactures, % <sup>Ⓢ</sup> .....      | 0.1   | 74    |
| 6.3 Knowledge diffusion.....   | 26.1  | 48    |
| 6.3.1 Intellectual property receipts, % total trade <sup>Ⓢ</sup> ..... | 0.0   | 107 ○ |
| 6.3.2 High-tech exports less re-exports, % total trade.....            | 0.1   | 115 ○ |
| 6.3.3 ICT services exports, % total trade.....                         | 0.5   | 102   |
| 6.3.4 FDI net outflows, % GDP.....                                     | 3.6   | 16 ●  |

**7 Creative outputs..... 25.5 87**

|   |      |       |
|---|------|-------|
| 7.1 Intangible assets.....  | 37.9 | 82    |
| 7.1.1 Trademarks by origin/bn PPP\$ GDP.....                      | 16.5 | 91    |
| 7.1.2 Industrial designs by origin/bn PPP\$ GDP.....              | 0.1  | 107 ○ |
| 7.1.3 ICTs & business model creation <sup>†</sup> .....           | 63.8 | 50    |
| 7.1.4 ICTs & organizational model creation <sup>†</sup> .....     | 60.8 | 37 ●  |
| 7.2 Creative goods & services.....                                | 7.5  | 98    |
| 7.2.1 Cultural & creative services exports, % of total trade..... | 0.0  | 66    |
| 7.2.2 National feature films/mn pop. 15–69.....                   | 7.4  | 21 ●  |
| 7.2.3 Global ent. & media market/th pop. 15–69.....               | n/a  | n/a   |
| 7.2.4 Printing & publishing manufactures, % <sup>Ⓢ</sup> .....    | 0.7  | 82    |
| 7.2.5 Creative goods exports, % total trade.....                  | 0.0  | 119 ○ |
| 7.3 Online creativity.....  | 18.8 | 66    |
| 7.3.1 Generic top-level domains (TLDs)/th pop. 15–69.....         | 1.0  | 96    |
| 7.3.2 Country-code TLDs/th pop. 15–69.....                        | 1.1  | 79    |
| 7.3.3 Wikipedia edits/mn pop. 15–69.....                          | 5.6  | 48    |
| 7.3.4 Video uploads on YouTube/pop. 15–69.....                    | n/a  | n/a   |

NOTES: ● indicates a strength; ○ a weakness; \* an index; † a survey question.

Ⓢ indicates that the country's data are older than the base year; see Appendix II for details, including the year of the data, at <http://globalinnovationindex.org>.

Square brackets indicate that the data minimum coverage (DMC) requirements were not met at the sub-pillar or pillar level; see page 181 of this appendix for details.

## Bahrain

## Key indicators

|                            |                                  |
|----------------------------|----------------------------------|
| Population (millions)..... | 1.4                              |
| GDP (US\$ billions).....   | 31.8                             |
| GDP per capita, PPP\$..... | 50,094.9                         |
| Income group.....          | High income                      |
| Region.....                | Northern Africa and Western Asia |

|  | Score 0–100<br>or value (hard data) | Rank      |
|--|-------------------------------------|-----------|
| <b>Global Innovation Index (out of 127).....</b> | <b>34.7</b>                         | <b>66</b> |
| Innovation Output Sub-Index.....                 | 24.9                                | 67        |
| Innovation Input Sub-Index.....                  | 44.4                                | 55        |
| Innovation Efficiency Ratio.....                 | 0.6                                 | 88        |
| Global Innovation Index 2016 (out of 128).....   | 35.5                                | 57        |

**1 Institutions.....67.3 51**

|   |      |      |
|---|------|------|
| 1.1 Political environment.....                        | 47.3 | 75   |
| 1.1.1 Political stability & safety*.....              | 37.7 | 114  |
| 1.1.2 Government effectiveness*.....                  | 56.9 | 41   |
| 1.2 Regulatory environment.....                       | 79.0 | 26 ● |
| 1.2.1 Regulatory quality*.....                        | 63.3 | 37   |
| 1.2.2 Rule of law*.....                               | 52.9 | 45   |
| 1.2.3 Cost of redundancy dismissal, salary weeks..... | 8.0  | 1 ●  |
| 1.3 Business environment.....                         | 75.6 | 45   |
| 1.3.1 Ease of starting a business*.....               | 87.8 | 60   |
| 1.3.2 Ease of resolving insolvency*.....              | 44.7 | 80   |
| 1.3.3 Ease of paying taxes*.....                      | 94.4 | 4 ●  |

**2 Human capital & research.....30.6 73**

|  |       |       |
|--|-------|-------|
| 2.1 Education.....   | 42.4  | [82]  |
| 2.1.1 Expenditure on education, % GDP <sup>Ⓐ</sup> .....     | 2.6   | 107 ○ |
| 2.1.2 Gov't expenditure/pupil, secondary, % GDP/cap.....     | n/a   | n/a   |
| 2.1.3 School life expectancy, years.....                     | n/a   | n/a   |
| 2.1.4 PISA scales in reading, maths, & science.....          | n/a   | n/a   |
| 2.1.5 Pupil-teacher ratio, secondary.....                    | 9.9   | 23 ●  |
| 2.2 Tertiary education.....                                  | 44.5  | 35    |
| 2.2.1 Tertiary enrolment, % gross.....                       | 37.4  | 69    |
| 2.2.2 Graduates in science & engineering, %.....             | 19.5  | 60    |
| 2.2.3 Tertiary inbound mobility, %.....                      | 13.9  | 12 ●  |
| 2.3 Research & development (R&D).....                        | 5.0   | 76    |
| 2.3.1 Researchers, FTE/mn pop. <sup>Ⓐ</sup> .....            | 362.0 | 67    |
| 2.3.2 Gross expenditure on R&D, % GDP <sup>Ⓐ</sup> .....     | 0.1   | 103 ○ |
| 2.3.3 Global R&D companies, avg. expend. top 3, mn \$US..... | 0.0   | 43 ○  |
| 2.3.4 QS university ranking, average score top 3*.....       | 13.7  | 57    |

**3 Infrastructure.....54.6 38**

|  |          |       |
|--|----------|-------|
| 3.1 Information & communication technologies (ICTs).....     | 77.8     | 25 ●  |
| 3.1.1 ICT access*.....                                       | 79.1     | 29    |
| 3.1.2 ICT use*.....  | 74.8     | 20 ●  |
| 3.1.3 Government's online service*.....                      | 82.6     | 22 ●  |
| 3.1.4 E-participation*.....                                  | 74.6     | 32    |
| 3.2 General infrastructure.....                              | 50.9     | 22 ●  |
| 3.2.1 Electricity output, kWh/cap.....                       | 20,039.0 | 3 ●   |
| 3.2.2 Logistics performance*.....                            | 57.8     | 43    |
| 3.2.3 Gross capital formation, % GDP.....                    | 19.7     | 83    |
| 3.3 Ecological sustainability.....                           | 35.3     | 101   |
| 3.3.1 GDP/unit of energy use.....                            | 4.1      | 111 ○ |
| 3.3.2 Environmental performance*.....                        | 70.1     | 77    |
| 3.3.3 ISO 14001 environmental certificates/bn PPP\$ GDP..... | 1.4      | 58    |

**4 Market sophistication.....42.7 84**

|   |      |     |
|---|------|-----|
| 4.1 Credit.....                                     | 37.0 | 57  |
| 4.1.1 Ease of getting credit*.....                  | 45.0 | 84  |
| 4.1.2 Domestic credit to private sector, % GDP..... | 73.7 | 40  |
| 4.1.3 Microfinance gross loans, % GDP.....          | n/a  | n/a |

|   |      |    |
|---|------|----|
| 4.2 Investment.....                                     | 32.8 | 98 |
| 4.2.1 Ease of protecting minority investors*.....       | 50.0 | 89 |
| 4.2.2 Market capitalization, % GDP.....                 | 61.8 | 28 |
| 4.2.3 Venture capital deals/bn PPP\$ GDP.....           | 0.0  | 57 |
| 4.3 Trade, competition, & market scale.....             | 58.3 | 77 |
| 4.3.1 Applied tariff rate, weighted mean, %.....        | 3.3  | 71 |
| 4.3.2 Intensity of local competition <sup>†</sup> ..... | 70.1 | 60 |
| 4.3.3 Domestic market scale, bn PPP\$.....              | 66.4 | 86 |

**5 Business sophistication.....26.8 93**

|   |      |       |
|---|------|-------|
| 5.1 Knowledge workers.....  | 25.1 | 98    |
| 5.1.1 Knowledge-intensive employment, % <sup>Ⓐ</sup> .....          | 20.9 | 71    |
| 5.1.2 Firms offering formal training, % firms.....                  | n/a  | n/a   |
| 5.1.3 GERD performed by business, % of GDP <sup>Ⓐ</sup> .....       | 0.0  | 78    |
| 5.1.4 GERD financed by business, % <sup>Ⓐ</sup> .....               | 21.8 | 60    |
| 5.1.5 Females employed w/advanced degrees, % total.....             | n/a  | n/a   |
| 5.2 Innovation linkages.....  | 39.6 | 32    |
| 5.2.1 University/industry research collaboration <sup>†</sup> ..... | 45.4 | 42    |
| 5.2.2 State of cluster development <sup>†</sup> .....               | 60.3 | 23 ●  |
| 5.2.3 GERD financed by abroad, % <sup>Ⓐ</sup> .....                 | 12.4 | 41    |
| 5.2.4 JV-strategic alliance deals/bn PPP\$ GDP.....                 | 0.2  | 2 ●   |
| 5.2.5 Patent families 2+ offices/bn PPP\$ GDP.....                  | 0.0  | 89    |
| 5.3 Knowledge absorption.....                                       | 15.7 | 125 ○ |
| 5.3.1 Intellectual property payments, % total trade.....            | n/a  | n/a   |
| 5.3.2 High-tech imports less re-imports, % total trade.....         | 5.3  | 104   |
| 5.3.3 ICT services imports, % total trade <sup>Ⓐ</sup> .....        | 0.3  | 112   |
| 5.3.4 FDI net inflows, % GDP.....                                   | 0.4  | 119 ○ |
| 5.3.5 Research talent, % in business enterprise <sup>Ⓐ</sup> .....  | 0.4  | 82 ○  |

**6 Knowledge & technology outputs.....20.8 73**

|   |      |       |
|---|------|-------|
| 6.1 Knowledge creation.....                                       | 1.9  | 121 ○ |
| 6.1.1 Patents by origin/bn PPP\$ GDP.....                         | 0.2  | 100   |
| 6.1.2 PCT patent applications/bn PPP\$ GDP.....                   | 0.1  | 67    |
| 6.1.3 Utility models by origin/bn PPP\$ GDP.....                  | n/a  | n/a   |
| 6.1.4 Scientific & technical articles/bn PPP\$ GDP.....           | 2.7  | 114 ○ |
| 6.1.5 Citable documents H index.....                              | 2.4  | 113   |
| 6.2 Knowledge impact.....   | 30.7 | 67    |
| 6.2.1 Growth rate of PPP\$ GDP/worker, %.....                     | 0.8  | 64    |
| 6.2.2 New businesses/th pop. 15–64.....                           | n/a  | n/a   |
| 6.2.3 Computer software spending, % GDP.....                      | 0.4  | 27    |
| 6.2.4 ISO 9001 quality certificates/bn PPP\$ GDP.....             | 5.8  | 58    |
| 6.2.5 High- & medium-high-tech manufactures, % <sup>Ⓐ</sup> ..... | 0.1  | 81    |
| 6.3 Knowledge diffusion.....                                      | 29.9 | 40    |
| 6.3.1 Intellectual property receipts, % total trade.....          | n/a  | n/a   |
| 6.3.2 High-tech exports less re-exports, % total trade.....       | 0.1  | 110   |
| 6.3.3 ICT services exports, % total trade <sup>Ⓐ</sup> .....      | 3.3  | 25 ●  |
| 6.3.4 FDI net outflows, % GDP.....                                | 1.5  | 39    |

**7 Creative outputs.....29.0 71**

|   |      |       |
|---|------|-------|
| 7.1 Intangible assets.....  | 36.5 | 91    |
| 7.1.1 Trademarks by origin/bn PPP\$ GDP.....                      | 5.9  | 110 ○ |
| 7.1.2 Industrial designs by origin/bn PPP\$ GDP.....              | 0.0  | 111 ○ |
| 7.1.3 ICTs & business model creation <sup>†</sup> .....           | 66.8 | 42    |
| 7.1.4 ICTs & organizational model creation <sup>†</sup> .....     | 58.2 | 45    |
| 7.2 Creative goods & services.....                                | 18.6 | 63    |
| 7.2.1 Cultural & creative services exports, % of total trade..... | n/a  | n/a   |
| 7.2.2 National feature films/mn pop. 15–69 <sup>Ⓐ</sup> .....     | 0.0  | 104 ○ |
| 7.2.3 Global ent. & media market/th pop. 15–69.....               | 8.0  | 39    |
| 7.2.4 Printing & publishing manufactures, % <sup>Ⓐ</sup> .....    | 1.5  | 34    |
| 7.2.5 Creative goods exports, % total trade.....                  | 1.3  | 34    |
| 7.3 Online creativity.....  | 24.7 | 51    |
| 7.3.1 Generic top-level domains (TLDs)/th pop. 15–69.....         | 5.4  | 53    |
| 7.3.2 Country-code TLDs/th pop. 15–69.....                        | 1.2  | 76    |
| 7.3.3 Wikipedia edits/mn pop. 15–69 <sup>Ⓐ</sup> .....            | 5.1  | 61    |
| 7.3.4 Video uploads on YouTube/pop. 15–69.....                    | 42.9 | 27    |

NOTES: ● indicates a strength; ○ a weakness; \* an index; † a survey question.

Ⓐ indicates that the country's data are older than the base year; see Appendix II for details, including the year of the data, at <http://globalinnovationindex.org>.

Square brackets indicate that the data minimum coverage (DMC) requirements were not met at the sub-pillar or pillar level; see page 181 of this appendix for details.

## Key indicators

|                            |                           |
|----------------------------|---------------------------|
| Population (millions)..... | 162.9                     |
| GDP (US\$ billions).....   | 226.8                     |
| GDP per capita, PPP\$..... | 3,606.6                   |
| Income group.....          | Lower-middle income       |
| Region.....                | Central and Southern Asia |

|  | Score 0–100<br>or value (hard data) | Rank       |
|--|-------------------------------------|------------|
| <b>Global Innovation Index (out of 127).....</b> | <b>23.7</b>                         | <b>114</b> |
| Innovation Output Sub-Index.....                 | 16.8                                | 108        |
| Innovation Input Sub-Index.....                  | 30.6                                | 113        |
| Innovation Efficiency Ratio.....                 | 0.5                                 | 93         |
| Global Innovation Index 2016 (out of 128).....   | 22.9                                | 117        |

|  |             |            |   |
|--|-------------|------------|---|
| <b>1 Institutions.....</b>                                     | <b>40.3</b> | <b>122</b> | ○ |
| 1.1 Political environment.....                                 | 29.6        | 117        |   |
| 1.1.1 Political stability & safety*.....                       | 35.8        | 116        |   |
| 1.1.2 Government effectiveness*.....                           | 23.5        | 111        |   |
| 1.2 Regulatory environment.....                                | 36.6        | 117        |   |
| 1.2.1 Regulatory quality*.....                                 | 18.4        | 118        |   |
| 1.2.2 Rule of law*.....  | 19.0        | 102        |   |
| 1.2.3 Cost of redundancy dismissal, salary weeks.....          | 31.0        | 119        |   |
| 1.3 Business environment.....                                  | 54.8        | 116        |   |
| 1.3.1 Ease of starting a business*.....                        | 81.7        | 93         |   |
| 1.3.2 Ease of resolving insolvency*.....                       | 27.0        | 121        |   |
| 1.3.3 Ease of paying taxes*.....                               | 55.6        | 104        |   |
| <b>2 Human capital &amp; research.....</b>                     | <b>12.0</b> | <b>124</b> | ○ |
| 2.1 Education.....   | 16.1        | 126        | ○ |
| 2.1.1 Expenditure on education, % GDP.....                     | 2.2         | 111        |   |
| 2.1.2 Gov't expenditure/pupil, secondary, % GDP/cap.....       | 8.4         | 100        |   |
| 2.1.3 School life expectancy, years <sup>Ⓐ</sup> .....         | 9.9         | 103        |   |
| 2.1.4 PISA scales in reading, maths, & science.....            | n/a         | n/a        |   |
| 2.1.5 Pupil-teacher ratio, secondary <sup>Ⓐ</sup> .....        | 35.2        | 106        | ○ |
| 2.2 Tertiary education.....                                    | 17.0        | 106        |   |
| 2.2.1 Tertiary enrolment, % gross <sup>Ⓐ</sup> .....           | 13.4        | 99         |   |
| 2.2.2 Graduates in science & engineering, % <sup>Ⓐ</sup> ..... | 15.6        | 82         |   |
| 2.2.3 Tertiary inbound mobility, % <sup>Ⓐ</sup> .....          | 0.1         | 106        | ○ |
| 2.3 Research & development (R&D).....                          | 2.8         | 88         |   |
| 2.3.1 Researchers, FTE/mn pop.....                             | n/a         | n/a        |   |
| 2.3.2 Gross expenditure on R&D, % GDP.....                     | n/a         | n/a        |   |
| 2.3.3 Global R&D companies, avg. expend. top 3, mn \$US.....   | 0.0         | 43         | ○ |
| 2.3.4 QS university ranking, average score top 3*.....         | 5.6         | 69         |   |
| <b>3 Infrastructure.....</b>                                   | <b>37.0</b> | <b>95</b>  |   |
| 3.1 Information & communication technologies (ICTs).....       | 39.0        | 95         |   |
| 3.1.1 ICT access*.....   | 30.6        | 109        |   |
| 3.1.2 ICT use*.....  | 10.6        | 113        |   |
| 3.1.3 Government's online service*.....                        | 62.3        | 60         | ● |
| 3.1.4 E-participation*.....                                    | 52.5        | 82         |   |
| 3.2 General infrastructure.....                                | 35.5        | 71         |   |
| 3.2.1 Electricity output, kWh/cap.....                         | 351.0       | 107        |   |
| 3.2.2 Logistics performance*.....                              | 27.8        | 86         |   |
| 3.2.3 Gross capital formation, % GDP.....                      | 28.5        | 25         | ● |
| 3.3 Ecological sustainability.....                             | 36.4        | 96         |   |
| 3.3.1 GDP/unit of energy use.....                              | 13.2        | 18         | ● |
| 3.3.2 Environmental performance*.....                          | 41.8        | 120        | ○ |
| 3.3.3 ISO 14001 environmental certificates/bn PPP\$ GDP.....   | 0.2         | 112        |   |
| <b>4 Market sophistication.....</b>                            | <b>38.3</b> | <b>103</b> |   |
| 4.1 Credit.....  | 25.4        | 96         |   |
| 4.1.1 Ease of getting credit*.....                             | 25.0        | 119        |   |
| 4.1.2 Domestic credit to private sector, % GDP.....            | 43.9        | 77         |   |
| 4.1.3 Microfinance gross loans, % GDP.....                     | 1.9         | 16         | ● |

|   |       |     |   |
|---|-------|-----|---|
| 4.2 Investment.....                                     | 32.4  | 99  |   |
| 4.2.1 Ease of protecting minority investors*.....       | 56.7  | 67  |   |
| 4.2.2 Market capitalization, % GDP <sup>Ⓐ</sup> .....   | 37.1  | 40  | ● |
| 4.2.3 Venture capital deals/bn PPP\$ GDP.....           | 0.0   | 91  | ○ |
| 4.3 Trade, competition, & market scale.....             | 57.1  | 82  |   |
| 4.3.1 Applied tariff rate, weighted mean, %.....        | 11.9  | 121 | ○ |
| 4.3.2 Intensity of local competition <sup>†</sup> ..... | 68.5  | 69  |   |
| 4.3.3 Domestic market scale, bn PPP\$.....              | 628.4 | 32  | ● |

**5 Business sophistication.....25.6 99**

|   |      |      |   |
|---|------|------|---|
| 5.1 Knowledge workers.....  | 29.4 | [84] |   |
| 5.1.1 Knowledge-intensive employment, % <sup>Ⓐ</sup> .....                | 20.0 | 74   |   |
| 5.1.2 Firms offering formal training, % firms.....                        | 21.9 | 72   |   |
| 5.1.3 GERD performed by business, % of GDP.....                           | n/a  | n/a  |   |
| 5.1.4 GERD financed by business, %.....                                   | n/a  | n/a  |   |
| 5.1.5 Females employed w/advanced degrees, % total.....                   | n/a  | n/a  |   |
| 5.2 Innovation linkages.....  | 23.5 | 81   |   |
| 5.2.1 University/industry research collaboration <sup>†</sup> .....       | 25.7 | 116  |   |
| 5.2.2 State of cluster development <sup>†</sup> .....                     | 44.0 | 72   |   |
| 5.2.3 GERD financed by abroad, %.....                                     | n/a  | n/a  |   |
| 5.2.4 JV-strategic alliance deals/bn PPP\$ GDP.....                       | 0.0  | 84   |   |
| 5.2.5 Patent families 2+ offices/bn PPP\$ GDP.....                        | 0.0  | 116  | ○ |
| 5.3 Knowledge absorption.....   | 24.0 | 105  |   |
| 5.3.1 Intellectual property payments, % total trade <sup>Ⓐ</sup> .....    | 0.1  | 104  |   |
| 5.3.2 High-tech imports less re-imports, % total trade <sup>Ⓐ</sup> ..... | 9.4  | 48   | ● |
| 5.3.3 ICT services imports, % total trade <sup>Ⓐ</sup> .....              | 0.1  | 119  |   |
| 5.3.4 FDI net inflows, % GDP.....   | 1.6  | 91   |   |
| 5.3.5 Research talent, % in business enterprise.....                      | n/a  | n/a  |   |

**6 Knowledge & technology outputs.....16.0 96**

|   |      |     |   |
|---|------|-----|---|
| 6.1 Knowledge creation.....   | 4.5  | 95  |   |
| 6.1.1 Patents by origin/bn PPP\$ GDP.....                                 | 0.1  | 110 |   |
| 6.1.2 PCT patent applications/bn PPP\$ GDP.....                           | n/a  | n/a |   |
| 6.1.3 Utility models by origin/bn PPP\$ GDP.....                          | n/a  | n/a |   |
| 6.1.4 Scientific & technical articles/bn PPP\$ GDP.....                   | 2.9  | 110 |   |
| 6.1.5 Citable documents H index.....                                      | 9.8  | 63  | ● |
| 6.2 Knowledge impact.....   | 29.2 | 72  |   |
| 6.2.1 Growth rate of PPP\$ GDP/worker, %.....                             | 3.8  | 16  | ● |
| 6.2.2 New businesses/th pop. 15–64 <sup>Ⓐ</sup> .....                     | 0.1  | 101 | ○ |
| 6.2.3 Computer software spending, % GDP.....                              | 0.2  | 77  |   |
| 6.2.4 ISO 9001 quality certificates/bn PPP\$ GDP.....                     | 0.8  | 114 |   |
| 6.2.5 High- & medium-high-tech manufactures, % <sup>Ⓐ</sup> .....         | 0.1  | 84  |   |
| 6.3 Knowledge diffusion.....  | 14.4 | 112 |   |
| 6.3.1 Intellectual property receipts, % total trade <sup>Ⓐ</sup> .....    | 0.0  | 98  |   |
| 6.3.2 High-tech exports less re-exports, % total trade <sup>Ⓐ</sup> ..... | 0.1  | 107 |   |
| 6.3.3 ICT services exports, % total trade <sup>Ⓐ</sup> .....              | 1.1  | 78  |   |
| 6.3.4 FDI net outflows, % GDP.....  | 0.1  | 90  |   |

**7 Creative outputs.....17.6 110**

|   |      |     |   |
|---|------|-----|---|
| 7.1 Intangible assets.....  | 30.1 | 104 |   |
| 7.1.1 Trademarks by origin/bn PPP\$ GDP.....                      | 16.1 | 92  |   |
| 7.1.2 Industrial designs by origin/bn PPP\$ GDP.....              | 2.2  | 42  | ● |
| 7.1.3 ICTs & business model creation <sup>†</sup> .....           | 49.5 | 103 |   |
| 7.1.4 ICTs & organizational model creation <sup>†</sup> .....     | 42.0 | 104 |   |
| 7.2 Creative goods & services.....                                | 1.1  | 125 | ○ |
| 7.2.1 Cultural & creative services exports, % of total trade..... | 0.0  | 83  |   |
| 7.2.2 National feature films/mn pop. 15–69 <sup>Ⓐ</sup> .....     | 0.7  | 87  |   |
| 7.2.3 Global ent. & media market/th pop. 15–69.....               | n/a  | n/a |   |
| 7.2.4 Printing & publishing manufactures, % <sup>Ⓐ</sup> .....    | 0.2  | 99  | ○ |
| 7.2.5 Creative goods exports, % total trade <sup>Ⓐ</sup> .....    | 0.1  | 100 |   |
| 7.3 Online creativity.....  | 8.9  | 102 |   |
| 7.3.1 Generic top-level domains (TLDs)/th pop. 15–69.....         | 0.4  | 111 |   |
| 7.3.2 Country-code TLDs/th pop. 15–69.....                        | 0.0  | 123 | ○ |
| 7.3.3 Wikipedia edits/mn pop. 15–69.....                          | 2.7  | 103 |   |
| 7.3.4 Video uploads on YouTube/pop. 15–69.....                    | n/a  | n/a |   |

NOTES: ● indicates a strength; ○ a weakness; \* an index; † a survey question.

Ⓐ indicates that the country's data are older than the base year; see Appendix II for details, including the year of the data, at <http://globalinnovationindex.org>.

Square brackets indicate that the data minimum coverage (DMC) requirements were not met at the sub-pillar or pillar level; see page 181 of this appendix for details.

## Belarus

## Key indicators

|                            |                     |
|----------------------------|---------------------|
| Population (millions)..... | 9.5                 |
| GDP (US\$ billions).....   | 48.1                |
| GDP per capita, PPP\$..... | 17,654.2            |
| Income group.....          | Upper-middle income |
| Region.....                | Europe              |

|  | Score 0–100<br>or value (hard data) | Rank      |
|--|-------------------------------------|-----------|
| <b>Global Innovation Index (out of 127).....</b> | <b>30.0</b>                         | <b>88</b> |
| Innovation Output Sub-Index.....                 | 16.7                                | 109 ○     |
| Innovation Input Sub-Index.....                  | 43.2                                | 63        |
| Innovation Efficiency Ratio.....                 | 0.4                                 | 120 ○     |
| Global Innovation Index 2016 (out of 128).....   | 30.4                                | 79        |

|   |             |           |
|---|-------------|-----------|
| <b>1 Institutions.....</b>                            | <b>54.1</b> | <b>81</b> |
| 1.1 Political environment.....                        | 46.9        | 77        |
| 1.1.1 Political stability & safety*.....              | 63.8        | 61        |
| 1.1.2 Government effectiveness*.....                  | 29.9        | 93        |
| 1.2 Regulatory environment.....                       | 44.7        | 109 ○     |
| 1.2.1 Regulatory quality*.....                        | 16.5        | 120 ○     |
| 1.2.2 Rule of law*.....                               | 16.4        | 107 ○     |
| 1.2.3 Cost of redundancy dismissal, salary weeks..... | 21.7        | 90        |
| 1.3 Business environment.....                         | 70.8        | 64        |
| 1.3.1 Ease of starting a business*.....               | 92.9        | 28 ●      |
| 1.3.2 Ease of resolving insolvency*.....              | 49.1        | 64        |
| 1.3.3 Ease of paying taxes*.....                      | 70.4        | 74        |

|  |             |           |
|--|-------------|-----------|
| <b>2 Human capital &amp; research.....</b>                   | <b>41.9</b> | <b>36</b> |
| 2.1 Education.....   | 64.5        | 12 ●      |
| 2.1.1 Expenditure on education, % GDP.....                   | 4.9         | 52        |
| 2.1.2 Gov't expenditure/pupil, secondary, % GDP/cap.....     | n/a         | n/a       |
| 2.1.3 School life expectancy, years.....                     | 15.7        | 34        |
| 2.1.4 PISA scales in reading, maths, & science.....          | n/a         | n/a       |
| 2.1.5 Pupil-teacher ratio, secondary.....                    | 8.4         | 12 ●      |
| 2.2 Tertiary education.....                                  | 51.8        | 17 ●      |
| 2.2.1 Tertiary enrolment, % gross.....                       | 87.9        | 6 ●       |
| 2.2.2 Graduates in science & engineering, %.....             | 28.6        | 12 ●      |
| 2.2.3 Tertiary inbound mobility, %.....                      | 3.3         | 54        |
| 2.3 Research & development (R&D).....                        | 9.4         | 60        |
| 2.3.1 Researchers, FTE/mn pop.....                           | n/a         | n/a       |
| 2.3.2 Gross expenditure on R&D, % GDP.....                   | 0.5         | 63        |
| 2.3.3 Global R&D companies, avg. expend. top 3, mn \$US..... | 0.0         | 43 ○      |
| 2.3.4 QS university ranking, average score top 3*.....       | 16.4        | 55        |

|  |             |           |
|--|-------------|-----------|
| <b>3 Infrastructure.....</b>                                 | <b>46.1</b> | <b>67</b> |
| 3.1 Information & communication technologies (ICTs).....     | 60.3        | 59        |
| 3.1.1 ICT access*.....                                       | 78.0        | 32        |
| 3.1.2 ICT use*.....  | 58.8        | 39        |
| 3.1.3 Government's online service*.....                      | 48.6        | 87        |
| 3.1.4 E-participation*.....                                  | 55.9        | 74        |
| 3.2 General infrastructure.....                              | 33.7        | 79        |
| 3.2.1 Electricity output, kWh/cap.....                       | 3,667.9     | 56        |
| 3.2.2 Logistics performance*.....                            | 15.6        | 112 ○     |
| 3.2.3 Gross capital formation, % GDP.....                    | 26.9        | 32        |
| 3.3 Ecological sustainability.....                           | 44.3        | 65        |
| 3.3.1 GDP/unit of energy use.....                            | 5.8         | 94        |
| 3.3.2 Environmental performance*.....                        | 82.3        | 35        |
| 3.3.3 ISO 14001 environmental certificates/bn PPP\$ GDP..... | 2.6         | 44        |

|   |             |           |
|---|-------------|-----------|
| <b>4 Market sophistication.....</b>                 | <b>41.9</b> | <b>90</b> |
| 4.1 Credit.....                                     | 19.2        | 114 ○     |
| 4.1.1 Ease of getting credit*.....                  | 45.0        | 84        |
| 4.1.2 Domestic credit to private sector, % GDP..... | 2.9         | 126 ○     |
| 4.1.3 Microfinance gross loans, % GDP.....          | 0.7         | 30        |

|   |       |      |
|---|-------|------|
| 4.2 Investment.....                                     | 42.8  | 51   |
| 4.2.1 Ease of protecting minority investors*.....       | 63.3  | 41   |
| 4.2.2 Market capitalization, % GDP.....                 | n/a   | n/a  |
| 4.2.3 Venture capital deals/bn PPP\$ GDP.....           | 0.0   | 82 ○ |
| 4.3 Trade, competition, & market scale.....             | 63.7  | 54   |
| 4.3.1 Applied tariff rate, weighted mean, %.....        | 1.8   | 52   |
| 4.3.2 Intensity of local competition <sup>†</sup> ..... | n/a   | n/a  |
| 4.3.3 Domestic market scale, bn PPP\$.....              | 165.4 | 65   |

|   |             |           |
|---|-------------|-----------|
| <b>5 Business sophistication.....</b>                                 | <b>32.2</b> | <b>65</b> |
| 5.1 Knowledge workers.....  | 59.1        | 25 ●      |
| 5.1.1 Knowledge-intensive employment, % <sup>Ⓐ</sup> .....            | 35.9        | 34        |
| 5.1.2 Firms offering formal training, % firms.....                    | 51.1        | 21 ●      |
| 5.1.3 GERD performed by business, % of GDP.....                       | 0.3         | 41        |
| 5.1.4 GERD financed by business, %.....                               | 41.3        | 32        |
| 5.1.5 Females employed w/advanced degrees, % total <sup>Ⓐ</sup> ..... | 33.9        | 1 ●       |
| 5.2 Innovation linkages.....  | 13.9        | 124 ○     |
| 5.2.1 University/industry research collaboration <sup>†</sup> .....   | n/a         | n/a       |
| 5.2.2 State of cluster development <sup>†</sup> .....                 | n/a         | n/a       |
| 5.2.3 GERD financed by abroad, %.....                                 | 12.7        | 39        |
| 5.2.4 JV-strategic alliance deals/bn PPP\$ GDP.....                   | 0.0         | 53        |
| 5.2.5 Patent families 2+ offices/bn PPP\$ GDP.....                    | 0.4         | 39        |
| 5.3 Knowledge absorption.....   | 23.6        | 107 ○     |
| 5.3.1 Intellectual property payments, % total trade.....              | 0.4         | 69        |
| 5.3.2 High-tech imports less re-imports, % total trade.....           | 5.2         | 105 ○     |
| 5.3.3 ICT services imports, % total trade.....                        | 0.6         | 89        |
| 5.3.4 FDI net inflows, % GDP.....                                     | 2.8         | 63        |
| 5.3.5 Research talent, % in business enterprise.....                  | n/a         | n/a       |

|   |             |           |
|---|-------------|-----------|
| <b>6 Knowledge &amp; technology outputs.....</b>            | <b>21.7</b> | <b>61</b> |
| 6.1 Knowledge creation.....                                 | 23.8        | 39        |
| 6.1.1 Patents by origin/bn PPP\$ GDP.....                   | 4.2         | 27 ●      |
| 6.1.2 PCT patent applications/bn PPP\$ GDP.....             | 0.1         | 63        |
| 6.1.3 Utility models by origin/bn PPP\$ GDP.....            | 2.3         | 11 ●      |
| 6.1.4 Scientific & technical articles/bn PPP\$ GDP.....     | 6.5         | 85        |
| 6.1.5 Citable documents H index.....                        | 9.7         | 64        |
| 6.2 Knowledge impact.....                                   | 21.1        | 105       |
| 6.2.1 Growth rate of PPP\$ GDP/worker, %.....               | (2.4)       | 104 ○     |
| 6.2.2 New businesses/th pop. 15–64.....                     | 1.1         | 68        |
| 6.2.3 Computer software spending, % GDP.....                | 0.0         | 108 ○     |
| 6.2.4 ISO 9001 quality certificates/bn PPP\$ GDP.....       | 21.7        | 17 ●      |
| 6.2.5 High- & medium-high-tech manufactures, %.....         | 0.3         | 41        |
| 6.3 Knowledge diffusion.....                                | 20.2        | 76        |
| 6.3.1 Intellectual property receipts, % total trade.....    | 0.1         | 61        |
| 6.3.2 High-tech exports less re-exports, % total trade..... | 1.8         | 57        |
| 6.3.3 ICT services exports, % total trade.....              | 3.1         | 29 ●      |
| 6.3.4 FDI net outflows, % GDP.....                          | 0.2         | 84        |

|   |             |            |
|---|-------------|------------|
| <b>7 Creative outputs.....</b>                                    | <b>11.7</b> | <b>123</b> |
| 7.1 Intangible assets.....  | 11.0        | 124 ○      |
| 7.1.1 Trademarks by origin/bn PPP\$ GDP.....                      | 26.7        | 76         |
| 7.1.2 Industrial designs by origin/bn PPP\$ GDP.....              | 1.2         | 57         |
| 7.1.3 ICTs & business model creation <sup>†</sup> .....           | n/a         | n/a        |
| 7.1.4 ICTs & organizational model creation <sup>†</sup> .....     | n/a         | n/a        |
| 7.2 Creative goods & services.....                                | 4.2         | 113 ○      |
| 7.2.1 Cultural & creative services exports, % of total trade..... | 0.0         | 67         |
| 7.2.2 National feature films/mn pop. 15–69 <sup>Ⓐ</sup> .....     | 0.1         | 100 ○      |
| 7.2.3 Global ent. & media market/th pop. 15–69.....               | n/a         | n/a        |
| 7.2.4 Printing & publishing manufactures, %.....                  | n/a         | n/a        |
| 7.2.5 Creative goods exports, % total trade.....                  | 0.2         | 74         |
| 7.3 Online creativity.....  | 20.8        | 61         |
| 7.3.1 Generic top-level domains (TLDs)/th pop. 15–69.....         | 1.8         | 82         |
| 7.3.2 Country-code TLDs/th pop. 15–69.....                        | 5.2         | 48         |
| 7.3.3 Wikipedia edits/mn pop. 15–69.....                          | 5.7         | 46         |
| 7.3.4 Video uploads on YouTube/pop. 15–69.....                    | n/a         | n/a        |

NOTES: ● indicates a strength; ○ a weakness; \* an index; † a survey question.

Ⓐ indicates that the country's data are older than the base year; see Appendix II for details, including the year of the data, at <http://globalinnovationindex.org>.

Square brackets indicate that the data minimum coverage (DMC) requirements were not met at the sub-pillar or pillar level; see page 181 of this appendix for details.



## Key indicators

|                            |             |
|----------------------------|-------------|
| Population (millions)..... | 11.4        |
| GDP (US\$ billions).....   | 470.2       |
| GDP per capita, PPP\$..... | 43,585.0    |
| Income group.....          | High income |
| Region.....                | Europe      |

|  | Score 0–100<br>or value (hard data) | Rank      |
|--|-------------------------------------|-----------|
| <b>Global Innovation Index (out of 127).....</b> | <b>49.9</b>                         | <b>27</b> |
| Innovation Output Sub-Index.....                 | 40.2                                | 27        |
| Innovation Input Sub-Index.....                  | 59.5                                | 22        |
| Innovation Efficiency Ratio.....                 | 0.7                                 | 47        |
| Global Innovation Index 2016 (out of 128).....   | 52.0                                | 23        |

|  |             |             |
|--|-------------|-------------|
| <b>1 Institutions.....</b>   | <b>80.5</b> | <b>26</b>   |
| 1.1 Political environment.....   | 78.8        | 23          |
| 1.1.1 Political stability & safety*.....                               | 78.5        | 37          |
| 1.1.2 Government effectiveness*.....                                   | 79.2        | 22          |
| 1.2 Regulatory environment.....  | 77.4        | 32          |
| 1.2.1 Regulatory quality*.....   | 74.8        | 21          |
| 1.2.2 Rule of law*.....  | 80.9        | 20          |
| 1.2.3 Cost of redundancy dismissal, salary weeks.....                  | 19.7        | 81 ○        |
| 1.3 Business environment.....  | 85.4        | 22          |
| 1.3.1 Ease of starting a business*.....                                | 94.5        | 16          |
| 1.3.2 Ease of resolving insolvency*.....                               | 84.3        | 9 ●         |
| 1.3.3 Ease of paying taxes*.....                                       | 77.3        | 56          |
| <b>2 Human capital &amp; research.....</b>                             | <b>59.7</b> | <b>11 ●</b> |
| 2.1 Education.....   | 72.8        | 6 ●         |
| 2.1.1 Expenditure on education, % GDP <sup>Ⓔ</sup> .....               | 6.4         | 17          |
| 2.1.2 Gov't expenditure/pupil, secondary, % GDP/cap <sup>Ⓔ</sup> ..... | 37.6        | 8 ●         |
| 2.1.3 School life expectancy, years.....                               | 19.9        | 2 ●         |
| 2.1.4 PISA scales in reading, maths, & science.....                    | 502.5       | 18          |
| 2.1.5 Pupil-teacher ratio, secondary <sup>Ⓔ</sup> .....                | 9.4         | 19          |
| 2.2 Tertiary education.....  | 45.6        | 31          |
| 2.2.1 Tertiary enrolment, % gross <sup>Ⓔ</sup> .....                   | 73.3        | 22          |
| 2.2.2 Graduates in science & engineering, % <sup>Ⓔ</sup> .....         | 16.4        | 76 ○        |
| 2.2.3 Tertiary inbound mobility, % <sup>Ⓔ</sup> .....                  | 11.2        | 14          |
| 2.3 Research & development (R&D).....                                  | 60.6        | 16          |
| 2.3.1 Researchers, FTE/mn pop.....                                     | 4,875.3     | 12          |
| 2.3.2 Gross expenditure on R&D, % GDP.....                             | 2.5         | 11 ●        |
| 2.3.3 Global R&D companies, avg. expend. top 3, mn \$US.....           | 66.7        | 20          |
| 2.3.4 QS university ranking, average score top 3*.....                 | 59.6        | 16          |
| <b>3 Infrastructure.....</b>   | <b>57.2</b> | <b>32</b>   |
| 3.1 Information & communication technologies (ICTs).....               | 72.5        | 32          |
| 3.1.1 ICT access*.....   | 83.4        | 16          |
| 3.1.2 ICT use*.....  | 71.0        | 22          |
| 3.1.3 Government's online service*.....                                | 71.0        | 43          |
| 3.1.4 E-participation*.....  | 64.4        | 54 ○        |
| 3.2 General infrastructure.....  | 51.9        | 17          |
| 3.2.1 Electricity output, kWh/cap.....                                 | 5,969.5     | 34          |
| 3.2.2 Logistics performance*.....                                      | 94.6        | 6 ●         |
| 3.2.3 Gross capital formation, % GDP.....                              | 23.7        | 51          |
| 3.3 Ecological sustainability.....                                     | 47.3        | 54          |
| 3.3.1 GDP/unit of energy use.....                                      | 8.5         | 63 ○        |
| 3.3.2 Environmental performance*.....                                  | 80.2        | 41          |
| 3.3.3 ISO 14001 environmental certificates/bn PPP\$ GDP.....           | 2.3         | 46          |
| <b>4 Market sophistication.....</b>                                    | <b>51.8</b> | <b>40</b>   |
| 4.1 Credit.....  | 34.5        | 66 ○        |
| 4.1.1 Ease of getting credit*.....                                     | 45.0        | 84 ○        |
| 4.1.2 Domestic credit to private sector, % GDP.....                    | 61.5        | 51          |
| 4.1.3 Microfinance gross loans, % GDP.....                             | n/a         | n/a         |

|   |       |      |
|---|-------|------|
| 4.2 Investment.....                                     | 46.7  | 37   |
| 4.2.1 Ease of protecting minority investors*.....       | 58.3  | 62 ○ |
| 4.2.2 Market capitalization, % GDP.....                 | 91.1  | 11   |
| 4.2.3 Venture capital deals/bn PPP\$ GDP.....           | 0.1   | 19   |
| 4.3 Trade, competition, & market scale.....             | 74.1  | 24   |
| 4.3.1 Applied tariff rate, weighted mean, %.....        | 1.6   | 23   |
| 4.3.2 Intensity of local competition <sup>†</sup> ..... | 80.8  | 12 ● |
| 4.3.3 Domestic market scale, bn PPP\$.....              | 508.6 | 35   |

**5 Business sophistication..... 48.5 22**

|   |       |       |
|---|-------|-------|
| 5.1 Knowledge workers.....  | 71.1  | 6 ●   |
| 5.1.1 Knowledge-intensive employment, %.....                        | 45.6  | 11    |
| 5.1.2 Firms offering formal training, % firms.....                  | n/a   | n/a   |
| 5.1.3 GERD performed by business, % of GDP.....                     | 1.8   | 11    |
| 5.1.4 GERD financed by business, % <sup>Ⓔ</sup> .....               | 61.3  | 10    |
| 5.1.5 Females employed w/advanced degrees, % total.....             | 23.3  | 14    |
| 5.2 Innovation linkages.....  | 41.8  | 24    |
| 5.2.1 University/industry research collaboration <sup>†</sup> ..... | 71.0  | 9 ●   |
| 5.2.2 State of cluster development <sup>†</sup> .....               | 60.1  | 24    |
| 5.2.3 GERD financed by abroad, % <sup>Ⓔ</sup> .....                 | 13.2  | 35    |
| 5.2.4 JV-strategic alliance deals/bn PPP\$ GDP.....                 | 0.1   | 29    |
| 5.2.5 Patent families 2+ offices/bn PPP\$ GDP.....                  | 3.8   | 17    |
| 5.3 Knowledge absorption.....                                       | 32.4  | 67 ○  |
| 5.3.1 Intellectual property payments, % total trade.....            | 0.9   | 38    |
| 5.3.2 High-tech imports less re-imports, % total trade.....         | 10.3  | 42    |
| 5.3.3 ICT services imports, % total trade.....                      | 2.3   | 16    |
| 5.3.4 FDI net inflows, % GDP.....                                   | (4.6) | 127 ○ |
| 5.3.5 Research talent, % in business enterprise.....                | 48.3  | 27    |

**6 Knowledge & technology outputs..... 33.2 31**

|   |       |       |
|---|-------|-------|
| 6.1 Knowledge creation.....                                 | 43.3  | 17    |
| 6.1.1 Patents by origin/bn PPP\$ GDP.....                   | 6.0   | 20    |
| 6.1.2 PCT patent applications/bn PPP\$ GDP.....             | 2.4   | 16    |
| 6.1.3 Utility models by origin/bn PPP\$ GDP.....            | n/a   | n/a   |
| 6.1.4 Scientific & technical articles/bn PPP\$ GDP.....     | 40.1  | 16    |
| 6.1.5 Citable documents H index.....                        | 52.7  | 13    |
| 6.2 Knowledge impact.....                                   | 37.4  | 41    |
| 6.2.1 Growth rate of PPP\$ GDP/worker, %.....               | 0.5   | 71 ○  |
| 6.2.2 New businesses/th pop. 15–64 <sup>Ⓔ</sup> .....       | 2.1   | 47    |
| 6.2.3 Computer software spending, % GDP.....                | 0.6   | 8 ●   |
| 6.2.4 ISO 9001 quality certificates/bn PPP\$ GDP.....       | 7.2   | 51    |
| 6.2.5 High- & medium-high-tech manufactures, %.....         | 0.3   | 31    |
| 6.3 Knowledge diffusion.....                                | 19.1  | 87 ○  |
| 6.3.1 Intellectual property receipts, % total trade.....    | 0.8   | 19    |
| 6.3.2 High-tech exports less re-exports, % total trade..... | 11.1  | 19    |
| 6.3.3 ICT services exports, % total trade.....              | 3.0   | 30    |
| 6.3.4 FDI net outflows, % GDP.....                          | (3.1) | 124 ○ |

**7 Creative outputs..... 47.1 19**

|   |      |      |
|---|------|------|
| 7.1 Intangible assets.....  | 51.3 | 34   |
| 7.1.1 Trademarks by origin/bn PPP\$ GDP.....                                    | 49.3 | 53 ○ |
| 7.1.2 Industrial designs by origin/bn PPP\$ GDP.....                            | 2.9  | 38   |
| 7.1.3 ICTs & business model creation <sup>†</sup> .....                         | 76.4 | 19   |
| 7.1.4 ICTs & organizational model creation <sup>†</sup> .....                   | 70.4 | 22   |
| 7.2 Creative goods & services.....  | 39.8 | 12 ● |
| 7.2.1 Cultural & creative services exports, % of total trade <sup>Ⓔ</sup> ..... | 1.6  | 4 ●  |
| 7.2.2 National feature films/mn pop. 15–69.....                                 | 8.7  | 18   |
| 7.2.3 Global ent. & media market/th pop. 15–69.....                             | 52.8 | 16   |
| 7.2.4 Printing & publishing manufactures, %.....                                | 1.2  | 45   |
| 7.2.5 Creative goods exports, % total trade.....                                | 1.8  | 28   |
| 7.3 Online creativity.....  | 46.1 | 20   |
| 7.3.1 Generic top-level domains (TLDs)/th pop. 15–69.....                       | 22.1 | 27   |
| 7.3.2 Country-code TLDs/th pop. 15–69.....                                      | 58.0 | 12 ● |
| 7.3.3 Wikipedia edits/mn pop. 15–69.....  | 6.2  | 33   |
| 7.3.4 Video uploads on YouTube/pop. 15–69.....                                  | 44.1 | 25   |

NOTES: ● indicates a strength; ○ a weakness; \* an index; † a survey question.

Ⓔ indicates that the country's data are older than the base year; see Appendix II for details, including the year of the data, at <http://globalinnovationindex.org>.

Square brackets indicate that the data minimum coverage (DMC) requirements were not met at the sub-pillar or pillar level; see page 181 of this appendix for details.

## Key indicators

|                             |                    |
|-----------------------------|--------------------|
| Population (millions) ..... | 11.2               |
| GDP (US\$ billions) .....   | 8.9                |
| GDP per capita, PPP\$ ..... | 2,113.2            |
| Income group .....          | Low income         |
| Region .....                | Sub-Saharan Africa |

|  | Score 0–100<br>or value (hard data) | Rank       |
|--|-------------------------------------|------------|
| <b>Global Innovation Index (out of 127).....</b> | <b>23.0</b>                         | <b>116</b> |
| Innovation Output Sub-Index .....                | 14.8                                | 120        |
| Innovation Input Sub-Index .....                 | 31.3                                | 110        |
| Innovation Efficiency Ratio .....                | 0.5                                 | 110        |
| Global Innovation Index 2016 (out of 128) .....  | 22.2                                | 121        |

|          |  |             |           |
|----------|--|-------------|-----------|
| <b>1</b> | <b>Institutions.....</b>                         | <b>54.0</b> | <b>82</b> |
| 1.1      | Political environment .....                      | 45.1        | 83        |
| 1.1.1    | Political stability & safety* .....              | 63.9        | 60        |
| 1.1.2    | Government effectiveness* .....                  | 26.3        | 102       |
| 1.2      | Regulatory environment .....                     | 59.0        | 74        |
| 1.2.1    | Regulatory quality* .....                        | 27.9        | 103       |
| 1.2.2    | Rule of law* .....                               | 22.4        | 95        |
| 1.2.3    | Cost of redundancy dismissal, salary weeks ..... | 11.6        | 41 ●      |
| 1.3      | Business environment .....                       | 58.0        | 106       |
| 1.3.1    | Ease of starting a business* .....               | 90.6        | 48 ●      |
| 1.3.2    | Ease of resolving insolvency* .....              | 38.7        | 101       |
| 1.3.3    | Ease of paying taxes* .....                      | 44.6        | 119       |

|          |  |             |           |
|----------|--|-------------|-----------|
| <b>2</b> | <b>Human capital &amp; research.....</b>                 | <b>21.1</b> | <b>97</b> |
| 2.1      | Education .....  | 39.0        | 90        |
| 2.1.1    | Expenditure on education, % GDP .....                    | 4.3         | 72        |
| 2.1.2    | Gov't expenditure/pupil, secondary, % GDP/cap .....      | 11.4        | 92        |
| 2.1.3    | School life expectancy, years <sup>Ⓐ</sup> .....         | 12.1        | 85        |
| 2.1.4    | PISA scales in reading, maths, & science .....           | n/a         | n/a       |
| 2.1.5    | Pupil-teacher ratio, secondary .....                     | 10.3        | 28 ●      |
| 2.2      | Tertiary education .....                                 | 24.4        | 94        |
| 2.2.1    | Tertiary enrolment, % gross <sup>Ⓐ</sup> .....           | 15.4        | 97        |
| 2.2.2    | Graduates in science & engineering, % <sup>Ⓐ</sup> ..... | 12.7        | 92        |
| 2.2.3    | Tertiary inbound mobility, % <sup>Ⓐ</sup> .....          | 7.9         | 22 ●      |
| 2.3      | Research & development (R&D) .....                       | 0.0         | 115 ○     |
| 2.3.1    | Researchers, FTE/mn pop. .....                           | n/a         | n/a       |
| 2.3.2    | Gross expenditure on R&D, % GDP .....                    | n/a         | n/a       |
| 2.3.3    | Global R&D companies, avg. expend. top 3, mn \$US .....  | 0.0         | 43 ○      |
| 2.3.4    | QS university ranking, average score top 3* .....        | 0.0         | 75 ○      |

|          |   |             |            |   |
|----------|---|-------------|------------|---|
| <b>3</b> | <b>Infrastructure.....</b>                              | <b>23.3</b> | <b>123</b> | ○ |
| 3.1      | Information & communication technologies (ICTs) .....   | 16.0        | 123        | ○ |
| 3.1.1    | ICT access* .....                                       | 28.6        | 113        |   |
| 3.1.2    | ICT use* .....  | 4.0         | 124        | ○ |
| 3.1.3    | Government's online service* .....                      | 14.5        | 119        | ○ |
| 3.1.4    | E-participation* .....                                  | 16.9        | 117        |   |
| 3.2      | General infrastructure .....                            | 30.0        | 93         |   |
| 3.2.1    | Electricity output, kWh/cap .....                       | 17.4        | 119        | ○ |
| 3.2.2    | Logistics performance* .....                            | 16.9        | 109        |   |
| 3.2.3    | Gross capital formation, % GDP .....                    | 26.2        | 34         | ● |
| 3.3      | Ecological sustainability .....                         | 23.7        | 121        | ○ |
| 3.3.1    | GDP/unit of energy use .....                            | 4.7         | 107        |   |
| 3.3.2    | Environmental performance* .....                        | 43.7        | 117        |   |
| 3.3.3    | ISO 14001 environmental certificates/bn PPP\$ GDP ..... | 0.0         | 124        | ○ |

|          |  |             |            |
|----------|--|-------------|------------|
| <b>4</b> | <b>Market sophistication .....</b>             | <b>30.6</b> | <b>120</b> |
| 4.1      | Credit .....                                   | 21.4        | 109        |
| 4.1.1    | Ease of getting credit* .....                  | 30.0        | 108        |
| 4.1.2    | Domestic credit to private sector, % GDP ..... | 21.5        | 111        |
| 4.1.3    | Microfinance gross loans, % GDP .....          | 1.5         | 21 ●       |

|       |   |      |       |
|-------|---|------|-------|
| 4.2   | Investment .....                                  | 40.0 | [64]  |
| 4.2.1 | Ease of protecting minority investors* .....      | 40.0 | 111   |
| 4.2.2 | Market capitalization, % GDP .....                | n/a  | n/a   |
| 4.2.3 | Venture capital deals/bn PPP\$ GDP .....          | n/a  | n/a   |
| 4.3   | Trade, competition, & market scale .....          | 30.3 | 125 ○ |
| 4.3.1 | Applied tariff rate, weighted mean, % .....       | 17.2 | 126 ○ |
| 4.3.2 | Intensity of local competition <sup>†</sup> ..... | 63.7 | 84    |
| 4.3.3 | Domestic market scale, bn PPP\$ .....             | 24.3 | 116   |

**5 Business sophistication .....** **27.5** **[88]**

|       |  |      |       |
|-------|--|------|-------|
| 5.1   | Knowledge workers .....  | 21.9 | [107] |
| 5.1.1 | Knowledge-intensive employment, % .....                          | n/a  | n/a   |
| 5.1.2 | Firms offering formal training, % firms .....                    | 20.0 | 76    |
| 5.1.3 | GERD performed by business, % of GDP .....                       | n/a  | n/a   |
| 5.1.4 | GERD financed by business, % .....                               | n/a  | n/a   |
| 5.1.5 | Females employed w/advanced degrees, % total .....               | n/a  | n/a   |
| 5.2   | Innovation linkages .....  | 37.6 | [38]  |
| 5.2.1 | University/industry research collaboration <sup>†</sup> .....    | 35.6 | 91    |
| 5.2.2 | State of cluster development <sup>†</sup> .....                  | 38.6 | 90    |
| 5.2.3 | GERD financed by abroad, % .....                                 | n/a  | n/a   |
| 5.2.4 | JV-strategic alliance deals/bn PPP\$ GDP .....                   | n/a  | n/a   |
| 5.2.5 | Patent families 2+ offices/bn PPP\$ GDP .....                    | n/a  | n/a   |
| 5.3   | Knowledge absorption .....                                       | 23.1 | 108   |
| 5.3.1 | Intellectual property payments, % total trade <sup>Ⓐ</sup> ..... | 0.1  | 106   |
| 5.3.2 | High-tech imports less re-imports, % total trade .....           | 2.6  | 124 ○ |
| 5.3.3 | ICT services imports, % total trade <sup>Ⓐ</sup> .....           | 1.3  | 55 ●  |
| 5.3.4 | FDI net inflows, % GDP .....                                     | 3.6  | 45 ●  |
| 5.3.5 | Research talent, % in business enterprise .....                  | n/a  | n/a   |

**6 Knowledge & technology outputs .....** **8.5** **122** ○

|       |  |      |       |
|-------|--|------|-------|
| 6.1   | Knowledge creation .....   | 5.1  | 87    |
| 6.1.1 | Patents by origin/bn PPP\$ GDP .....                             | 0.2  | 96    |
| 6.1.2 | PCT patent applications/bn PPP\$ GDP <sup>Ⓐ</sup> .....          | 0.0  | 83    |
| 6.1.3 | Utility models by origin/bn PPP\$ GDP .....                      | n/a  | n/a   |
| 6.1.4 | Scientific & technical articles/bn PPP\$ GDP .....               | 11.3 | 62    |
| 6.1.5 | Citable documents H index .....                                  | 3.4  | 108   |
| 6.2   | Knowledge impact .....   | 3.8  | [122] |
| 6.2.1 | Growth rate of PPP\$ GDP/worker, % .....                         | n/a  | n/a   |
| 6.2.2 | New businesses/th pop. 15–64 .....                               | n/a  | n/a   |
| 6.2.3 | Computer software spending, % GDP .....                          | 0.1  | 101   |
| 6.2.4 | ISO 9001 quality certificates/bn PPP\$ GDP .....                 | 2.2  | 89    |
| 6.2.5 | High- & medium-high-tech manufactures, % .....                   | n/a  | n/a   |
| 6.3   | Knowledge diffusion .....  | 16.6 | 103   |
| 6.3.1 | Intellectual property receipts, % total trade <sup>Ⓐ</sup> ..... | 0.0  | 105 ○ |
| 6.3.2 | High-tech exports less re-exports, % total trade .....           | 0.1  | 118   |
| 6.3.3 | ICT services exports, % total trade <sup>Ⓐ</sup> .....           | 1.8  | 55 ●  |
| 6.3.4 | FDI net outflows, % GDP .....                                    | 0.4  | 74    |

**7 Creative outputs .....** **21.0** **99**

|       |  |      |       |
|-------|--|------|-------|
| 7.1   | Intangible assets .....                                      | 28.6 | 109   |
| 7.1.1 | Trademarks by origin/bn PPP\$ GDP .....                      | 7.5  | 108   |
| 7.1.2 | Industrial designs by origin/bn PPP\$ GDP .....              | 0.3  | 88    |
| 7.1.3 | ICTs & business model creation <sup>†</sup> .....            | 50.1 | 98    |
| 7.1.4 | ICTs & organizational model creation <sup>†</sup> .....      | 45.7 | 87    |
| 7.2   | Creative goods & services .....                              | 19.6 | [60]  |
| 7.2.1 | Cultural & creative services exports, % of total trade ..... | 1.2  | 11 ●  |
| 7.2.2 | National feature films/mn pop. 15–69 .....                   | n/a  | n/a   |
| 7.2.3 | Global ent. & media market/th pop. 15–69 .....               | n/a  | n/a   |
| 7.2.4 | Printing & publishing manufactures, % .....                  | n/a  | n/a   |
| 7.2.5 | Creative goods exports, % total trade .....                  | 0.0  | 117   |
| 7.3   | Online creativity .....                                      | 7.4  | 105   |
| 7.3.1 | Generic top-level domains (TLDs)/th pop. 15–69 .....         | 0.6  | 104   |
| 7.3.2 | Country-code TLDs/th pop. 15–69 .....                        | 0.0  | 121 ○ |
| 7.3.3 | Wikipedia edits/mn pop. 15–69 <sup>Ⓐ</sup> .....             | 2.2  | 106   |
| 7.3.4 | Video uploads on YouTube/pop. 15–69 .....                    | n/a  | n/a   |

NOTES: ● indicates a strength; ○ a weakness; \* an index; † a survey question.

Ⓐ indicates that the country's data are older than the base year; see Appendix II for details, including the year of the data, at <http://globalinnovationindex.org>.

Square brackets indicate that the data minimum coverage (DMC) requirements were not met at the sub-pillar or pillar level; see page 181 of this appendix for details.



## Key indicators

|                            |                                 |
|----------------------------|---------------------------------|
| Population (millions)..... | 10.9                            |
| GDP (US\$ billions).....   | 35.7                            |
| GDP per capita, PPP\$..... | 6,465.3                         |
| Income group.....          | Lower-middle income             |
| Region.....                | Latin America and the Caribbean |

|  | Score 0–100<br>or value (hard data) | Rank       |
|--|-------------------------------------|------------|
| <b>Global Innovation Index (out of 127).....</b> | <b>25.6</b>                         | <b>106</b> |
| Innovation Output Sub-Index.....                 | 18.7                                | 99         |
| Innovation Input Sub-Index.....                  | 32.6                                | 107        |
| Innovation Efficiency Ratio.....                 | 0.6                                 | 85         |
| Global Innovation Index 2016 (out of 128).....   | 25.2                                | 109        |

|          |   |             |            |   |
|----------|---|-------------|------------|---|
| <b>1</b> | <b>Institutions.....</b>                                      | <b>29.8</b> | <b>127</b> | ○ |
| 1.1      | Political environment.....                                    | 41.1        | 92         |   |
| 1.1.1    | Political stability & safety*.....                            | 57.0        | 77         |   |
| 1.1.2    | Government effectiveness*.....                                | 25.3        | 106        |   |
| 1.2      | Regulatory environment.....                                   | 6.2         | 127        | ○ |
| 1.2.1    | Regulatory quality*.....                                      | 18.9        | 117        |   |
| 1.2.2    | Rule of law*.....   | 5.8         | 124        | ○ |
| 1.2.3    | Cost of redundancy dismissal, salary weeks <sup>Ⓐ</sup> ..... | 82.3        | 126        | ○ |
| 1.3      | Business environment.....                                     | 42.2        | 127        | ○ |
| 1.3.1    | Ease of starting a business*.....                             | 62.9        | 124        | ○ |
| 1.3.2    | Ease of resolving insolvency*.....                            | 42.3        | 85         |   |
| 1.3.3    | Ease of paying taxes*.....                                    | 21.4        | 127        | ○ |
| <b>2</b> | <b>Human capital &amp; research.....</b>                      | <b>25.8</b> | <b>85</b>  |   |
| 2.1      | Education.....  | 50.3        | 52         | ● |
| 2.1.1    | Expenditure on education, % GDP.....                          | 7.3         | 11         | ● |
| 2.1.2    | Gov't expenditure/pupil, secondary, % GDP/cap.....            | 18.4        | 57         |   |
| 2.1.3    | School life expectancy, years.....                            | n/a         | n/a        |   |
| 2.1.4    | PISA scales in reading, maths, & science.....                 | n/a         | n/a        |   |
| 2.1.5    | Pupil-teacher ratio, secondary <sup>Ⓐ</sup> .....             | 18.2        | 76         |   |
| 2.2      | Tertiary education.....                                       | n/a         | n/a        |   |
| 2.2.1    | Tertiary enrolment, % gross.....                              | n/a         | n/a        |   |
| 2.2.2    | Graduates in science & engineering, %.....                    | n/a         | n/a        |   |
| 2.2.3    | Tertiary inbound mobility, %.....                             | n/a         | n/a        |   |
| 2.3      | Research & development (R&D).....                             | 1.3         | 99         |   |
| 2.3.1    | Researchers, FTE/mn pop. <sup>Ⓐ</sup> .....                   | 166.0       | 79         |   |
| 2.3.2    | Gross expenditure on R&D, % GDP <sup>Ⓐ</sup> .....            | 0.2         | 93         |   |
| 2.3.3    | Global R&D companies, avg. expend. top 3, mn \$US.....        | 0.0         | 43         | ○ |
| 2.3.4    | QS university ranking, average score top 3*.....              | 0.0         | 75         | ○ |
| <b>3</b> | <b>Infrastructure.....</b>                                    | <b>35.3</b> | <b>102</b> |   |
| 3.1      | Information & communication technologies (ICTs).....          | 44.5        | 88         |   |
| 3.1.1    | ICT access*.....  | 43.7        | 95         |   |
| 3.1.2    | ICT use*.....   | 27.2        | 92         |   |
| 3.1.3    | Government's online service*.....                             | 49.3        | 86         |   |
| 3.1.4    | E-participation*.....   | 57.6        | 70         |   |
| 3.2      | General infrastructure.....                                   | 20.8        | 117        |   |
| 3.2.1    | Electricity output, kWh/cap.....                              | 829.1       | 98         |   |
| 3.2.2    | Logistics performance*.....                                   | 8.7         | 120        | ○ |
| 3.2.3    | Gross capital formation, % GDP.....                           | 19.2        | 92         |   |
| 3.3      | Ecological sustainability.....                                | 40.6        | 80         |   |
| 3.3.1    | GDP/unit of energy use.....                                   | 7.9         | 72         |   |
| 3.3.2    | Environmental performance*.....                               | 71.1        | 69         |   |
| 3.3.3    | ISO 14001 environmental certificates/bn PPP\$ GDP.....        | 0.7         | 74         |   |
| <b>4</b> | <b>Market sophistication.....</b>                             | <b>46.2</b> | <b>63</b>  |   |
| 4.1      | Credit.....   | 52.5        | 24         | ● |
| 4.1.1    | Ease of getting credit*.....                                  | 35.0        | 104        |   |
| 4.1.2    | Domestic credit to private sector, % GDP.....                 | 58.1        | 52         | ● |
| 4.1.3    | Microfinance gross loans, % GDP.....                          | 19.6        | 1          | ● |

|       |   |      |     |  |
|-------|---|------|-----|--|
| 4.2   | Investment.....                                   | 30.1 | 112 |  |
| 4.2.1 | Ease of protecting minority investors*.....       | 41.7 | 105 |  |
| 4.2.2 | Market capitalization, % GDP <sup>Ⓐ</sup> .....   | 16.4 | 65  |  |
| 4.2.3 | Venture capital deals/bn PPP\$ GDP.....           | n/a  | n/a |  |
| 4.3   | Trade, competition, & market scale.....           | 55.9 | 89  |  |
| 4.3.1 | Applied tariff rate, weighted mean, %.....        | 4.8  | 87  |  |
| 4.3.2 | Intensity of local competition <sup>†</sup> ..... | 65.6 | 79  |  |
| 4.3.3 | Domestic market scale, bn PPP\$.....              | 78.4 | 81  |  |

**5 Business sophistication.....26.0 98**

|       |   |      |     |   |
|-------|---|------|-----|---|
| 5.1   | Knowledge workers.....  | 40.0 | 56  | ● |
| 5.1.1 | Knowledge-intensive employment, % <sup>Ⓐ</sup> .....          | 15.2 | 86  |   |
| 5.1.2 | Firms offering formal training, % firms <sup>Ⓐ</sup> .....    | 57.1 | 11  | ● |
| 5.1.3 | GERD performed by business, % of GDP.....                     | n/a  | n/a |   |
| 5.1.4 | GERD financed by business, % <sup>Ⓐ</sup> .....               | 5.2  | 77  |   |
| 5.1.5 | Females employed w/advanced degrees, % total.....             | n/a  | n/a |   |
| 5.2   | Innovation linkages.....                                      | 13.6 | 125 | ○ |
| 5.2.1 | University/industry research collaboration <sup>†</sup> ..... | 23.8 | 120 | ○ |
| 5.2.2 | State of cluster development <sup>†</sup> .....               | 30.8 | 119 | ○ |
| 5.2.3 | GERD financed by abroad, % <sup>Ⓐ</sup> .....                 | 1.9  | 76  |   |
| 5.2.4 | JV-strategic alliance deals/bn PPP\$ GDP.....                 | 0.0  | 85  |   |
| 5.2.5 | Patent families 2+ offices/bn PPP\$ GDP <sup>Ⓐ</sup> .....    | 0.0  | 108 |   |
| 5.3   | Knowledge absorption.....                                     | 24.3 | 102 |   |
| 5.3.1 | Intellectual property payments, % total trade.....            | 0.6  | 57  | ● |
| 5.3.2 | High-tech imports less re-imports, % total trade.....         | 10.0 | 45  | ● |
| 5.3.3 | ICT services imports, % total trade.....                      | 0.8  | 80  |   |
| 5.3.4 | FDI net inflows, % GDP.....                                   | 3.0  | 55  | ● |
| 5.3.5 | Research talent, % in business enterprise <sup>Ⓐ</sup> .....  | 0.4  | 83  | ○ |

**6 Knowledge & technology outputs.....15.6 99**

|       |   |      |     |   |
|-------|---|------|-----|---|
| 6.1   | Knowledge creation.....                                     | 3.2  | 111 |   |
| 6.1.1 | Patents by origin/bn PPP\$ GDP <sup>Ⓐ</sup> .....           | 0.1  | 104 |   |
| 6.1.2 | PCT patent applications/bn PPP\$ GDP.....                   | n/a  | n/a |   |
| 6.1.3 | Utility models by origin/bn PPP\$ GDP <sup>Ⓐ</sup> .....    | 0.2  | 44  |   |
| 6.1.4 | Scientific & technical articles/bn PPP\$ GDP.....           | 3.2  | 109 |   |
| 6.1.5 | Citable documents H index.....                              | 5.5  | 91  |   |
| 6.2   | Knowledge impact.....                                       | 27.9 | 79  |   |
| 6.2.1 | Growth rate of PPP\$ GDP/worker, %.....                     | 2.8  | 23  | ● |
| 6.2.2 | New businesses/th pop. 15–64.....                           | 0.6  | 84  |   |
| 6.2.3 | Computer software spending, % GDP.....                      | 0.2  | 71  |   |
| 6.2.4 | ISO 9001 quality certificates/bn PPP\$ GDP.....             | 3.1  | 77  |   |
| 6.2.5 | High- & medium-high-tech manufactures, % <sup>Ⓐ</sup> ..... | 0.1  | 85  |   |
| 6.3   | Knowledge diffusion.....                                    | 15.8 | 110 |   |
| 6.3.1 | Intellectual property receipts, % total trade.....          | 0.2  | 36  | ● |
| 6.3.2 | High-tech exports less re-exports, % total trade.....       | 0.2  | 97  |   |
| 6.3.3 | ICT services exports, % total trade.....                    | 1.0  | 85  |   |
| 6.3.4 | FDI net outflows, % GDP.....                                | 0.0  | 109 |   |

**7 Creative outputs.....21.7 96**

|       |  |      |     |   |
|-------|--|------|-----|---|
| 7.1   | Intangible assets.....                                       | 29.2 | 107 |   |
| 7.1.1 | Trademarks by origin/bn PPP\$ GDP <sup>Ⓐ</sup> .....         | 35.1 | 65  |   |
| 7.1.2 | Industrial designs by origin/bn PPP\$ GDP <sup>Ⓐ</sup> ..... | 0.4  | 85  |   |
| 7.1.3 | ICTs & business model creation <sup>†</sup> .....            | 47.4 | 110 |   |
| 7.1.4 | ICTs & organizational model creation <sup>†</sup> .....      | 36.1 | 115 |   |
| 7.2   | Creative goods & services.....                               | 16.2 | 72  |   |
| 7.2.1 | Cultural & creative services exports, % of total trade.....  | 0.1  | 61  |   |
| 7.2.2 | National feature films/mn pop. 15–69.....                    | 0.9  | 81  |   |
| 7.2.3 | Global ent. & media market/th pop. 15–69.....                | n/a  | n/a |   |
| 7.2.4 | Printing & publishing manufactures, % <sup>Ⓐ</sup> .....     | 1.1  | 56  |   |
| 7.2.5 | Creative goods exports, % total trade.....                   | 1.3  | 35  | ● |
| 7.3   | Online creativity.....                                       | 12.3 | 93  |   |
| 7.3.1 | Generic top-level domains (TLDs)/th pop. 15–69.....          | 1.8  | 80  |   |
| 7.3.2 | Country-code TLDs/th pop. 15–69.....                         | 0.5  | 89  |   |
| 7.3.3 | Wikipedia edits/mn pop. 15–69 <sup>Ⓐ</sup> .....             | 3.6  | 93  |   |
| 7.3.4 | Video uploads on YouTube/pop. 15–69.....                     | n/a  | n/a |   |

NOTES: ● indicates a strength; ○ a weakness; \* an index; † a survey question.

Ⓐ indicates that the country's data are older than the base year; see Appendix II for details, including the year of the data, at <http://globalinnovationindex.org>.

Square brackets indicate that the data minimum coverage (DMC) requirements were not met at the sub-pillar or pillar level; see page 181 of this appendix for details.

# Bosnia and Herzegovina

## Key indicators

|                            |                     |
|----------------------------|---------------------|
| Population (millions)..... | 3.8                 |
| GDP (US\$ billions).....   | 16.5                |
| GDP per capita, PPP\$..... | 10,491.8            |
| Income group.....          | Upper-middle income |
| Region.....                | Europe              |

|  | Score 0–100<br>or value (hard data) | Rank      |
|--|-------------------------------------|-----------|
| <b>Global Innovation Index (out of 127).....</b> | <b>30.2</b>                         | <b>86</b> |
| Innovation Output Sub-Index.....                 | 19.3                                | 96        |
| Innovation Input Sub-Index.....                  | 41.1                                | 75        |
| Innovation Efficiency Ratio.....                 | 0.5                                 | 112 ○     |
| Global Innovation Index 2016 (out of 128).....   | 29.6                                | 87        |

## 1 Institutions.....56.8 71

|   |      |       |
|---|------|-------|
| 1.1 Political environment.....                        | 40.5 | 94    |
| 1.1.1 Political stability & safety*.....              | 52.9 | 86    |
| 1.1.2 Government effectiveness*.....                  | 28.2 | 97    |
| 1.2 Regulatory environment.....                       | 65.9 | 59    |
| 1.2.1 Regulatory quality*.....                        | 37.5 | 80    |
| 1.2.2 Rule of law*.....                               | 30.9 | 75    |
| 1.2.3 Cost of redundancy dismissal, salary weeks..... | 9.2  | 26 ●  |
| 1.3 Business environment.....                         | 64.0 | 80    |
| 1.3.1 Ease of starting a business*.....               | 65.1 | 122 ○ |
| 1.3.2 Ease of resolving insolvency*.....              | 66.9 | 38 ●  |
| 1.3.3 Ease of paying taxes*.....                      | 60.1 | 95    |

## 2 Human capital & research.....41.3 39

|  |       |      |
|--|-------|------|
| 2.1 Education.....   | 90.2  | [1]  |
| 2.1.1 Expenditure on education, % GDP.....                   | n/a   | n/a  |
| 2.1.2 Gov't expenditure/pupil, secondary, % GDP/cap.....     | n/a   | n/a  |
| 2.1.3 School life expectancy, years.....                     | n/a   | n/a  |
| 2.1.4 PISA scales in reading, maths, & science.....          | n/a   | n/a  |
| 2.1.5 Pupil-teacher ratio, secondary.....                    | 10.1  | 26 ● |
| 2.2 Tertiary education.....                                  | 31.4  | 76   |
| 2.2.1 Tertiary enrolment, % gross.....                       | n/a   | n/a  |
| 2.2.2 Graduates in science & engineering, %.....             | 15.4  | 84   |
| 2.2.3 Tertiary inbound mobility, %.....                      | 7.5   | 25 ● |
| 2.3 Research & development (R&D).....                        | 2.2   | 92   |
| 2.3.1 Researchers, FTE/mn pop.....                           | 328.7 | 69   |
| 2.3.2 Gross expenditure on R&D, % GDP.....                   | 0.2   | 88   |
| 2.3.3 Global R&D companies, avg. expend. top 3, mn \$US..... | 0.0   | 43 ○ |
| 2.3.4 QS university ranking, average score top 3*.....       | 0.0   | 75 ○ |

## 3 Infrastructure.....36.9 96

|  |         |       |
|--|---------|-------|
| 3.1 Information & communication technologies (ICTs).....     | 48.9    | 81    |
| 3.1.1 ICT access*.....                                       | 57.8    | 74    |
| 3.1.2 ICT use*.....  | 42.1    | 66    |
| 3.1.3 Government's online service*.....                      | 44.9    | 94    |
| 3.1.4 E-participation*.....                                  | 50.8    | 87    |
| 3.2 General infrastructure.....                              | 25.5    | 106   |
| 3.2.1 Electricity output, kWh/cap.....                       | 4,230.4 | 50    |
| 3.2.2 Logistics performance*.....                            | 24.7    | 95    |
| 3.2.3 Gross capital formation, % GDP.....                    | 17.1    | 103   |
| 3.3 Ecological sustainability.....                           | 36.2    | 99    |
| 3.3.1 GDP/unit of energy use.....                            | 4.5     | 108 ○ |
| 3.3.2 Environmental performance*.....                        | 63.3    | 98    |
| 3.3.3 ISO 14001 environmental certificates/bn PPP\$ GDP..... | 3.7     | 28 ●  |

## 4 Market sophistication.....43.4 79

|   |      |      |
|---|------|------|
| 4.1 Credit.....                                     | 36.0 | 60   |
| 4.1.1 Ease of getting credit*.....                  | 65.0 | 40   |
| 4.1.2 Domestic credit to private sector, % GDP..... | 53.7 | 64   |
| 4.1.3 Microfinance gross loans, % GDP.....          | 1.2  | 23 ● |

|   |      |       |
|---|------|-------|
| 4.2 Investment.....                                     | 38.4 | 73    |
| 4.2.1 Ease of protecting minority investors*.....       | 55.0 | 75    |
| 4.2.2 Market capitalization, % GDP <sup>Ⓔ</sup> .....   | 12.2 | 74    |
| 4.2.3 Venture capital deals/bn PPP\$ GDP.....           | n/a  | n/a   |
| 4.3 Trade, competition, & market scale.....             | 55.8 | 91    |
| 4.3.1 Applied tariff rate, weighted mean, %.....        | 1.1  | 14 ●  |
| 4.3.2 Intensity of local competition <sup>†</sup> ..... | 57.6 | 110 ○ |
| 4.3.3 Domestic market scale, bn PPP\$.....              | 42.5 | 96    |

## 5 Business sophistication.....27.4 90

|   |      |       |
|---|------|-------|
| 5.1 Knowledge workers.....  | 37.7 | 61    |
| 5.1.1 Knowledge-intensive employment, %.....                        | 24.0 | 60    |
| 5.1.2 Firms offering formal training, % firms.....                  | 52.4 | 18 ●  |
| 5.1.3 GERD performed by business, % of GDP.....                     | 0.1  | 66    |
| 5.1.4 GERD financed by business, %.....                             | 31.4 | 48    |
| 5.1.5 Females employed w/advanced degrees, % total.....             | 3.2  | 81 ○  |
| 5.2 Innovation linkages.....  | 23.9 | 80    |
| 5.2.1 University/industry research collaboration <sup>†</sup> ..... | 29.6 | 105   |
| 5.2.2 State of cluster development <sup>†</sup> .....               | 35.8 | 99    |
| 5.2.3 GERD financed by abroad, %.....                               | 16.9 | 29 ●  |
| 5.2.4 JV-strategic alliance deals/bn PPP\$ GDP.....                 | 0.0  | 56    |
| 5.2.5 Patent families 2+ offices/bn PPP\$ GDP.....                  | 0.2  | 56    |
| 5.3 Knowledge absorption.....                                       | 20.6 | 120 ○ |
| 5.3.1 Intellectual property payments, % total trade.....            | 0.1  | 90    |
| 5.3.2 High-tech imports less re-imports, % total trade.....         | 6.5  | 84    |
| 5.3.3 ICT services imports, % total trade.....                      | 0.8  | 79    |
| 5.3.4 FDI net inflows, % GDP.....                                   | 2.1  | 80    |
| 5.3.5 Research talent, % in business enterprise.....                | 6.5  | 71    |

## 6 Knowledge & technology outputs.....17.2 92

|   |      |       |
|---|------|-------|
| 6.1 Knowledge creation.....                                       | 5.9  | 84    |
| 6.1.1 Patents by origin/bn PPP\$ GDP <sup>Ⓔ</sup> .....           | 1.0  | 62    |
| 6.1.2 PCT patent applications/bn PPP\$ GDP.....                   | 0.1  | 66    |
| 6.1.3 Utility models by origin/bn PPP\$ GDP.....                  | n/a  | n/a   |
| 6.1.4 Scientific & technical articles/bn PPP\$ GDP.....           | 10.2 | 66    |
| 6.1.5 Citable documents H index.....                              | 3.0  | 110 ○ |
| 6.2 Knowledge impact.....   | 27.2 | 82    |
| 6.2.1 Growth rate of PPP\$ GDP/worker, %.....                     | 1.3  | 46    |
| 6.2.2 New businesses/th pop. 15–64.....                           | 0.8  | 77    |
| 6.2.3 Computer software spending, % GDP.....                      | 0.1  | 89    |
| 6.2.4 ISO 9001 quality certificates/bn PPP\$ GDP.....             | 19.4 | 20 ●  |
| 6.2.5 High- & medium-high-tech manufactures, % <sup>Ⓔ</sup> ..... | 0.1  | 79    |
| 6.3 Knowledge diffusion.....                                      | 18.5 | 94    |
| 6.3.1 Intellectual property receipts, % total trade.....          | 0.2  | 42    |
| 6.3.2 High-tech exports less re-exports, % total trade.....       | 1.4  | 63    |
| 6.3.3 ICT services exports, % total trade.....                    | 1.7  | 60    |
| 6.3.4 FDI net outflows, % GDP.....                                | 0.3  | 79    |

## 7 Creative outputs.....21.4 98

|   |      |       |
|---|------|-------|
| 7.1 Intangible assets.....  | 26.5 | 118 ○ |
| 7.1.1 Trademarks by origin/bn PPP\$ GDP.....                      | 16.9 | 88    |
| 7.1.2 Industrial designs by origin/bn PPP\$ GDP.....              | 0.6  | 75    |
| 7.1.3 ICTs & business model creation <sup>†</sup> .....           | 44.7 | 116 ○ |
| 7.1.4 ICTs & organizational model creation <sup>†</sup> .....     | 38.4 | 110 ○ |
| 7.2 Creative goods & services.....                                | 11.2 | 85    |
| 7.2.1 Cultural & creative services exports, % of total trade..... | 0.0  | 81 ○  |
| 7.2.2 National feature films/mn pop. 15–69.....                   | 4.8  | 40    |
| 7.2.3 Global ent. & media market/th pop. 15–69.....               | n/a  | n/a   |
| 7.2.4 Printing & publishing manufactures, % <sup>Ⓔ</sup> .....    | 1.1  | 63    |
| 7.2.5 Creative goods exports, % total trade.....                  | 0.3  | 65    |
| 7.3 Online creativity.....  | 21.5 | 58    |
| 7.3.1 Generic top-level domains (TLDs)/th pop. 15–69.....         | 2.4  | 73    |
| 7.3.2 Country-code TLDs/th pop. 15–69.....                        | 2.0  | 67    |
| 7.3.3 Wikipedia edits/mn pop. 15–69.....                          | 6.0  | 43    |
| 7.3.4 Video uploads on YouTube/pop. 15–69.....                    | 23.2 | 55    |

NOTES: ● indicates a strength; ○ a weakness; \* an index; † a survey question.

Ⓔ indicates that the country's data are older than the base year; see Appendix II for details, including the year of the data, at <http://globalinnovationindex.org>.

Square brackets indicate that the data minimum coverage (DMC) requirements were not met at the sub-pillar or pillar level; see page 181 of this appendix for details.

**Key indicators**

|                            |                     |
|----------------------------|---------------------|
| Population (millions)..... | 2.3                 |
| GDP (US\$ billions).....   | 10.9                |
| GDP per capita, PPP\$..... | 16,368.2            |
| Income group.....          | Upper-middle income |
| Region.....                | Sub-Saharan Africa  |

|  | Score 0–100<br>or value (hard data) | Rank      |
|--|-------------------------------------|-----------|
| <b>Global Innovation Index (out of 127).....</b> | <b>30.0</b>                         | <b>89</b> |
| Innovation Output Sub-Index.....                 | 16.4                                | 111       |
| Innovation Input Sub-Index.....                  | 43.6                                | 59        |
| Innovation Efficiency Ratio.....                 | 0.4                                 | 121 ○     |
| Global Innovation Index 2016 (out of 128).....   | 29.0                                | 90        |

|   |             |           |
|---|-------------|-----------|
| <b>1 Institutions.....</b>                            | <b>68.6</b> | <b>46</b> |
| 1.1 Political environment.....                        | 72.1        | 36        |
| 1.1.1 Political stability & safety*.....              | 88.8        | 12 ●      |
| 1.1.2 Government effectiveness*.....                  | 55.3        | 43        |
| 1.2 Regulatory environment.....                       | 64.6        | 65        |
| 1.2.1 Regulatory quality*.....                        | 54.5        | 50        |
| 1.2.2 Rule of law*.....                               | 57.9        | 39        |
| 1.2.3 Cost of redundancy dismissal, salary weeks..... | 21.7        | 93        |
| 1.3 Business environment.....                         | 69.1        | 71        |
| 1.3.1 Ease of starting a business*.....               | 76.2        | 113 ○     |
| 1.3.2 Ease of resolving insolvency*.....              | 50.5        | 59        |
| 1.3.3 Ease of paying taxes*.....                      | 80.6        | 46        |

|  |             |           |
|--|-------------|-----------|
| <b>2 Human capital &amp; research.....</b>                             | <b>32.0</b> | <b>65</b> |
| 2.1 Education.....   | 68.3        | 9 ●       |
| 2.1.1 Expenditure on education, % GDP <sup>Ⓐ</sup> .....               | 9.6         | 1 ●       |
| 2.1.2 Gov't expenditure/pupil, secondary, % GDP/cap <sup>Ⓐ</sup> ..... | 42.0        | 3 ●       |
| 2.1.3 School life expectancy, years <sup>Ⓐ</sup> .....                 | 12.1        | 87        |
| 2.1.4 PISA scales in reading, maths, & science.....                    | n/a         | n/a       |
| 2.1.5 Pupil-teacher ratio, secondary <sup>Ⓐ</sup> .....                | 13.8        | 56        |
| 2.2 Tertiary education.....  | 24.1        | 96        |
| 2.2.1 Tertiary enrolment, % gross <sup>Ⓐ</sup> .....                   | 27.5        | 84        |
| 2.2.2 Graduates in science & engineering, %.....                       | 17.5        | 70        |
| 2.2.3 Tertiary inbound mobility, % <sup>Ⓐ</sup> .....                  | 1.6         | 76        |
| 2.3 Research & development (R&D).....                                  | 3.6         | 82        |
| 2.3.1 Researchers, FTE/mn pop. <sup>Ⓐ</sup> .....                      | 175.5       | 78        |
| 2.3.2 Gross expenditure on R&D, % GDP <sup>Ⓐ</sup> .....               | 0.5         | 60        |
| 2.3.3 Global R&D companies, avg. expend. top 3, mn \$US.....           | 0.0         | 43 ○      |
| 2.3.4 QS university ranking, average score top 3*.....                 | 0.0         | 75 ○      |

|  |             |           |
|--|-------------|-----------|
| <b>3 Infrastructure.....</b>                                 | <b>41.0</b> | <b>83</b> |
| 3.1 Information & communication technologies (ICTs).....     | 33.2        | 103       |
| 3.1.1 ICT access*.....                                       | 43.3        | 96        |
| 3.1.2 ICT use*.....  | 32.6        | 81        |
| 3.1.3 Government's online service*.....                      | 28.3        | 109       |
| 3.1.4 E-participation*.....                                  | 28.8        | 107       |
| 3.2 General infrastructure.....                              | 42.8        | 45        |
| 3.2.1 Electricity output, kWh/cap.....                       | 1,064.4     | 91        |
| 3.2.2 Logistics performance*.....                            | 45.4        | 56        |
| 3.2.3 Gross capital formation, % GDP.....                    | 30.4        | 17 ●      |
| 3.3 Ecological sustainability.....                           | 46.8        | 57        |
| 3.3.1 GDP/unit of energy use.....                            | 12.3        | 25 ●      |
| 3.3.2 Environmental performance*.....                        | 70.7        | 72        |
| 3.3.3 ISO 14001 environmental certificates/bn PPP\$ GDP..... | 0.3         | 103       |

|   |             |           |
|---|-------------|-----------|
| <b>4 Market sophistication.....</b>                 | <b>49.3</b> | <b>52</b> |
| 4.1 Credit.....                                     | 33.8        | 68        |
| 4.1.1 Ease of getting credit*.....                  | 55.0        | 67        |
| 4.1.2 Domestic credit to private sector, % GDP..... | 33.9        | 95        |
| 4.1.3 Microfinance gross loans, % GDP.....          | n/a         | n/a       |

|   |      |      |
|---|------|------|
| 4.2 Investment.....                                     | 55.0 | [23] |
| 4.2.1 Ease of protecting minority investors*.....       | 55.0 | 75   |
| 4.2.2 Market capitalization, % GDP.....                 | n/a  | n/a  |
| 4.2.3 Venture capital deals/bn PPP\$ GDP.....           | n/a  | n/a  |
| 4.3 Trade, competition, & market scale.....             | 59.0 | 75   |
| 4.3.1 Applied tariff rate, weighted mean, %.....        | 0.5  | 6 ●  |
| 4.3.2 Intensity of local competition <sup>†</sup> ..... | 71.2 | 49   |
| 4.3.3 Domestic market scale, bn PPP\$.....              | 36.5 | 103  |

**5 Business sophistication.....** 27.1 91

|  |      |       |
|--|------|-------|
| 5.1 Knowledge workers.....   | 34.4 | 76    |
| 5.1.1 Knowledge-intensive employment, % <sup>Ⓐ</sup> .....             | 17.8 | 80    |
| 5.1.2 Firms offering formal training, % firms <sup>Ⓐ</sup> .....       | 51.9 | 19 ●  |
| 5.1.3 GERD performed by business, % of GDP <sup>Ⓐ</sup> .....          | 0.1  | 62    |
| 5.1.4 GERD financed by business, % <sup>Ⓐ</sup> .....                  | 17.7 | 65    |
| 5.1.5 Females employed w/advanced degrees, % total <sup>Ⓐ</sup> .....  | 9.1  | 67    |
| 5.2 Innovation linkages.....   | 31.2 | 54    |
| 5.2.1 University/industry research collaboration <sup>†</sup> .....    | 40.2 | 69    |
| 5.2.2 State of cluster development <sup>†</sup> .....                  | 40.6 | 84    |
| 5.2.3 GERD financed by abroad, % <sup>Ⓐ</sup> .....                    | 21.7 | 18 ●  |
| 5.2.4 JV-strategic alliance deals/bn PPP\$ GDP.....                    | 0.1  | 20 ●  |
| 5.2.5 Patent families 2+ offices/bn PPP\$ GDP <sup>Ⓐ</sup> .....       | 0.1  | 72    |
| 5.3 Knowledge absorption.....  | 15.7 | 126 ○ |
| 5.3.1 Intellectual property payments, % total trade <sup>Ⓐ</sup> ..... | 0.1  | 99    |
| 5.3.2 High-tech imports less re-imports, % total trade.....            | 3.7  | 117 ○ |
| 5.3.3 ICT services imports, % total trade <sup>Ⓐ</sup> .....           | 0.5  | 98    |
| 5.3.4 FDI net inflows, % GDP.....                                      | 2.9  | 60    |
| 5.3.5 Research talent, % in business enterprise <sup>Ⓐ</sup> .....     | 1.0  | 77 ○  |

**6 Knowledge & technology outputs.....** 15.6 102

|  |      |       |
|--|------|-------|
| 6.1 Knowledge creation.....  | 2.8  | 115 ○ |
| 6.1.1 Patents by origin/bn PPP\$ GDP <sup>Ⓐ</sup> .....                | 0.1  | 105   |
| 6.1.2 PCT patent applications/bn PPP\$ GDP.....                        | 0.0  | 91    |
| 6.1.3 Utility models by origin/bn PPP\$ GDP <sup>Ⓐ</sup> .....         | 0.0  | 61 ○  |
| 6.1.4 Scientific & technical articles/bn PPP\$ GDP.....                | 8.2  | 73    |
| 6.1.5 Citable documents H index.....                                   | 4.7  | 97    |
| 6.2 Knowledge impact.....  | 29.0 | 73    |
| 6.2.1 Growth rate of PPP\$ GDP/worker, %.....                          | n/a  | n/a   |
| 6.2.2 New businesses/th pop. 15–64.....                                | 13.1 | 8 ●   |
| 6.2.3 Computer software spending, % GDP.....                           | 0.1  | 85    |
| 6.2.4 ISO 9001 quality certificates/bn PPP\$ GDP.....                  | 0.4  | 119 ○ |
| 6.2.5 High- & medium-high-tech manufactures, %.....                    | n/a  | n/a   |
| 6.3 Knowledge diffusion.....   | 15.0 | 111   |
| 6.3.1 Intellectual property receipts, % total trade <sup>Ⓐ</sup> ..... | 0.0  | 99 ○  |
| 6.3.2 High-tech exports less re-exports, % total trade.....            | 0.5  | 82    |
| 6.3.3 ICT services exports, % total trade <sup>Ⓐ</sup> .....           | 0.3  | 111 ○ |
| 6.3.4 FDI net outflows, % GDP.....                                     | 0.6  | 65    |

**7 Creative outputs.....** 17.1 114 ○

|  |      |       |
|--|------|-------|
| 7.1 Intangible assets.....   | 28.4 | 110   |
| 7.1.1 Trademarks by origin/bn PPP\$ GDP <sup>Ⓐ</sup> .....         | 10.4 | 102 ○ |
| 7.1.2 Industrial designs by origin/bn PPP\$ GDP <sup>Ⓐ</sup> ..... | 0.3  | 89    |
| 7.1.3 ICTs & business model creation <sup>†</sup> .....            | 52.5 | 92    |
| 7.1.4 ICTs & organizational model creation <sup>†</sup> .....      | 41.3 | 106   |
| 7.2 Creative goods & services.....                                 | 6.1  | [102] |
| 7.2.1 Cultural & creative services exports, % of total trade.....  | n/a  | n/a   |
| 7.2.2 National feature films/mn pop. 15–69.....                    | n/a  | n/a   |
| 7.2.3 Global ent. & media market/th pop. 15–69.....                | n/a  | n/a   |
| 7.2.4 Printing & publishing manufactures, %.....                   | n/a  | n/a   |
| 7.2.5 Creative goods exports, % total trade.....                   | 0.2  | 76    |
| 7.3 Online creativity.....   | 5.5  | 109   |
| 7.3.1 Generic top-level domains (TLDs)/th pop. 15–69.....          | 1.0  | 94    |
| 7.3.2 Country-code TLDs/th pop. 15–69.....                         | 1.4  | 73    |
| 7.3.3 Wikipedia edits/mn pop. 15–69 <sup>Ⓐ</sup> .....             | 1.5  | 111   |
| 7.3.4 Video uploads on YouTube/pop. 15–69.....                     | n/a  | n/a   |

**NOTES:** ● indicates a strength; ○ a weakness; \* an index; † a survey question.

Ⓐ indicates that the country's data are older than the base year; see Appendix II for details, including the year of the data, at <http://globalinnovationindex.org>.

Square brackets indicate that the data minimum coverage (DMC) requirements were not met at the sub-pillar or pillar level; see page 181 of this appendix for details.

## Brazil

## Key indicators

|                            |                                 |
|----------------------------|---------------------------------|
| Population (millions)..... | 209.6                           |
| GDP (US\$ billions).....   | 1,769.6                         |
| GDP per capita, PPP\$..... | 15,614.5                        |
| Income group.....          | Upper-middle income             |
| Region.....                | Latin America and the Caribbean |

|  | Score 0–100<br>or value (hard data) | Rank      |
|--|-------------------------------------|-----------|
| <b>Global Innovation Index (out of 127).....</b> | <b>33.1</b>                         | <b>69</b> |
| Innovation Output Sub-Index.....                 | 22.7                                | 80        |
| Innovation Input Sub-Index.....                  | 43.5                                | 60        |
| Innovation Efficiency Ratio.....                 | 0.5                                 | 99        |
| Global Innovation Index 2016 (out of 128).....   | 33.2                                | 69        |

|   |             |           |
|---|-------------|-----------|
| <b>1 Institutions.....</b>                            | <b>51.8</b> | <b>91</b> |
| 1.1 Political environment.....                        | 46.0        | 80        |
| 1.1.1 Political stability & safety*.....              | 54.6        | 80        |
| 1.1.2 Government effectiveness*.....                  | 37.3        | 81        |
| 1.2 Regulatory environment.....                       | 60.2        | 72        |
| 1.2.1 Regulatory quality*.....                        | 36.7        | 83        |
| 1.2.2 Rule of law*.....                               | 33.8        | 71        |
| 1.2.3 Cost of redundancy dismissal, salary weeks..... | 15.4        | 62        |
| 1.3 Business environment.....                         | 49.1        | 123 ○     |
| 1.3.1 Ease of starting a business*.....               | 65.0        | 123 ○     |
| 1.3.2 Ease of resolving insolvency*.....              | 49.2        | 62        |
| 1.3.3 Ease of paying taxes*.....                      | 33.0        | 124 ○     |

|  |             |           |
|--|-------------|-----------|
| <b>2 Human capital &amp; research.....</b>                     | <b>35.9</b> | <b>50</b> |
| 2.1 Education.....   | 49.3        | 56        |
| 2.1.1 Expenditure on education, % GDP.....                     | 6.0         | 21 ●      |
| 2.1.2 Gov't expenditure/pupil, secondary, % GDP/cap.....       | 21.6        | 48        |
| 2.1.3 School life expectancy, years.....                       | 15.3        | 41        |
| 2.1.4 PISA scales in reading, maths, & science.....            | 395.0       | 64 ○      |
| 2.1.5 Pupil-teacher ratio, secondary <sup>Ⓐ</sup> .....        | 16.7        | 73        |
| 2.2 Tertiary education.....                                    | 21.1        | 101 ○     |
| 2.2.1 Tertiary enrolment, % gross <sup>Ⓐ</sup> .....           | 49.3        | 53        |
| 2.2.2 Graduates in science & engineering, % <sup>Ⓐ</sup> ..... | 12.0        | 96 ○      |
| 2.2.3 Tertiary inbound mobility, % <sup>Ⓐ</sup> .....          | 0.2         | 100 ○     |
| 2.3 Research & development (R&D).....                          | 37.2        | 29 ●      |
| 2.3.1 Researchers, FTE/mn pop. <sup>Ⓐ</sup> .....              | 698.1       | 55        |
| 2.3.2 Gross expenditure on R&D, % GDP <sup>Ⓐ</sup> .....       | 1.2         | 32 ●      |
| 2.3.3 Global R&D companies, avg. expend. top 3, mn \$US.....   | 66.1        | 21 ●      |
| 2.3.4 QS university ranking, average score top 3*.....         | 47.4        | 24 ●      |

|  |             |           |
|--|-------------|-----------|
| <b>3 Infrastructure.....</b>                                 | <b>48.3</b> | <b>57</b> |
| 3.1 Information & communication technologies (ICTs).....     | 66.6        | 41        |
| 3.1.1 ICT access*.....                                       | 64.2        | 66        |
| 3.1.2 ICT use*.....  | 56.0        | 47        |
| 3.1.3 Government's online service*.....                      | 73.2        | 37 ●      |
| 3.1.4 E-participation*.....                                  | 72.9        | 37 ●      |
| 3.2 General infrastructure.....                              | 30.9        | 91        |
| 3.2.1 Electricity output, kWh/cap.....                       | 2,866.0     | 63        |
| 3.2.2 Logistics performance*.....                            | 47.4        | 54        |
| 3.2.3 Gross capital formation, % GDP.....                    | 18.0        | 98 ○      |
| 3.3 Ecological sustainability.....                           | 47.5        | 52        |
| 3.3.1 GDP/unit of energy use.....                            | 10.1        | 47        |
| 3.3.2 Environmental performance*.....                        | 78.9        | 45        |
| 3.3.3 ISO 14001 environmental certificates/bn PPP\$ GDP..... | 1.0         | 65        |

|   |             |           |
|---|-------------|-----------|
| <b>4 Market sophistication.....</b>                 | <b>44.2</b> | <b>74</b> |
| 4.1 Credit.....                                     | 24.1        | 102 ○     |
| 4.1.1 Ease of getting credit*.....                  | 45.0        | 84        |
| 4.1.2 Domestic credit to private sector, % GDP..... | 67.9        | 44        |
| 4.1.3 Microfinance gross loans, % GDP.....          | 0.0         | 62        |

|   |         |       |
|---|---------|-------|
| 4.2 Investment.....                                     | 37.3    | 78    |
| 4.2.1 Ease of protecting minority investors*.....       | 65.0    | 31    |
| 4.2.2 Market capitalization, % GDP.....                 | 27.6    | 51    |
| 4.2.3 Venture capital deals/bn PPP\$ GDP.....           | 0.0     | 48    |
| 4.3 Trade, competition, & market scale.....             | 71.1    | 32 ●  |
| 4.3.1 Applied tariff rate, weighted mean, %.....        | 8.3     | 108 ○ |
| 4.3.2 Intensity of local competition <sup>†</sup> ..... | 71.0    | 51    |
| 4.3.3 Domestic market scale, bn PPP\$.....              | 3,134.9 | 7 ●   |

|   |             |           |
|---|-------------|-----------|
| <b>5 Business sophistication.....</b>                                 | <b>37.2</b> | <b>43</b> |
| 5.1 Knowledge workers.....  | 41.7        | 52        |
| 5.1.1 Knowledge-intensive employment, % <sup>Ⓐ</sup> .....            | 21.6        | 67        |
| 5.1.2 Firms offering formal training, % firms <sup>Ⓐ</sup> .....      | 42.2        | 29        |
| 5.1.3 GERD performed by business, % of GDP.....                       | n/a         | n/a       |
| 5.1.4 GERD financed by business, % <sup>Ⓐ</sup> .....                 | 36.4        | 42        |
| 5.1.5 Females employed w/advanced degrees, % total <sup>Ⓐ</sup> ..... | 9.1         | 66        |
| 5.2 Innovation linkages.....  | 28.0        | 63        |
| 5.2.1 University/industry research collaboration <sup>†</sup> .....   | 37.4        | 84        |
| 5.2.2 State of cluster development <sup>†</sup> .....                 | 49.3        | 43        |
| 5.2.3 GERD financed by abroad, %.....                                 | n/a         | n/a       |
| 5.2.4 JV-strategic alliance deals/bn PPP\$ GDP.....                   | 0.0         | 90 ○      |
| 5.2.5 Patent families 2+ offices/bn PPP\$ GDP.....                    | 0.1         | 61        |
| 5.3 Knowledge absorption.....   | 41.9        | 29 ●      |
| 5.3.1 Intellectual property payments, % total trade.....              | 2.3         | 8 ●       |
| 5.3.2 High-tech imports less re-imports, % total trade.....           | 12.4        | 22 ●      |
| 5.3.3 ICT services imports, % total trade.....                        | 1.4         | 45        |
| 5.3.4 FDI net inflows, % GDP.....                                     | 3.7         | 41        |
| 5.3.5 Research talent, % in business enterprise <sup>Ⓐ</sup> .....    | 25.9        | 49        |

|   |             |           |
|---|-------------|-----------|
| <b>6 Knowledge &amp; technology outputs.....</b>                  | <b>18.9</b> | <b>85</b> |
| 6.1 Knowledge creation.....                                       | 16.7        | 50        |
| 6.1.1 Patents by origin/bn PPP\$ GDP.....                         | 1.5         | 56        |
| 6.1.2 PCT patent applications/bn PPP\$ GDP.....                   | 0.2         | 52        |
| 6.1.3 Utility models by origin/bn PPP\$ GDP.....                  | 0.8         | 29        |
| 6.1.4 Scientific & technical articles/bn PPP\$ GDP.....           | 13.5        | 55        |
| 6.1.5 Citable documents H index.....                              | 35.8        | 23 ●      |
| 6.2 Knowledge impact.....   | 18.8        | 106 ○     |
| 6.2.1 Growth rate of PPP\$ GDP/worker, %.....                     | (4.1)       | 109 ○     |
| 6.2.2 New businesses/th pop. 15–64.....                           | 2.9         | 39        |
| 6.2.3 Computer software spending, % GDP.....                      | 0.2         | 72        |
| 6.2.4 ISO 9001 quality certificates/bn PPP\$ GDP.....             | 5.5         | 60        |
| 6.2.5 High- & medium-high-tech manufactures, % <sup>Ⓐ</sup> ..... | 0.4         | 21 ●      |
| 6.3 Knowledge diffusion.....                                      | 21.1        | 67        |
| 6.3.1 Intellectual property receipts, % total trade.....          | 0.3         | 34        |
| 6.3.2 High-tech exports less re-exports, % total trade.....       | 4.1         | 38        |
| 6.3.3 ICT services exports, % total trade.....                    | 0.7         | 92        |
| 6.3.4 FDI net outflows, % GDP.....                                | 0.8         | 57        |

|   |             |           |
|---|-------------|-----------|
| <b>7 Creative outputs.....</b>                                    | <b>26.6</b> | <b>83</b> |
| 7.1 Intangible assets.....  | 38.0        | 81        |
| 7.1.1 Trademarks by origin/bn PPP\$ GDP.....                      | 40.9        | 57        |
| 7.1.2 Industrial designs by origin/bn PPP\$ GDP.....              | 1.0         | 61        |
| 7.1.3 ICTs & business model creation <sup>†</sup> .....           | 58.2        | 71        |
| 7.1.4 ICTs & organizational model creation <sup>†</sup> .....     | 51.3        | 69        |
| 7.2 Creative goods & services.....                                | 7.0         | 99        |
| 7.2.1 Cultural & creative services exports, % of total trade..... | 0.1         | 56        |
| 7.2.2 National feature films/mn pop. 15–69.....                   | 0.9         | 82 ○      |
| 7.2.3 Global ent. & media market/th pop. 15–69.....               | 7.9         | 40        |
| 7.2.4 Printing & publishing manufactures, % <sup>Ⓐ</sup> .....    | 0.8         | 77        |
| 7.2.5 Creative goods exports, % total trade.....                  | 0.2         | 72        |
| 7.3 Online creativity.....  | 23.4        | 55        |
| 7.3.1 Generic top-level domains (TLDs)/th pop. 15–69.....         | 1.6         | 86        |
| 7.3.2 Country-code TLDs/th pop. 15–69.....                        | 7.7         | 43        |
| 7.3.3 Wikipedia edits/mn pop. 15–69.....                          | 4.6         | 67        |
| 7.3.4 Video uploads on YouTube/pop. 15–69.....                    | 39.7        | 29        |

NOTES: ● indicates a strength; ○ a weakness; \* an index; † a survey question.

<sup>Ⓐ</sup> indicates that the country's data are older than the base year; see Appendix II for details, including the year of the data, at <http://globalinnovationindex.org>.

Square brackets indicate that the data minimum coverage (DMC) requirements were not met at the sub-pillar or pillar level; see page 181 of this appendix for details.

## Key indicators

|                            |   |
|----------------------------|---|
| Population (millions)..... | 0.4                                     |
| GDP (US\$ billions).....   | 10.5                                    |
| GDP per capita, PPP\$..... | 79,587.0                                |
| Income group.....          | High income                             |
| Region.....                | South East Asia, East Asia, and Oceania |

|  | Score 0–100<br>or value (hard data) | Rank      |
|--|-------------------------------------|-----------|
| <b>Global Innovation Index (out of 127).....</b> | <b>32.9</b>                         | <b>71</b> |
| Innovation Output Sub-Index.....                 | 16.5                                | 110 ○     |
| Innovation Input Sub-Index.....                  | 49.3                                | 40        |
| Innovation Efficiency Ratio.....                 | 0.3                                 | 124 ○     |
| Global Innovation Index 2016 (out of 128).....   | n/a                                 | n/a       |

## 1 Institutions.....77.2 31

|   |      |      |
|---|------|------|
| 1.1 Political environment.....                        | 81.2 | 20 ● |
| 1.1.1 Political stability & safety*.....              | 93.1 | 7 ●  |
| 1.1.2 Government effectiveness*.....                  | 69.2 | 30 ● |
| 1.2 Regulatory environment.....                       | 79.0 | 27 ● |
| 1.2.1 Regulatory quality*.....                        | 63.7 | 36   |
| 1.2.2 Rule of law*.....                               | 52.4 | 46   |
| 1.2.3 Cost of redundancy dismissal, salary weeks..... | 8.0  | 1 ●  |
| 1.3 Business environment.....                         | 71.4 | 62   |
| 1.3.1 Ease of starting a business*.....               | 86.7 | 68   |
| 1.3.2 Ease of resolving insolvency*.....              | 55.1 | 54   |
| 1.3.3 Ease of paying taxes*.....                      | 72.4 | 68   |

## 2 Human capital & research.....31.1 69

|  |      |       |
|--|------|-------|
| 2.1 Education.....   | 46.3 | 68    |
| 2.1.1 Expenditure on education, % GDP.....                   | 3.7  | 88    |
| 2.1.2 Gov't expenditure/pupil, secondary, % GDP/cap.....     | 20.1 | 52    |
| 2.1.3 School life expectancy, years.....                     | 14.7 | 56    |
| 2.1.4 PISA scales in reading, maths, & science.....          | n/a  | n/a   |
| 2.1.5 Pupil-teacher ratio, secondary.....                    | 8.8  | 15 ●  |
| 2.2 Tertiary education.....                                  | 47.0 | 27 ●  |
| 2.2.1 Tertiary enrolment, % gross.....                       | 30.8 | 78    |
| 2.2.2 Graduates in science & engineering, %.....             | 34.0 | 6 ●   |
| 2.2.3 Tertiary inbound mobility, %.....                      | 4.9  | 37    |
| 2.3 Research & development (R&D).....                        | 0.0  | 115 ○ |
| 2.3.1 Researchers, FTE/mn pop.....                           | n/a  | n/a   |
| 2.3.2 Gross expenditure on R&D, % GDP.....                   | n/a  | n/a   |
| 2.3.3 Global R&D companies, avg. expend. top 3, mn \$US..... | 0.0  | 43 ○  |
| 2.3.4 QS university ranking, average score top 3*.....       | 0.0  | 75 ○  |

## 3 Infrastructure.....49.4 55

|  |          |      |
|--|----------|------|
| 3.1 Information & communication technologies (ICTs).....     | 47.5     | 85   |
| 3.1.1 ICT access*.....                                       | 72.1     | 47   |
| 3.1.2 ICT use*.....  | 29.7     | 85   |
| 3.1.3 Government's online service*.....                      | 50.7     | 83   |
| 3.1.4 E-participation*.....                                  | 37.3     | 101  |
| 3.2 General infrastructure.....                              | 61.3     | 6 ●  |
| 3.2.1 Electricity output, kWh/cap.....                       | 10,728.6 | 12 ● |
| 3.2.2 Logistics performance*.....                            | 37.3     | 69   |
| 3.2.3 Gross capital formation, % GDP.....                    | 40.9     | 5 ●  |
| 3.3 Ecological sustainability.....                           | 39.4     | 84   |
| 3.3.1 GDP/unit of energy use.....                            | 7.8      | 73   |
| 3.3.2 Environmental performance*.....                        | 67.9     | 86   |
| 3.3.3 ISO 14001 environmental certificates/bn PPP\$ GDP..... | 0.9      | 66   |

## 4 Market sophistication.....48.5 54

|   |      |     |
|---|------|-----|
| 4.1 Credit.....                                     | 37.9 | 55  |
| 4.1.1 Ease of getting credit*.....                  | 60.0 | 55  |
| 4.1.2 Domestic credit to private sector, % GDP..... | 41.4 | 81  |
| 4.1.3 Microfinance gross loans, % GDP.....          | n/a  | n/a |

|  |      |      |
|--|------|------|
| 4.2 Investment.....  | 51.7 | [28] |
| 4.2.1 Ease of protecting minority investors*.....              | 51.7 | 86   |
| 4.2.2 Market capitalization, % GDP.....                        | n/a  | n/a  |
| 4.2.3 Venture capital deals/bn PPP\$ GDP.....                  | n/a  | n/a  |
| 4.3 Trade, competition, & market scale.....                    | 55.9 | 90   |
| 4.3.1 Applied tariff rate, weighted mean, % <sup>Ⓔ</sup> ..... | 0.5  | 5 ●  |
| 4.3.2 Intensity of local competition <sup>†</sup> .....        | 60.0 | 102  |
| 4.3.3 Domestic market scale, bn PPP\$.....                     | 33.7 | 106  |

## 5 Business sophistication.....40.2 34

|  |      |       |
|--|------|-------|
| 5.1 Knowledge workers.....   | 71.0 | [7]   |
| 5.1.1 Knowledge-intensive employment, % <sup>Ⓔ</sup> .....             | 40.5 | 25 ●  |
| 5.1.2 Firms offering formal training, % firms.....                     | n/a  | n/a   |
| 5.1.3 GERD performed by business, % of GDP.....                        | n/a  | n/a   |
| 5.1.4 GERD financed by business, %.....                                | n/a  | n/a   |
| 5.1.5 Females employed w/advanced degrees, % total.....                | n/a  | n/a   |
| 5.2 Innovation linkages.....   | 28.0 | 64    |
| 5.2.1 University/industry research collaboration <sup>†</sup> .....    | 38.4 | 79    |
| 5.2.2 State of cluster development <sup>†</sup> .....                  | 48.9 | 47    |
| 5.2.3 GERD financed by abroad, %.....                                  | n/a  | n/a   |
| 5.2.4 JV-strategic alliance deals/bn PPP\$ GDP.....                    | 0.0  | 93 ○  |
| 5.2.5 Patent families 2+ offices/bn PPP\$ GDP.....                     | 0.1  | 63    |
| 5.3 Knowledge absorption.....  | 21.7 | 115 ○ |
| 5.3.1 Intellectual property payments, % total trade <sup>Ⓔ</sup> ..... | 0.1  | 91    |
| 5.3.2 High-tech imports less re-imports, % total trade.....            | 6.0  | 96    |
| 5.3.3 ICT services imports, % total trade <sup>Ⓔ</sup> .....           | 0.3  | 113 ○ |
| 5.3.4 FDI net inflows, % GDP.....                                      | 3.0  | 56    |
| 5.3.5 Research talent, % in business enterprise.....                   | n/a  | n/a   |

## 6 Knowledge & technology outputs.....13.6 114 ○

|   |      |       |
|---|------|-------|
| 6.1 Knowledge creation.....                                       | 4.1  | 98    |
| 6.1.1 Patents by origin/bn PPP\$ GDP <sup>Ⓔ</sup> .....           | 0.8  | 68    |
| 6.1.2 PCT patent applications/bn PPP\$ GDP.....                   | 0.1  | 56    |
| 6.1.3 Utility models by origin/bn PPP\$ GDP.....                  | n/a  | n/a   |
| 6.1.4 Scientific & technical articles/bn PPP\$ GDP.....           | 6.1  | 88    |
| 6.1.5 Citable documents H index.....                              | 2.1  | 116 ○ |
| 6.2 Knowledge impact.....   | 2.9  | [125] |
| 6.2.1 Growth rate of PPP\$ GDP/worker, %.....                     | n/a  | n/a   |
| 6.2.2 New businesses/th pop. 15–64.....                           | n/a  | n/a   |
| 6.2.3 Computer software spending, % GDP.....                      | n/a  | n/a   |
| 6.2.4 ISO 9001 quality certificates/bn PPP\$ GDP.....             | 3.1  | 79    |
| 6.2.5 High- & medium-high-tech manufactures, % <sup>Ⓔ</sup> ..... | 0.0  | 99 ○  |
| 6.3 Knowledge diffusion.....                                      | 33.9 | 31    |
| 6.3.1 Intellectual property receipts, % total trade.....          | n/a  | n/a   |
| 6.3.2 High-tech exports less re-exports, % total trade.....       | 1.4  | 62    |
| 6.3.3 ICT services exports, % total trade <sup>Ⓔ</sup> .....      | 0.4  | 107 ○ |
| 6.3.4 FDI net outflows, % GDP.....                                | 3.6  | 15 ●  |

## 7 Creative outputs.....19.4 105

|  |      |       |
|--|------|-------|
| 7.1 Intangible assets.....   | 28.7 | 108 ○ |
| 7.1.1 Trademarks by origin/bn PPP\$ GDP <sup>Ⓔ</sup> .....         | 2.5  | 115 ○ |
| 7.1.2 Industrial designs by origin/bn PPP\$ GDP <sup>Ⓔ</sup> ..... | 0.1  | 104 ○ |
| 7.1.3 ICTs & business model creation <sup>†</sup> .....            | 51.9 | 93    |
| 7.1.4 ICTs & organizational model creation <sup>†</sup> .....      | 47.7 | 81    |
| 7.2 Creative goods & services.....                                 | 4.5  | [110] |
| 7.2.1 Cultural & creative services exports, % of total trade.....  | n/a  | n/a   |
| 7.2.2 National feature films/mn pop. 15–69.....                    | n/a  | n/a   |
| 7.2.3 Global ent. & media market/th pop. 15–69.....                | n/a  | n/a   |
| 7.2.4 Printing & publishing manufactures, % <sup>Ⓔ</sup> .....     | 0.5  | 91 ○  |
| 7.2.5 Creative goods exports, % total trade.....                   | 0.1  | 85    |
| 7.3 Online creativity.....   | 15.6 | 78    |
| 7.3.1 Generic top-level domains (TLDs)/th pop. 15–69.....          | 7.0  | 47    |
| 7.3.2 Country-code TLDs/th pop. 15–69.....                         | 0.9  | 82    |
| 7.3.3 Wikipedia edits/mn pop. 15–69 <sup>Ⓔ</sup> .....             | 4.0  | 81    |
| 7.3.4 Video uploads on YouTube/pop. 15–69.....                     | n/a  | n/a   |

NOTES: ● indicates a strength; ○ a weakness; \* an index; † a survey question.

Ⓔ indicates that the country's data are older than the base year; see Appendix II for details, including the year of the data, at <http://globalinnovationindex.org>.

Square brackets indicate that the data minimum coverage (DMC) requirements were not met at the sub-pillar or pillar level; see page 181 of this appendix for details.



## Bulgaria

## Key indicators

|                            |                     |
|----------------------------|---------------------|
| Population (millions)..... | 7.1                 |
| GDP (US\$ billions).....   | 50.4                |
| GDP per capita, PPP\$..... | 19,097.3            |
| Income group.....          | Upper-middle income |
| Region.....                | Europe              |

|  | Score 0–100<br>or value (hard data) | Rank      |
|--|-------------------------------------|-----------|
| <b>Global Innovation Index (out of 127).....</b> | <b>42.8</b>                         | <b>36</b> |
| Innovation Output Sub-Index.....                 | 38.1                                | 32        |
| Innovation Input Sub-Index.....                  | 47.6                                | 45        |
| Innovation Efficiency Ratio.....                 | 0.8                                 | 15 ●      |
| Global Innovation Index 2016 (out of 128).....   | 41.4                                | 38        |

|   |             |           |
|---|-------------|-----------|
| <b>1 Institutions.....</b>                            | <b>67.1</b> | <b>52</b> |
| 1.1 Political environment.....                        | 56.0        | 55        |
| 1.1.1 Political stability & safety*.....              | 64.2        | 58        |
| 1.1.2 Government effectiveness*.....                  | 47.7        | 58        |
| 1.2 Regulatory environment.....                       | 72.4        | 40        |
| 1.2.1 Regulatory quality*.....                        | 56.3        | 47        |
| 1.2.2 Rule of law*.....                               | 35.8        | 67        |
| 1.2.3 Cost of redundancy dismissal, salary weeks..... | 8.6         | 20 ●      |
| 1.3 Business environment.....                         | 73.0        | 59        |
| 1.3.1 Ease of starting a business*.....               | 86.8        | 67        |
| 1.3.2 Ease of resolving insolvency*.....              | 59.4        | 45        |
| 1.3.3 Ease of paying taxes*.....                      | 72.8        | 65        |

|  |             |           |
|--|-------------|-----------|
| <b>2 Human capital &amp; research.....</b>                   | <b>33.7</b> | <b>56</b> |
| 2.1 Education.....   | 47.1        | 63        |
| 2.1.1 Expenditure on education, % GDP.....                   | 4.1         | 80 ○      |
| 2.1.2 Gov't expenditure/pupil, secondary, % GDP/cap.....     | 22.2        | 44        |
| 2.1.3 School life expectancy, years.....                     | 14.9        | 51        |
| 2.1.4 PISA scales in reading, maths, & science.....          | 439.6       | 45 ○      |
| 2.1.5 Pupil-teacher ratio, secondary <sup>Ⓔ</sup> .....      | 13.2        | 52        |
| 2.2 Tertiary education.....                                  | 40.7        | 45        |
| 2.2.1 Tertiary enrolment, % gross.....                       | 73.9        | 21 ●      |
| 2.2.2 Graduates in science & engineering, %.....             | 20.1        | 56        |
| 2.2.3 Tertiary inbound mobility, %.....                      | 4.2         | 44        |
| 2.3 Research & development (R&D).....                        | 13.2        | 52        |
| 2.3.1 Researchers, FTE/mn pop.....                           | 1,989.4     | 39        |
| 2.3.2 Gross expenditure on R&D, % GDP.....                   | 1.0         | 38        |
| 2.3.3 Global R&D companies, avg. expend. top 3, mn \$US..... | 0.0         | 43 ○      |
| 2.3.4 QS university ranking, average score top 3*.....       | 6.2         | 66        |

|  |             |           |
|--|-------------|-----------|
| <b>3 Infrastructure.....</b>                                 | <b>51.9</b> | <b>48</b> |
| 3.1 Information & communication technologies (ICTs).....     | 63.3        | 50        |
| 3.1.1 ICT access*.....                                       | 68.6        | 53        |
| 3.1.2 ICT use*.....  | 58.4        | 42        |
| 3.1.3 Government's online service*.....                      | 56.5        | 74        |
| 3.1.4 E-participation*.....                                  | 69.5        | 43        |
| 3.2 General infrastructure.....                              | 35.4        | 72        |
| 3.2.1 Electricity output, kWh/cap.....                       | 6,499.6     | 30        |
| 3.2.2 Logistics performance*.....                            | 34.4        | 72        |
| 3.2.3 Gross capital formation, % GDP.....                    | 22.0        | 65        |
| 3.3 Ecological sustainability.....                           | 57.1        | 24        |
| 3.3.1 GDP/unit of energy use.....                            | 6.5         | 87 ○      |
| 3.3.2 Environmental performance*.....                        | 83.4        | 33        |
| 3.3.3 ISO 14001 environmental certificates/bn PPP\$ GDP..... | 10.8        | 6 ●       |

|   |             |             |
|---|-------------|-------------|
| <b>4 Market sophistication.....</b>                 | <b>43.9</b> | <b>76</b> ○ |
| 4.1 Credit.....                                     | 30.5        | 76 ○        |
| 4.1.1 Ease of getting credit*.....                  | 70.0        | 29          |
| 4.1.2 Domestic credit to private sector, % GDP..... | 55.4        | 58          |
| 4.1.3 Microfinance gross loans, % GDP.....          | 0.0         | 75 ○        |

|   |       |      |
|---|-------|------|
| 4.2 Investment.....                                     | 38.7  | 70   |
| 4.2.1 Ease of protecting minority investors*.....       | 73.3  | 13 ● |
| 4.2.2 Market capitalization, % GDP <sup>Ⓔ</sup> .....   | 14.4  | 69 ○ |
| 4.2.3 Venture capital deals/bn PPP\$ GDP.....           | 0.0   | 76 ○ |
| 4.3 Trade, competition, & market scale.....             | 62.5  | 60   |
| 4.3.1 Applied tariff rate, weighted mean, %.....        | 1.6   | 23   |
| 4.3.2 Intensity of local competition <sup>†</sup> ..... | 60.3  | 98 ○ |
| 4.3.3 Domestic market scale, bn PPP\$.....              | 143.1 | 69   |

|   |             |           |
|---|-------------|-----------|
| <b>5 Business sophistication.....</b>                               | <b>41.4</b> | <b>32</b> |
| 5.1 Knowledge workers.....  | 46.1        | 43        |
| 5.1.1 Knowledge-intensive employment, %.....                        | 32.3        | 43        |
| 5.1.2 Firms offering formal training, % firms.....                  | 42.7        | 28        |
| 5.1.3 GERD performed by business, % of GDP.....                     | 0.7         | 26        |
| 5.1.4 GERD financed by business, % <sup>Ⓔ</sup> .....               | 22.3        | 59 ○      |
| 5.1.5 Females employed w/advanced degrees, % total.....             | 19.7        | 24        |
| 5.2 Innovation linkages.....  | 44.6        | 21 ●      |
| 5.2.1 University/industry research collaboration <sup>†</sup> ..... | 39.7        | 71        |
| 5.2.2 State of cluster development <sup>†</sup> .....               | 43.8        | 73 ○      |
| 5.2.3 GERD financed by abroad, % <sup>Ⓔ</sup> .....                 | 50.9        | 3 ●       |
| 5.2.4 JV-strategic alliance deals/bn PPP\$ GDP.....                 | 0.0         | 42        |
| 5.2.5 Patent families 2+ offices/bn PPP\$ GDP.....                  | 0.3         | 46        |
| 5.3 Knowledge absorption.....                                       | 33.6        | 61        |
| 5.3.1 Intellectual property payments, % total trade.....            | 0.6         | 55        |
| 5.3.2 High-tech imports less re-imports, % total trade.....         | 7.4         | 72        |
| 5.3.3 ICT services imports, % total trade.....                      | 1.1         | 65        |
| 5.3.4 FDI net inflows, % GDP.....                                   | 3.6         | 44        |
| 5.3.5 Research talent, % in business enterprise.....                | 38.6        | 35        |

|   |             |           |
|---|-------------|-----------|
| <b>6 Knowledge &amp; technology outputs.....</b>            | <b>32.0</b> | <b>35</b> |
| 6.1 Knowledge creation.....                                 | 23.1        | 40        |
| 6.1.1 Patents by origin/bn PPP\$ GDP.....                   | 2.3         | 43        |
| 6.1.2 PCT patent applications/bn PPP\$ GDP.....             | 0.4         | 40        |
| 6.1.3 Utility models by origin/bn PPP\$ GDP.....            | 1.9         | 15        |
| 6.1.4 Scientific & technical articles/bn PPP\$ GDP.....     | 15.3        | 50        |
| 6.1.5 Citable documents H index.....                        | 14.5        | 50        |
| 6.2 Knowledge impact.....                                   | 49.5        | 12 ●      |
| 6.2.1 Growth rate of PPP\$ GDP/worker, %.....               | 2.6         | 27        |
| 6.2.2 New businesses/th pop. 15–64.....                     | 8.9         | 13 ●      |
| 6.2.3 Computer software spending, % GDP.....                | 0.3         | 48        |
| 6.2.4 ISO 9001 quality certificates/bn PPP\$ GDP.....       | 39.7        | 3 ●       |
| 6.2.5 High- & medium-high-tech manufactures, %.....         | 0.2         | 57        |
| 6.3 Knowledge diffusion.....                                | 23.5        | 60        |
| 6.3.1 Intellectual property receipts, % total trade.....    | 0.1         | 45        |
| 6.3.2 High-tech exports less re-exports, % total trade..... | 3.7         | 42        |
| 6.3.3 ICT services exports, % total trade.....              | 2.7         | 39        |
| 6.3.4 FDI net outflows, % GDP.....                          | 0.8         | 61        |

|   |             |           |
|---|-------------|-----------|
| <b>7 Creative outputs.....</b>  | <b>44.1</b> | <b>29</b> |
| 7.1 Intangible assets.....  | 59.4        | 16 ●      |
| 7.1.1 Trademarks by origin/bn PPP\$ GDP.....                                    | 113.6       | 8 ●       |
| 7.1.2 Industrial designs by origin/bn PPP\$ GDP.....                            | 10.8        | 12 ●      |
| 7.1.3 ICTs & business model creation <sup>†</sup> .....                         | 62.0        | 56        |
| 7.1.4 ICTs & organizational model creation <sup>†</sup> .....                   | 58.6        | 44        |
| 7.2 Creative goods & services.....  | 26.5        | 41        |
| 7.2.1 Cultural & creative services exports, % of total trade <sup>Ⓔ</sup> ..... | 1.1         | 13 ●      |
| 7.2.2 National feature films/mn pop. 15–69.....                                 | 4.8         | 39        |
| 7.2.3 Global ent. & media market/th pop. 15–69.....                             | n/a         | n/a       |
| 7.2.4 Printing & publishing manufactures, %.....                                | 1.3         | 38        |
| 7.2.5 Creative goods exports, % total trade.....                                | 1.0         | 43        |
| 7.3 Online creativity.....  | 31.2        | 38        |
| 7.3.1 Generic top-level domains (TLDs)/th pop. 15–69.....                       | 22.7        | 26        |
| 7.3.2 Country-code TLDs/th pop. 15–69.....                                      | 2.0         | 65        |
| 7.3.3 Wikipedia edits/mn pop. 15–69.....  | 6.5         | 26        |
| 7.3.4 Video uploads on YouTube/pop. 15–69.....                                  | 36.8        | 36        |

NOTES: ● indicates a strength; ○ a weakness; \* an index; † a survey question.

Ⓔ indicates that the country's data are older than the base year; see Appendix II for details, including the year of the data, at <http://globalinnovationindex.org>.

Square brackets indicate that the data minimum coverage (DMC) requirements were not met at the sub-pillar or pillar level; see page 181 of this appendix for details.

## Key indicators

|                            |                    |
|----------------------------|--------------------|
| Population (millions)..... | 18.6               |
| GDP (US\$ billions).....   | 12.0               |
| GDP per capita, PPP\$..... | 1,723.6            |
| Income group.....          | Low income         |
| Region.....                | Sub-Saharan Africa |

|  | Score 0–100<br>or value (hard data) | Rank         |
|--|-------------------------------------|--------------|
| <b>Global Innovation Index (out of 127).....</b> | <b>21.9</b>                         | <b>120</b> ○ |
| Innovation Output Sub-Index.....                 | 8.4                                 | 126 ○        |
| Innovation Input Sub-Index.....                  | 35.3                                | 101          |
| Innovation Efficiency Ratio.....                 | 0.2                                 | 127 ○        |
| Global Innovation Index 2016 (out of 128).....   | 21.0                                | 122          |

|   |             |           |
|---|-------------|-----------|
| <b>1 Institutions.....</b>                            | <b>53.4</b> | <b>86</b> |
| 1.1 Political environment.....                        | 37.6        | 101       |
| 1.1.1 Political stability & safety*.....              | 48.1        | 96        |
| 1.1.2 Government effectiveness*.....                  | 27.1        | 99        |
| 1.2 Regulatory environment.....                       | 61.7        | 70        |
| 1.2.1 Regulatory quality*.....                        | 32.9        | 91        |
| 1.2.2 Rule of law*.....                               | 23.9        | 94        |
| 1.2.3 Cost of redundancy dismissal, salary weeks..... | 10.5        | 35 ●      |
| 1.3 Business environment.....                         | 61.0        | 93        |
| 1.3.1 Ease of starting a business*.....               | 88.1        | 59 ●      |
| 1.3.2 Ease of resolving insolvency*.....              | 39.3        | 99        |
| 1.3.3 Ease of paying taxes*.....                      | 55.8        | 103       |

|  |             |            |
|--|-------------|------------|
| <b>2 Human capital &amp; research.....</b>                   | <b>15.8</b> | <b>110</b> |
| 2.1 Education.....   | 25.3        | 118        |
| 2.1.1 Expenditure on education, % GDP.....                   | 3.9         | 82         |
| 2.1.2 Gov't expenditure/pupil, secondary, % GDP/cap.....     | 16.2        | 73         |
| 2.1.3 School life expectancy, years <sup>Ⓐ</sup> .....       | 7.7         | 114 ○      |
| 2.1.4 PISA scales in reading, maths, & science.....          | n/a         | n/a        |
| 2.1.5 Pupil-teacher ratio, secondary.....                    | 25.2        | 94         |
| 2.2 Tertiary education.....                                  | 20.8        | 102        |
| 2.2.1 Tertiary enrolment, % gross <sup>Ⓐ</sup> .....         | 4.8         | 114 ○      |
| 2.2.2 Graduates in science & engineering, %.....             | 17.6        | 69         |
| 2.2.3 Tertiary inbound mobility, % <sup>Ⓐ</sup> .....        | 2.9         | 57         |
| 2.3 Research & development (R&D).....                        | 1.2         | 102        |
| 2.3.1 Researchers, FTE/mn pop. <sup>Ⓐ</sup> .....            | 47.5        | 90         |
| 2.3.2 Gross expenditure on R&D, % GDP <sup>Ⓐ</sup> .....     | 0.2         | 90         |
| 2.3.3 Global R&D companies, avg. expend. top 3, mn \$US..... | 0.0         | 43 ○       |
| 2.3.4 QS university ranking, average score top 3*.....       | 0.0         | 75 ○       |

|  |             |            |
|--|-------------|------------|
| <b>3 Infrastructure.....</b>                                 | <b>25.4</b> | <b>118</b> |
| 3.1 Information & communication technologies (ICTs).....     | 20.1        | 115        |
| 3.1.1 ICT access*.....                                       | 28.7        | 112        |
| 3.1.2 ICT use*.....  | 9.0         | 115        |
| 3.1.3 Government's online service*.....                      | 18.8        | 116        |
| 3.1.4 E-participation*.....                                  | 23.7        | 111        |
| 3.2 General infrastructure.....                              | 26.8        | 103        |
| 3.2.1 Electricity output, kWh/cap.....                       | n/a         | n/a        |
| 3.2.2 Logistics performance*.....                            | 30.9        | 80         |
| 3.2.3 Gross capital formation, % GDP.....                    | 14.3        | 114        |
| 3.3 Ecological sustainability.....                           | 29.3        | 117        |
| 3.3.1 GDP/unit of energy use.....                            | n/a         | n/a        |
| 3.3.2 Environmental performance*.....                        | 43.7        | 116 ○      |
| 3.3.3 ISO 14001 environmental certificates/bn PPP\$ GDP..... | 0.1         | 119 ○      |

|   |             |              |
|---|-------------|--------------|
| <b>4 Market sophistication.....</b>                 | <b>29.7</b> | <b>121</b> ○ |
| 4.1 Credit.....                                     | 22.4        | 108          |
| 4.1.1 Ease of getting credit*.....                  | 30.0        | 108          |
| 4.1.2 Domestic credit to private sector, % GDP..... | 27.2        | 101          |
| 4.1.3 Microfinance gross loans, % GDP.....          | 1.5         | 19 ●         |

|   |      |       |
|---|------|-------|
| 4.2 Investment.....   | 30.0 | 114   |
| 4.2.1 Ease of protecting minority investors*.....           | 40.0 | 111   |
| 4.2.2 Market capitalization, % GDP.....                     | n/a  | n/a   |
| 4.2.3 Venture capital deals/bn PPP\$ GDP <sup>Ⓐ</sup> ..... | 0.0  | 39 ●  |
| 4.3 Trade, competition, & market scale.....                 | 36.6 | 122 ○ |
| 4.3.1 Applied tariff rate, weighted mean, %.....            | 9.6  | 112   |
| 4.3.2 Intensity of local competition <sup>†</sup> .....     | n/a  | n/a   |
| 4.3.3 Domestic market scale, bn PPP\$.....                  | 33.0 | 107   |

|  |             |             |
|--|-------------|-------------|
| <b>5 Business sophistication.....</b>                                  | <b>52.2</b> | <b>[14]</b> |
| 5.1 Knowledge workers.....   | 23.9        | [100]       |
| 5.1.1 Knowledge-intensive employment, %.....                           | n/a         | n/a         |
| 5.1.2 Firms offering formal training, % firms <sup>Ⓐ</sup> .....       | 24.8        | 65          |
| 5.1.3 GERD performed by business, % of GDP.....                        | n/a         | n/a         |
| 5.1.4 GERD financed by business, % <sup>Ⓐ</sup> .....                  | 11.9        | 70          |
| 5.1.5 Females employed w/advanced degrees, % total.....                | n/a         | n/a         |
| 5.2 Innovation linkages.....   | 100.0       | [1]         |
| 5.2.1 University/industry research collaboration <sup>†</sup> .....    | n/a         | n/a         |
| 5.2.2 State of cluster development <sup>†</sup> .....                  | n/a         | n/a         |
| 5.2.3 GERD financed by abroad, % <sup>Ⓐ</sup> .....                    | 59.6        | 1 ●         |
| 5.2.4 JV-strategic alliance deals/bn PPP\$ GDP.....                    | n/a         | n/a         |
| 5.2.5 Patent families 2+ offices/bn PPP\$ GDP.....                     | n/a         | n/a         |
| 5.3 Knowledge absorption.....  | 32.6        | 66          |
| 5.3.1 Intellectual property payments, % total trade <sup>Ⓐ</sup> ..... | 0.0         | 114 ○       |
| 5.3.2 High-tech imports less re-imports, % total trade.....            | 6.4         | 91          |
| 5.3.3 ICT services imports, % total trade <sup>Ⓐ</sup> .....           | 2.4         | 14 ●        |
| 5.3.4 FDI net inflows, % GDP.....                                      | 2.9         | 62 ●        |
| 5.3.5 Research talent, % in business enterprise.....                   | n/a         | n/a         |

|  |             |            |
|--|-------------|------------|
| <b>6 Knowledge &amp; technology outputs.....</b>                       | <b>15.1</b> | <b>106</b> |
| 6.1 Knowledge creation.....  | 5.1         | 86         |
| 6.1.1 Patents by origin/bn PPP\$ GDP.....                              | 0.2         | 94         |
| 6.1.2 PCT patent applications/bn PPP\$ GDP.....                        | n/a         | n/a        |
| 6.1.3 Utility models by origin/bn PPP\$ GDP <sup>Ⓐ</sup> .....         | 0.1         | 47         |
| 6.1.4 Scientific & technical articles/bn PPP\$ GDP.....                | 10.6        | 63 ●       |
| 6.1.5 Citable documents H index.....                                   | 5.0         | 94         |
| 6.2 Knowledge impact.....  | 24.1        | 93         |
| 6.2.1 Growth rate of PPP\$ GDP/worker, %.....                          | 1.9         | 38 ●       |
| 6.2.2 New businesses/th pop. 15–64 <sup>Ⓐ</sup> .....                  | 0.2         | 96         |
| 6.2.3 Computer software spending, % GDP.....                           | 0.0         | 110        |
| 6.2.4 ISO 9001 quality certificates/bn PPP\$ GDP.....                  | 1.6         | 100        |
| 6.2.5 High- & medium-high-tech manufactures, %.....                    | n/a         | n/a        |
| 6.3 Knowledge diffusion.....   | 16.2        | 109        |
| 6.3.1 Intellectual property receipts, % total trade <sup>Ⓐ</sup> ..... | 0.0         | 80         |
| 6.3.2 High-tech exports less re-exports, % total trade.....            | 0.2         | 101        |
| 6.3.3 ICT services exports, % total trade <sup>Ⓐ</sup> .....           | 1.3         | 72         |
| 6.3.4 FDI net outflows, % GDP.....                                     | 0.4         | 71         |

|   |            |              |
|---|------------|--------------|
| <b>7 Creative outputs.....</b>                                    | <b>1.8</b> | <b>127</b> ○ |
| 7.1 Intangible assets.....  | 1.0        | 126 ○        |
| 7.1.1 Trademarks by origin/bn PPP\$ GDP.....                      | 3.2        | 114 ○        |
| 7.1.2 Industrial designs by origin/bn PPP\$ GDP.....              | 0.2        | 100          |
| 7.1.3 ICTs & business model creation <sup>†</sup> .....           | n/a        | n/a          |
| 7.1.4 ICTs & organizational model creation <sup>†</sup> .....     | n/a        | n/a          |
| 7.2 Creative goods & services.....                                | 4.7        | 109          |
| 7.2.1 Cultural & creative services exports, % of total trade..... | 0.3        | 40 ●         |
| 7.2.2 National feature films/mn pop. 15–69.....                   | 0.5        | 92           |
| 7.2.3 Global ent. & media market/th pop. 15–69.....               | n/a        | n/a          |
| 7.2.4 Printing & publishing manufactures, %.....                  | n/a        | n/a          |
| 7.2.5 Creative goods exports, % total trade.....                  | 0.0        | 109          |
| 7.3 Online creativity.....  | 0.4        | 125 ○        |
| 7.3.1 Generic top-level domains (TLDs)/th pop. 15–69.....         | 0.1        | 122 ○        |
| 7.3.2 Country-code TLDs/th pop. 15–69.....                        | 0.0        | 119          |
| 7.3.3 Wikipedia edits/mn pop. 15–69 <sup>Ⓐ</sup> .....            | 0.1        | 125 ○        |
| 7.3.4 Video uploads on YouTube/pop. 15–69.....                    | n/a        | n/a          |

NOTES: ● indicates a strength; ○ a weakness; \* an index; † a survey question.

Ⓐ indicates that the country's data are older than the base year; see Appendix II for details, including the year of the data, at <http://globalinnovationindex.org>.

Square brackets indicate that the data minimum coverage (DMC) requirements were not met at the sub-pillar or pillar level; see page 181 of this appendix for details.



## Burundi

## Key indicators

|                            |                    |
|----------------------------|--------------------|
| Population (millions)..... | 11.6               |
| GDP (US\$ billions).....   | 2.7                |
| GDP per capita, PPP\$..... | 818.5              |
| Income group.....          | Low income         |
| Region.....                | Sub-Saharan Africa |

|  | Score 0–100<br>or value (hard data) | Rank       |
|--|-------------------------------------|------------|
| <b>Global Innovation Index (out of 127).....</b> | <b>21.3</b>                         | <b>122</b> |
| Innovation Output Sub-Index.....                 | 12.4                                | 122        |
| Innovation Input Sub-Index.....                  | 30.2                                | 115        |
| Innovation Efficiency Ratio.....                 | 0.4                                 | 117        |
| Global Innovation Index 2016 (out of 128).....   | 20.9                                | 123        |

**1 Institutions.....43.2 118**

|   |      |      |
|---|------|------|
| 1.1 Political environment.....                        | 17.3 | 124  |
| 1.1.1 Political stability & safety*.....              | 21.9 | 123  |
| 1.1.2 Government effectiveness*.....                  | 12.7 | 123  |
| 1.2 Regulatory environment.....                       | 49.8 | 98   |
| 1.2.1 Regulatory quality*.....                        | 24.0 | 107  |
| 1.2.2 Rule of law*.....                               | 6.7  | 123  |
| 1.2.3 Cost of redundancy dismissal, salary weeks..... | 15.9 | 67   |
| 1.3 Business environment.....                         | 62.4 | 85   |
| 1.3.1 Ease of starting a business*.....               | 94.5 | 17 ● |
| 1.3.2 Ease of resolving insolvency*.....              | 30.5 | 114  |
| 1.3.3 Ease of paying taxes*.....                      | 62.2 | 88   |

**2 Human capital & research.....14.9 114**

|  |      |      |
|--|------|------|
| 2.1 Education.....   | 37.7 | 95   |
| 2.1.1 Expenditure on education, % GDP.....                   | 5.4  | 35 ● |
| 2.1.2 Gov't expenditure/pupil, secondary, % GDP/cap.....     | 31.0 | 13 ● |
| 2.1.3 School life expectancy, years <sup>Ⓐ</sup> .....       | 10.6 | 98   |
| 2.1.4 PISA scales in reading, maths, & science.....          | n/a  | n/a  |
| 2.1.5 Pupil-teacher ratio, secondary.....                    | 35.8 | 107  |
| 2.2 Tertiary education.....                                  | 6.1  | 119  |
| 2.2.1 Tertiary enrolment, % gross <sup>Ⓐ</sup> .....         | 4.4  | 117  |
| 2.2.2 Graduates in science & engineering, %.....             | 6.4  | 100  |
| 2.2.3 Tertiary inbound mobility, % <sup>Ⓐ</sup> .....        | 1.0  | 81   |
| 2.3 Research & development (R&D).....                        | 0.8  | 105  |
| 2.3.1 Researchers, FTE/mn pop.....                           | n/a  | n/a  |
| 2.3.2 Gross expenditure on R&D, % GDP <sup>Ⓐ</sup> .....     | 0.1  | 99   |
| 2.3.3 Global R&D companies, avg. expend. top 3, mn \$US..... | 0.0  | 43 ○ |
| 2.3.4 QS university ranking, average score top 3*.....       | 0.0  | 75 ○ |

**3 Infrastructure.....21.9 124**

|  |      |       |
|--|------|-------|
| 3.1 Information & communication technologies (ICTs).....     | 14.0 | 125 ○ |
| 3.1.1 ICT access*.....                                       | 21.4 | 123   |
| 3.1.2 ICT use*.....  | 4.2  | 123   |
| 3.1.3 Government's online service*.....                      | 15.2 | 118   |
| 3.1.4 E-participation*.....                                  | 15.3 | 119   |
| 3.2 General infrastructure.....                              | 8.3  | 126 ○ |
| 3.2.1 Electricity output, kWh/cap.....                       | n/a  | n/a   |
| 3.2.2 Logistics performance*.....                            | 20.7 | 101   |
| 3.2.3 Gross capital formation, % GDP.....                    | 4.2  | 123 ○ |
| 3.3 Ecological sustainability.....                           | 43.4 | [70]  |
| 3.3.1 GDP/unit of energy use.....                            | n/a  | n/a   |
| 3.3.2 Environmental performance*.....                        | 43.4 | 118   |
| 3.3.3 ISO 14001 environmental certificates/bn PPP\$ GDP..... | n/a  | n/a   |

**4 Market sophistication.....32.7 114**

|   |      |       |
|---|------|-------|
| 4.1 Credit.....                                     | 25.1 | 97    |
| 4.1.1 Ease of getting credit*.....                  | 10.0 | 124 ○ |
| 4.1.2 Domestic credit to private sector, % GDP..... | 14.3 | 120   |
| 4.1.3 Microfinance gross loans, % GDP.....          | 3.4  | 13 ●  |

|   |      |       |
|---|------|-------|
| 4.2 Investment.....                                     | 41.7 | [55]  |
| 4.2.1 Ease of protecting minority investors*.....       | 41.7 | 105   |
| 4.2.2 Market capitalization, % GDP.....                 | n/a  | n/a   |
| 4.2.3 Venture capital deals/bn PPP\$ GDP.....           | n/a  | n/a   |
| 4.3 Trade, competition, & market scale.....             | 31.2 | 124   |
| 4.3.1 Applied tariff rate, weighted mean, %.....        | 5.4  | 94    |
| 4.3.2 Intensity of local competition <sup>†</sup> ..... | 56.1 | 113   |
| 4.3.3 Domestic market scale, bn PPP\$.....              | 7.9  | 127 ○ |

**5 Business sophistication.....38.4 36 ●**

|   |      |       |
|---|------|-------|
| 5.1 Knowledge workers.....  | 37.7 | [60]  |
| 5.1.1 Knowledge-intensive employment, %.....                              | n/a  | n/a   |
| 5.1.2 Firms offering formal training, % firms.....                        | 32.0 | 46    |
| 5.1.3 GERD performed by business, % of GDP.....                           | n/a  | n/a   |
| 5.1.4 GERD financed by business, %.....                                   | n/a  | n/a   |
| 5.1.5 Females employed w/advanced degrees, % total.....                   | n/a  | n/a   |
| 5.2 Innovation linkages.....  | 38.1 | 36 ●  |
| 5.2.1 University/industry research collaboration <sup>†</sup> .....       | 30.2 | 104   |
| 5.2.2 State of cluster development <sup>†</sup> .....                     | 31.3 | 117   |
| 5.2.3 GERD financed by abroad, % <sup>Ⓐ</sup> .....                       | 39.9 | 10 ●  |
| 5.2.4 JV-strategic alliance deals/bn PPP\$ GDP.....                       | n/a  | n/a   |
| 5.2.5 Patent families 2+ offices/bn PPP\$ GDP <sup>Ⓐ</sup> .....          | 0.2  | 54 ●  |
| 5.3 Knowledge absorption.....   | 39.5 | 33 ●  |
| 5.3.1 Intellectual property payments, % total trade <sup>Ⓐ</sup> .....    | 0.0  | 115 ○ |
| 5.3.2 High-tech imports less re-imports, % total trade <sup>Ⓐ</sup> ..... | 10.8 | 35 ●  |
| 5.3.3 ICT services imports, % total trade <sup>Ⓐ</sup> .....              | 2.6  | 11 ●  |
| 5.3.4 FDI net inflows, % GDP.....   | 2.8  | 64    |
| 5.3.5 Research talent, % in business enterprise.....                      | n/a  | n/a   |

**6 Knowledge & technology outputs.....7.9 124**

|   |      |       |
|---|------|-------|
| 6.1 Knowledge creation.....   | 2.5  | [118] |
| 6.1.1 Patents by origin/bn PPP\$ GDP.....                                 | n/a  | n/a   |
| 6.1.2 PCT patent applications/bn PPP\$ GDP.....                           | n/a  | n/a   |
| 6.1.3 Utility models by origin/bn PPP\$ GDP.....                          | n/a  | n/a   |
| 6.1.4 Scientific & technical articles/bn PPP\$ GDP.....                   | 3.9  | 104   |
| 6.1.5 Citable documents H index.....                                      | 0.3  | 125 ○ |
| 6.2 Knowledge impact.....   | 3.2  | 124   |
| 6.2.1 Growth rate of PPP\$ GDP/worker, %.....                             | n/a  | n/a   |
| 6.2.2 New businesses/th pop. 15–64.....                                   | n/a  | n/a   |
| 6.2.3 Computer software spending, % GDP.....                              | 0.1  | 94    |
| 6.2.4 ISO 9001 quality certificates/bn PPP\$ GDP.....                     | 0.0  | 127 ○ |
| 6.2.5 High- & medium-high-tech manufactures, % <sup>Ⓐ</sup> .....         | 0.0  | 98    |
| 6.3 Knowledge diffusion.....  | 17.9 | 95    |
| 6.3.1 Intellectual property receipts, % total trade <sup>Ⓐ</sup> .....    | 0.0  | 87    |
| 6.3.2 High-tech exports less re-exports, % total trade <sup>Ⓐ</sup> ..... | 0.1  | 114   |
| 6.3.3 ICT services exports, % total trade <sup>Ⓐ</sup> .....              | 3.2  | 27 ●  |
| 6.3.4 FDI net outflows, % GDP.....  | 0.0  | 108   |

**7 Creative outputs.....16.9 115**

|   |      |       |
|---|------|-------|
| 7.1 Intangible assets.....  | 29.2 | 106   |
| 7.1.1 Trademarks by origin/bn PPP\$ GDP.....                                    | n/a  | n/a   |
| 7.1.2 Industrial designs by origin/bn PPP\$ GDP.....                            | n/a  | n/a   |
| 7.1.3 ICTs & business model creation <sup>†</sup> .....                         | 31.9 | 122 ○ |
| 7.1.4 ICTs & organizational model creation <sup>†</sup> .....                   | 26.5 | 122 ○ |
| 7.2 Creative goods & services.....  | 8.4  | 94    |
| 7.2.1 Cultural & creative services exports, % of total trade <sup>Ⓐ</sup> ..... | 0.3  | 33 ●  |
| 7.2.2 National feature films/mn pop. 15–69.....                                 | 0.2  | 99    |
| 7.2.3 Global ent. & media market/th pop. 15–69.....                             | n/a  | n/a   |
| 7.2.4 Printing & publishing manufactures, % <sup>Ⓐ</sup> .....                  | 1.2  | 52    |
| 7.2.5 Creative goods exports, % total trade <sup>Ⓐ</sup> .....                  | 0.0  | 113   |
| 7.3 Online creativity.....  | 1.0  | 122   |
| 7.3.1 Generic top-level domains (TLDs)/th pop. 15–69.....                       | 0.0  | 125 ○ |
| 7.3.2 Country-code TLDs/th pop. 15–69.....                                      | 0.1  | 107   |
| 7.3.3 Wikipedia edits/mn pop. 15–69 <sup>Ⓐ</sup> .....                          | 0.3  | 122   |
| 7.3.4 Video uploads on YouTube/pop. 15–69.....                                  | n/a  | n/a   |

NOTES: ● indicates a strength; ○ a weakness; \* an index; † a survey question.

Ⓐ indicates that the country's data are older than the base year; see Appendix II for details, including the year of the data, at <http://globalinnovationindex.org>.

Square brackets indicate that the data minimum coverage (DMC) requirements were not met at the sub-pillar or pillar level; see page 181 of this appendix for details.

## Key indicators

|                             |   |
|-----------------------------|---|
| Population (millions) ..... | 15.8                                    |
| GDP (US\$ billions) .....   | 19.4                                    |
| GDP per capita, PPP\$ ..... | 3,487.5                                 |
| Income group .....          | Lower-middle income                     |
| Region .....                | South East Asia, East Asia, and Oceania |

|   | Score 0–100<br>or value (hard data) | Rank       |
|---|-------------------------------------|------------|
| <b>Global Innovation Index (out of 127)</b> ..... | <b>27.0</b>                         | <b>101</b> |
| Innovation Output Sub-Index .....                 | 20.9                                | 87         |
| Innovation Input Sub-Index .....                  | 33.2                                | 104        |
| Innovation Efficiency Ratio .....                 | 0.6                                 | 61         |
| Global Innovation Index 2016 (out of 128) .....   | 27.9                                | 95         |

|  |             |             |
|--|-------------|-------------|
| <b>1 Institutions</b> .....                                    | <b>49.1</b> | <b>98</b>   |
| 1.1 Political environment .....                                | 42.9        | 88          |
| 1.1.1 Political stability & safety* .....                      | 61.5        | 68          |
| 1.1.2 Government effectiveness* .....                          | 24.4        | 109         |
| 1.2 Regulatory environment .....                               | 49.3        | 101         |
| 1.2.1 Regulatory quality* .....                                | 29.8        | 98          |
| 1.2.2 Rule of law* .....                                       | 12.5        | 114         |
| 1.2.3 Cost of redundancy dismissal, salary weeks .....         | 19.4        | 80          |
| 1.3 Business environment .....                                 | 55.0        | 115         |
| 1.3.1 Ease of starting a business* .....                       | 54.9        | 126 ○       |
| 1.3.2 Ease of resolving insolvency* .....                      | 48.1        | 66          |
| 1.3.3 Ease of paying taxes* .....                              | 62.0        | 89          |
| <b>2 Human capital &amp; research</b> .....                    | <b>14.2</b> | <b>118</b>  |
| 2.1 Education .....  | 24.6        | 119         |
| 2.1.1 Expenditure on education, % GDP .....                    | 1.9         | 115 ○       |
| 2.1.2 Gov't expenditure/pupil, secondary, % GDP/cap .....      | n/a         | n/a         |
| 2.1.3 School life expectancy, years <sup>Ⓐ</sup> .....         | 10.5        | 99          |
| 2.1.4 PISA scales in reading, maths, & science .....           | n/a         | n/a         |
| 2.1.5 Pupil-teacher ratio, secondary <sup>Ⓐ</sup> .....        | 28.9        | 103         |
| 2.2 Tertiary education .....                                   | 17.9        | 105         |
| 2.2.1 Tertiary enrolment, % gross .....                        | 13.1        | 100         |
| 2.2.2 Graduates in science & engineering, % <sup>Ⓐ</sup> ..... | 12.5        | 93          |
| 2.2.3 Tertiary inbound mobility, % .....                       | n/a         | n/a         |
| 2.3 Research & development (R&D) .....                         | 0.0         | 115 ○       |
| 2.3.1 Researchers, FTE/mn pop. .....                           | n/a         | n/a         |
| 2.3.2 Gross expenditure on R&D, % GDP .....                    | n/a         | n/a         |
| 2.3.3 Global R&D companies, avg. expend. top 3, mn \$US .....  | 0.0         | 43 ○        |
| 2.3.4 QS university ranking, average score top 3* .....        | 0.0         | 75 ○        |
| <b>3 Infrastructure</b> .....                                  | <b>26.9</b> | <b>113</b>  |
| 3.1 Information & communication technologies (ICTs) .....      | 18.7        | 118         |
| 3.1.1 ICT access* .....  | 42.1        | 99          |
| 3.1.2 ICT use* .....   | 20.9        | 97          |
| 3.1.3 Government's online service* .....                       | 5.1         | 126 ○       |
| 3.1.4 E-participation* .....                                   | 6.8         | 125 ○       |
| 3.2 General infrastructure .....                               | 30.7        | 92          |
| 3.2.1 Electricity output, kWh/cap .....                        | 199.5       | 112 ○       |
| 3.2.2 Logistics performance* .....                             | 34.1        | 73          |
| 3.2.3 Gross capital formation, % GDP .....                     | 22.9        | 57 ●        |
| 3.3 Ecological sustainability .....                            | 31.3        | 113         |
| 3.3.1 GDP/unit of energy use .....                             | 7.4         | 81          |
| 3.3.2 Environmental performance* .....                         | 51.2        | 110         |
| 3.3.3 ISO 14001 environmental certificates/bn PPP\$ GDP .....  | 0.3         | 92          |
| <b>4 Market sophistication</b> .....                           | <b>52.4</b> | <b>37 ●</b> |
| 4.1 Credit .....   | 69.9        | 7 ●         |
| 4.1.1 Ease of getting credit* .....                            | 85.0        | 7 ●         |
| 4.1.2 Domestic credit to private sector, % GDP .....           | 63.1        | 50 ●        |
| 4.1.3 Microfinance gross loans, % GDP .....                    | 29.6        | 1 ●         |

|  |      |     |
|--|------|-----|
| 4.2 Investment .....   | 34.1 | 88  |
| 4.2.1 Ease of protecting minority investors* .....             | 48.3 | 92  |
| 4.2.2 Market capitalization, % GDP .....                       | n/a  | n/a |
| 4.2.3 Venture capital deals/bn PPP\$ GDP <sup>Ⓐ</sup> .....    | 0.0  | 54  |
| 4.3 Trade, competition, & market scale .....                   | 53.3 | 98  |
| 4.3.1 Applied tariff rate, weighted mean, % <sup>Ⓐ</sup> ..... | 4.9  | 90  |
| 4.3.2 Intensity of local competition <sup>†</sup> .....        | 62.1 | 93  |
| 4.3.3 Domestic market scale, bn PPP\$ .....                    | 58.9 | 90  |

**5 Business sophistication** ..... **23.3** **111**

|   |      |       |
|---|------|-------|
| 5.1 Knowledge workers .....   | 15.4 | [117] |
| 5.1.1 Knowledge-intensive employment, % <sup>Ⓐ</sup> .....          | 4.1  | 102 ○ |
| 5.1.2 Firms offering formal training, % firms .....                 | 22.2 | 69    |
| 5.1.3 GERD performed by business, % of GDP .....                    | n/a  | n/a   |
| 5.1.4 GERD financed by business, % .....                            | n/a  | n/a   |
| 5.1.5 Females employed w/advanced degrees, % total .....            | n/a  | n/a   |
| 5.2 Innovation linkages .....                                       | 30.7 | 55 ●  |
| 5.2.1 University/industry research collaboration <sup>†</sup> ..... | 34.7 | 95    |
| 5.2.2 State of cluster development <sup>†</sup> .....               | 49.1 | 44 ●  |
| 5.2.3 GERD financed by abroad, % .....                              | n/a  | n/a   |
| 5.2.4 JV-strategic alliance deals/bn PPP\$ GDP .....                | 0.1  | 25 ●  |
| 5.2.5 Patent families 2+ offices/bn PPP\$ GDP <sup>Ⓐ</sup> .....    | 0.0  | 93    |
| 5.3 Knowledge absorption .....                                      | 23.9 | 106   |
| 5.3.1 Intellectual property payments, % total trade .....           | 0.1  | 102   |
| 5.3.2 High-tech imports less re-imports, % total trade .....        | 2.9  | 122 ○ |
| 5.3.3 ICT services imports, % total trade .....                     | 0.7  | 87    |
| 5.3.4 FDI net inflows, % GDP .....                                  | 9.5  | 11 ●  |
| 5.3.5 Research talent, % in business enterprise .....               | n/a  | n/a   |

**6 Knowledge & technology outputs** ..... **17.4** **90**

|  |      |       |
|--|------|-------|
| 6.1 Knowledge creation .....                                 | 3.5  | 105   |
| 6.1.1 Patents by origin/bn PPP\$ GDP <sup>Ⓐ</sup> .....      | 0.0  | 118 ○ |
| 6.1.2 PCT patent applications/bn PPP\$ GDP .....             | n/a  | n/a   |
| 6.1.3 Utility models by origin/bn PPP\$ GDP .....            | n/a  | n/a   |
| 6.1.4 Scientific & technical articles/bn PPP\$ GDP .....     | 5.0  | 99    |
| 6.1.5 Citable documents H index .....                        | 4.0  | 103   |
| 6.2 Knowledge impact .....                                   | 34.4 | 49 ●  |
| 6.2.1 Growth rate of PPP\$ GDP/worker, % .....               | 5.0  | 7 ●   |
| 6.2.2 New businesses/th pop. 15–64 <sup>Ⓐ</sup> .....        | 0.2  | 95    |
| 6.2.3 Computer software spending, % GDP .....                | 0.0  | 112   |
| 6.2.4 ISO 9001 quality certificates/bn PPP\$ GDP .....       | 0.7  | 115   |
| 6.2.5 High- & medium-high-tech manufactures, % .....         | n/a  | n/a   |
| 6.3 Knowledge diffusion .....                                | 14.2 | 116   |
| 6.3.1 Intellectual property receipts, % total trade .....    | 0.0  | 92    |
| 6.3.2 High-tech exports less re-exports, % total trade ..... | 0.9  | 69    |
| 6.3.3 ICT services exports, % total trade .....              | 0.4  | 103   |
| 6.3.4 FDI net outflows, % GDP .....                          | 0.3  | 80    |

**7 Creative outputs** ..... **24.4** **92**

|  |      |      |
|--|------|------|
| 7.1 Intangible assets .....  | 36.7 | 89   |
| 7.1.1 Trademarks by origin/bn PPP\$ GDP <sup>Ⓐ</sup> .....         | 23.5 | 80   |
| 7.1.2 Industrial designs by origin/bn PPP\$ GDP .....              | 0.2  | 99   |
| 7.1.3 ICTs & business model creation <sup>†</sup> .....            | 60.7 | 61   |
| 7.1.4 ICTs & organizational model creation <sup>†</sup> .....      | 55.6 | 52 ● |
| 7.2 Creative goods & services .....                                | 14.7 | [74] |
| 7.2.1 Cultural & creative services exports, % of total trade ..... | n/a  | n/a  |
| 7.2.2 National feature films/mn pop. 15–69 .....                   | 3.1  | 55   |
| 7.2.3 Global ent. & media market/th pop. 15–69 .....               | n/a  | n/a  |
| 7.2.4 Printing & publishing manufactures, % .....                  | n/a  | n/a  |
| 7.2.5 Creative goods exports, % total trade .....                  | 0.6  | 56 ● |
| 7.3 Online creativity .....  | 9.8  | 99   |
| 7.3.1 Generic top-level domains (TLDs)/th pop. 15–69 .....         | 1.1  | 92   |
| 7.3.2 Country-code TLDs/th pop. 15–69 .....                        | 0.1  | 113  |
| 7.3.3 Wikipedia edits/mn pop. 15–69 <sup>Ⓐ</sup> .....             | 2.9  | 102  |
| 7.3.4 Video uploads on YouTube/pop. 15–69 .....                    | n/a  | n/a  |

NOTES: ● indicates a strength; ○ a weakness; \* an index; † a survey question.

Ⓐ indicates that the country's data are older than the base year; see Appendix II for details, including the year of the data, at <http://globalinnovationindex.org>.

Square brackets indicate that the data minimum coverage (DMC) requirements were not met at the sub-pillar or pillar level; see page 181 of this appendix for details.

## Cameroon

## Key indicators

|                       |                     |
|-----------------------|---------------------|
| Population (millions) | 23.9                |
| GDP (US\$ billions)   | 30.9                |
| GDP per capita, PPP\$ | 3,143.7             |
| Income group          | Lower-middle income |
| Region                | Sub-Saharan Africa  |

|   | Score 0–100<br>or value (hard data) | Rank       |
|---|-------------------------------------|------------|
| <b>Global Innovation Index (out of 127)</b> | <b>22.6</b>                         | <b>117</b> |
| Innovation Output Sub-Index                 | 16.1                                | 113        |
| Innovation Input Sub-Index                  | 29.0                                | 117        |
| Innovation Efficiency Ratio                 | 0.6                                 | 92         |
| Global Innovation Index 2016 (out of 128)   | 22.8                                | 118        |

|          |  |             |            |   |
|----------|--|-------------|------------|---|
| <b>1</b> | <b>Institutions</b>  | <b>42.3</b> | <b>119</b> | ○ |
| 1.1      | Political environment                                      | 31.2        | 115        |   |
| 1.1.1    | Political stability & safety*                              | 39.8        | 110        |   |
| 1.1.2    | Government effectiveness*                                  | 22.5        | 114        |   |
| 1.2      | Regulatory environment                                     | 45.8        | 108        |   |
| 1.2.1    | Regulatory quality*  | 19.0        | 116        |   |
| 1.2.2    | Rule of law*   | 11.3        | 117        |   |
| 1.2.3    | Cost of redundancy dismissal, salary weeks                 | 19.9        | 82         |   |
| 1.3      | Business environment                                       | 49.8        | 122        | ○ |
| 1.3.1    | Ease of starting a business*                               | 77.0        | 110        |   |
| 1.3.2    | Ease of resolving insolvency*                              | 36.6        | 104        |   |
| 1.3.3    | Ease of paying taxes*                                      | 35.9        | 123        | ○ |
| <b>2</b> | <b>Human capital &amp; research</b>                        | <b>19.8</b> | <b>101</b> |   |
| 2.1      | Education  | 34.4        | 100        |   |
| 2.1.1    | Expenditure on education, % GDP                            | 3.0         | 98         |   |
| 2.1.2    | Gov't expenditure/pupil, secondary, % GDP/cap <sup>Ⓔ</sup> | 19.7        | 54         | ● |
| 2.1.3    | School life expectancy, years                              | 12.2        | 84         |   |
| 2.1.4    | PISA scales in reading, maths, & science                   | n/a         | n/a        |   |
| 2.1.5    | Pupil-teacher ratio, secondary                             | 19.9        | 80         |   |
| 2.2      | Tertiary education   | 25.1        | 93         |   |
| 2.2.1    | Tertiary enrolment, % gross                                | 17.5        | 95         |   |
| 2.2.2    | Graduates in science & engineering, % <sup>Ⓔ</sup>         | 21.0        | 49         | ● |
| 2.2.3    | Tertiary inbound mobility, % <sup>Ⓔ</sup>                  | 1.1         | 80         |   |
| 2.3      | Research & development (R&D)                               | 0.0         | 115        | ○ |
| 2.3.1    | Researchers, FTE/mn pop.                                   | n/a         | n/a        |   |
| 2.3.2    | Gross expenditure on R&D, % GDP                            | n/a         | n/a        |   |
| 2.3.3    | Global R&D companies, avg. expend. top 3, mn \$US          | 0.0         | 43         | ○ |
| 2.3.4    | QS university ranking, average score top 3*                | 0.0         | 75         | ○ |
| <b>3</b> | <b>Infrastructure</b>                                      | <b>25.3</b> | <b>119</b> | ○ |
| 3.1      | Information & communication technologies (ICTs)            | 18.7        | 119        | ○ |
| 3.1.1    | ICT access*  | 27.7        | 115        |   |
| 3.1.2    | ICT use*   | 8.4         | 117        |   |
| 3.1.3    | Government's online service*                               | 21.7        | 113        |   |
| 3.1.4    | E-participation*   | 16.9        | 117        |   |
| 3.2      | General infrastructure                                     | 22.2        | 114        |   |
| 3.2.1    | Electricity output, kWh/cap.                               | 304.0       | 108        |   |
| 3.2.2    | Logistics performance*                                     | 4.1         | 125        | ○ |
| 3.2.3    | Gross capital formation, % GDP                             | 21.9        | 66         | ● |
| 3.3      | Ecological sustainability                                  | 35.1        | 102        |   |
| 3.3.1    | GDP/unit of energy use                                     | 8.3         | 66         | ● |
| 3.3.2    | Environmental performance*                                 | 57.1        | 106        |   |
| 3.3.3    | ISO 14001 environmental certificates/bn PPP\$ GDP          | 0.3         | 102        |   |
| <b>4</b> | <b>Market sophistication</b>                               | <b>33.7</b> | <b>113</b> |   |
| 4.1      | Credit   | 20.0        | 112        |   |
| 4.1.1    | Ease of getting credit*                                    | 35.0        | 104        |   |
| 4.1.2    | Domestic credit to private sector, % GDP                   | 16.4        | 114        |   |
| 4.1.3    | Microfinance gross loans, % GDP                            | 1.1         | 25         | ● |

|       |  |      |      |   |
|-------|--|------|------|---|
| 4.2   | Investment   | 41.7 | [55] |   |
| 4.2.1 | Ease of protecting minority investors*             | 41.7 | 105  |   |
| 4.2.2 | Market capitalization, % GDP                       | n/a  | n/a  |   |
| 4.2.3 | Venture capital deals/bn PPP\$ GDP                 | n/a  | n/a  |   |
| 4.3   | Trade, competition, & market scale                 | 39.4 | 121  | ○ |
| 4.3.1 | Applied tariff rate, weighted mean, % <sup>Ⓔ</sup> | 15.8 | 125  | ○ |
| 4.3.2 | Intensity of local competition <sup>†</sup>        | 63.8 | 83   |   |
| 4.3.3 | Domestic market scale, bn PPP\$                    | 77.2 | 82   |   |

**5 Business sophistication** 24.0 109

|       |  |      |      |   |
|-------|--|------|------|---|
| 5.1   | Knowledge workers  | 29.2 | [86] |   |
| 5.1.1 | Knowledge-intensive employment, %                          | n/a  | n/a  |   |
| 5.1.2 | Firms offering formal training, % firms <sup>Ⓔ</sup>       | 25.5 | 62   |   |
| 5.1.3 | GERD performed by business, % of GDP                       | n/a  | n/a  |   |
| 5.1.4 | GERD financed by business, %                               | n/a  | n/a  |   |
| 5.1.5 | Females employed w/advanced degrees, % total               | n/a  | n/a  |   |
| 5.2   | Innovation linkages  | 22.5 | 83   |   |
| 5.2.1 | University/industry research collaboration <sup>†</sup>    | 37.2 | 85   |   |
| 5.2.2 | State of cluster development <sup>†</sup>                  | 36.8 | 96   |   |
| 5.2.3 | GERD financed by abroad, %                                 | n/a  | n/a  |   |
| 5.2.4 | JV-strategic alliance deals/bn PPP\$ GDP                   | 0.0  | 96   |   |
| 5.2.5 | Patent families 2+ offices/bn PPP\$ GDP <sup>Ⓔ</sup>       | 0.0  | 107  |   |
| 5.3   | Knowledge absorption                                       | 20.4 | 121  | ○ |
| 5.3.1 | Intellectual property payments, % total trade <sup>Ⓔ</sup> | 0.1  | 100  |   |
| 5.3.2 | High-tech imports less re-imports, % total trade           | 5.1  | 108  |   |
| 5.3.3 | ICT services imports, % total trade <sup>Ⓔ</sup>           | 0.5  | 102  |   |
| 5.3.4 | FDI net inflows, % GDP                                     | 1.9  | 84   |   |
| 5.3.5 | Research talent, % in business enterprise                  | n/a  | n/a  |   |

**6 Knowledge & technology outputs** 15.6 101

|       |  |       |     |   |
|-------|--|-------|-----|---|
| 6.1   | Knowledge creation   | 5.6   | 85  |   |
| 6.1.1 | Patents by origin/bn PPP\$ GDP                             | 0.4   | 82  |   |
| 6.1.2 | PCT patent applications/bn PPP\$ GDP                       | 0.0   | 94  |   |
| 6.1.3 | Utility models by origin/bn PPP\$ GDP                      | n/a   | n/a |   |
| 6.1.4 | Scientific & technical articles/bn PPP\$ GDP               | 10.6  | 64  | ● |
| 6.1.5 | Citable documents H index                                  | 6.1   | 86  |   |
| 6.2   | Knowledge impact   | 28.5  | 75  | ● |
| 6.2.1 | Growth rate of PPP\$ GDP/worker, %                         | 2.4   | 33  | ● |
| 6.2.2 | New businesses/th pop. 15–64                               | n/a   | n/a |   |
| 6.2.3 | Computer software spending, % GDP                          | 0.2   | 76  |   |
| 6.2.4 | ISO 9001 quality certificates/bn PPP\$ GDP                 | 0.9   | 110 |   |
| 6.2.5 | High- & medium-high-tech manufactures, % <sup>Ⓔ</sup>      | 0.0   | 96  | ○ |
| 6.3   | Knowledge diffusion  | 12.7  | 122 | ○ |
| 6.3.1 | Intellectual property receipts, % total trade <sup>Ⓔ</sup> | 0.0   | 96  |   |
| 6.3.2 | High-tech exports less re-exports, % total trade           | 0.2   | 102 |   |
| 6.3.3 | ICT services exports, % total trade <sup>Ⓔ</sup>           | 1.3   | 74  | ● |
| 6.3.4 | FDI net outflows, % GDP                                    | (0.4) | 119 | ○ |

**7 Creative outputs** 16.7 117

|       |   |      |     |   |
|-------|---|------|-----|---|
| 7.1   | Intangible assets   | 28.3 | 111 |   |
| 7.1.1 | Trademarks by origin/bn PPP\$ GDP                                   | 7.3  | 109 | ○ |
| 7.1.2 | Industrial designs by origin/bn PPP\$ GDP                           | 0.4  | 87  |   |
| 7.1.3 | ICTs & business model creation <sup>†</sup>                         | 51.3 | 95  |   |
| 7.1.4 | ICTs & organizational model creation <sup>†</sup>                   | 43.7 | 98  |   |
| 7.2   | Creative goods & services   | 7.6  | 97  |   |
| 7.2.1 | Cultural & creative services exports, % of total trade <sup>Ⓔ</sup> | 0.1  | 64  |   |
| 7.2.2 | National feature films/mn pop. 15–69 <sup>Ⓔ</sup>                   | 1.8  | 63  | ● |
| 7.2.3 | Global ent. & media market/th pop. 15–69                            | n/a  | n/a |   |
| 7.2.4 | Printing & publishing manufactures, % <sup>Ⓔ</sup>                  | 1.3  | 41  | ● |
| 7.2.5 | Creative goods exports, % total trade                               | 0.0  | 118 | ○ |
| 7.3   | Online creativity   | 2.4  | 120 | ○ |
| 7.3.1 | Generic top-level domains (TLDs)/th pop. 15–69                      | 0.2  | 116 |   |
| 7.3.2 | Country-code TLDs/th pop. 15–69                                     | 0.3  | 100 |   |
| 7.3.3 | Wikipedia edits/mn pop. 15–69 <sup>Ⓔ</sup>                          | 0.7  | 119 | ○ |
| 7.3.4 | Video uploads on YouTube/pop. 15–69                                 | n/a  | n/a |   |

NOTES: ● indicates a strength; ○ a weakness; \* an index; † a survey question.

Ⓔ indicates that the country's data are older than the base year; see Appendix II for details, including the year of the data, at <http://globalinnovationindex.org>.

Square brackets indicate that the data minimum coverage (DMC) requirements were not met at the sub-pillar or pillar level; see page 181 of this appendix for details.

## Key indicators

|                            |                  |
|----------------------------|------------------|
| Population (millions)..... | 36.3             |
| GDP (US\$ billions).....   | 1,532.3          |
| GDP per capita, PPP\$..... | 45,552.6         |
| Income group.....          | High income      |
| Region.....                | Northern America |

|  | Score 0–100<br>or value (hard data) | Rank      |
|--|-------------------------------------|-----------|
| <b>Global Innovation Index (out of 127).....</b> | <b>53.7</b>                         | <b>18</b> |
| Innovation Output Sub-Index.....                 | 41.7                                | 23        |
| Innovation Input Sub-Index.....                  | 65.6                                | 10        |
| Innovation Efficiency Ratio.....                 | 0.6                                 | 59        |
| Global Innovation Index 2016 (out of 128).....   | 54.7                                | 15        |

|  |             |            |
|--|-------------|------------|
| <b>1 Institutions.....</b>   | <b>91.0</b> | <b>7</b>   |
| 1.1 Political environment.....   | 90.7        | 6 ●        |
| 1.1.1 Political stability & safety*.....                               | 94.0        | 5 ●        |
| 1.1.2 Government effectiveness*.....                                   | 87.5        | 11         |
| 1.2 Regulatory environment.....  | 92.7        | 10         |
| 1.2.1 Regulatory quality*.....   | 85.8        | 12         |
| 1.2.2 Rule of law*.....  | 93.1        | 11         |
| 1.2.3 Cost of redundancy dismissal, salary weeks.....                  | 10.0        | 31         |
| 1.3 Business environment.....  | 89.5        | 7          |
| 1.3.1 Ease of starting a business*.....                                | 98.2        | 2 ●        |
| 1.3.2 Ease of resolving insolvency*.....                               | 81.4        | 14         |
| 1.3.3 Ease of paying taxes*.....                                       | 88.9        | 16         |
| <b>2 Human capital &amp; research.....</b>                             | <b>53.3</b> | <b>20</b>  |
| 2.1 Education.....   | 44.9        | 74 ○       |
| 2.1.1 Expenditure on education, % GDP <sup>Ⓢ</sup> .....               | 5.3         | 40         |
| 2.1.2 Gov't expenditure/pupil, secondary, % GDP/cap <sup>Ⓢ</sup> ..... | 18.3        | 60 ○       |
| 2.1.3 School life expectancy, years.....                               | n/a         | n/a        |
| 2.1.4 PISA scales in reading, maths, & science.....                    | 523.3       | 5          |
| 2.1.5 Pupil-teacher ratio, secondary.....                              | n/a         | n/a        |
| 2.2 Tertiary education.....  | n/a         | n/a        |
| 2.2.1 Tertiary enrolment, % gross.....                                 | n/a         | n/a        |
| 2.2.2 Graduates in science & engineering, %.....                       | n/a         | n/a        |
| 2.2.3 Tertiary inbound mobility, %.....                                | n/a         | n/a        |
| 2.3 Research & development (R&D).....                                  | 61.8        | 15         |
| 2.3.1 Researchers, FTE/mn pop. <sup>Ⓢ</sup> .....                      | 4,518.5     | 16         |
| 2.3.2 Gross expenditure on R&D, % GDP <sup>Ⓢ</sup> .....               | 1.6         | 22         |
| 2.3.3 Global R&D companies, avg. expend. top 3, mn \$US.....           | 73.2        | 16         |
| 2.3.4 QS university ranking, average score top 3*.....                 | 82.0        | 5 ●        |
| <b>3 Infrastructure.....</b>   | <b>62.1</b> | <b>18</b>  |
| 3.1 Information & communication technologies (ICTs).....               | 83.9        | 12         |
| 3.1.1 ICT access*.....   | 79.9        | 25         |
| 3.1.2 ICT use*.....  | 68.5        | 24         |
| 3.1.3 Government's online service*.....                                | 95.7        | 4 ●        |
| 3.1.4 E-participation*.....  | 91.5        | 8          |
| 3.2 General infrastructure.....  | 59.7        | 7          |
| 3.2.1 Electricity output, kWh/cap.....                                 | 17,594.1    | 5 ●        |
| 3.2.2 Logistics performance*.....                                      | 86.4        | 14         |
| 3.2.3 Gross capital formation, % GDP.....                              | 23.1        | 56         |
| 3.3 Ecological sustainability.....                                     | 42.6        | 75 ○       |
| 3.3.1 GDP/unit of energy use.....                                      | 5.6         | 97 ○       |
| 3.3.2 Environmental performance*.....                                  | 85.1        | 25         |
| 3.3.3 ISO 14001 environmental certificates/bn PPP\$ GDP.....           | 0.8         | 73 ○       |
| <b>4 Market sophistication.....</b>                                    | <b>73.7</b> | <b>3 ●</b> |
| 4.1 Credit.....  | 67.3        | 8          |
| 4.1.1 Ease of getting credit*.....                                     | 85.0        | 7          |
| 4.1.2 Domestic credit to private sector, % GDP <sup>Ⓢ</sup> .....      | 124.4       | 18         |
| 4.1.3 Microfinance gross loans, % GDP.....                             | n/a         | n/a        |

|   |         |     |
|---|---------|-----|
| 4.2 Investment.....                                     | 74.3    | 2 ● |
| 4.2.1 Ease of protecting minority investors*.....       | 76.7    | 7   |
| 4.2.2 Market capitalization, % GDP.....                 | 102.8   | 8   |
| 4.2.3 Venture capital deals/bn PPP\$ GDP.....           | 0.5     | 1 ● |
| 4.3 Trade, competition, & market scale.....             | 79.4    | 9   |
| 4.3.1 Applied tariff rate, weighted mean, %.....        | 1.0     | 11  |
| 4.3.2 Intensity of local competition <sup>†</sup> ..... | 74.1    | 31  |
| 4.3.3 Domestic market scale, bn PPP\$.....              | 1,674.3 | 16  |

**5 Business sophistication..... 47.8 24**

|   |      |      |
|---|------|------|
| 5.1 Knowledge workers.....  | 56.7 | 27   |
| 5.1.1 Knowledge-intensive employment, % <sup>Ⓢ</sup> .....          | 43.7 | 18   |
| 5.1.2 Firms offering formal training, % firms.....                  | n/a  | n/a  |
| 5.1.3 GERD performed by business, % of GDP <sup>Ⓢ</sup> .....       | 0.8  | 24   |
| 5.1.4 GERD financed by business, % <sup>Ⓢ</sup> .....               | 45.4 | 27   |
| 5.1.5 Females employed w/advanced degrees, % total.....             | 17.0 | 30   |
| 5.2 Innovation linkages.....  | 41.5 | 27   |
| 5.2.1 University/industry research collaboration <sup>†</sup> ..... | 59.6 | 22   |
| 5.2.2 State of cluster development <sup>†</sup> .....               | 61.9 | 19   |
| 5.2.3 GERD financed by abroad, % <sup>Ⓢ</sup> .....                 | 6.0  | 61 ○ |
| 5.2.4 JV-strategic alliance deals/bn PPP\$ GDP.....                 | 0.2  | 5 ●  |
| 5.2.5 Patent families 2+ offices/bn PPP\$ GDP.....                  | 2.9  | 18   |
| 5.3 Knowledge absorption.....                                       | 45.3 | 21   |
| 5.3.1 Intellectual property payments, % total trade.....            | 1.8  | 12   |
| 5.3.2 High-tech imports less re-imports, % total trade.....         | 11.1 | 32   |
| 5.3.3 ICT services imports, % total trade.....                      | 0.9  | 70 ○ |
| 5.3.4 FDI net inflows, % GDP.....                                   | 3.7  | 42   |
| 5.3.5 Research talent, % in business enterprise <sup>Ⓢ</sup> .....  | 56.0 | 18   |

**6 Knowledge & technology outputs..... 38.7 19**

|   |      |      |
|---|------|------|
| 6.1 Knowledge creation.....                                 | 40.6 | 21   |
| 6.1.1 Patents by origin/bn PPP\$ GDP.....                   | 2.6  | 39   |
| 6.1.2 PCT patent applications/bn PPP\$ GDP.....             | 1.4  | 24   |
| 6.1.3 Utility models by origin/bn PPP\$ GDP.....            | n/a  | n/a  |
| 6.1.4 Scientific & technical articles/bn PPP\$ GDP.....     | 37.2 | 17   |
| 6.1.5 Citable documents H index.....                        | 77.9 | 5 ●  |
| 6.2 Knowledge impact.....                                   | 36.2 | 44   |
| 6.2.1 Growth rate of PPP\$ GDP/worker, %.....               | 0.3  | 75 ○ |
| 6.2.2 New businesses/th pop. 15–64.....                     | 1.3  | 61 ○ |
| 6.2.3 Computer software spending, % GDP.....                | 0.8  | 3 ●  |
| 6.2.4 ISO 9001 quality certificates/bn PPP\$ GDP.....       | 3.9  | 70 ○ |
| 6.2.5 High- & medium-high-tech manufactures, %.....         | 0.3  | 38   |
| 6.3 Knowledge diffusion.....                                | 39.1 | 23   |
| 6.3.1 Intellectual property receipts, % total trade.....    | 0.8  | 18   |
| 6.3.2 High-tech exports less re-exports, % total trade..... | 5.6  | 32   |
| 6.3.3 ICT services exports, % total trade.....              | 1.5  | 69   |
| 6.3.4 FDI net outflows, % GDP.....                          | 3.8  | 13   |

**7 Creative outputs..... 44.8 27**

|   |      |      |
|---|------|------|
| 7.1 Intangible assets.....  | 50.8 | 35   |
| 7.1.1 Trademarks by origin/bn PPP\$ GDP.....                                    | 51.1 | 45   |
| 7.1.2 Industrial designs by origin/bn PPP\$ GDP.....                            | 0.5  | 79 ○ |
| 7.1.3 ICTs & business model creation <sup>†</sup> .....                         | 75.8 | 23   |
| 7.1.4 ICTs & organizational model creation <sup>†</sup> .....                   | 74.8 | 12   |
| 7.2 Creative goods & services.....  | 20.7 | 57   |
| 7.2.1 Cultural & creative services exports, % of total trade <sup>Ⓢ</sup> ..... | 0.7  | 23   |
| 7.2.2 National feature films/mn pop. 15–69.....                                 | 3.9  | 50   |
| 7.2.3 Global ent. & media market/th pop. 15–69.....                             | 55.6 | 14   |
| 7.2.4 Printing & publishing manufactures, %.....                                | 0.4  | 94 ○ |
| 7.2.5 Creative goods exports, % total trade.....                                | 0.6  | 54   |
| 7.3 Online creativity.....  | 56.9 | 11   |
| 7.3.1 Generic top-level domains (TLDs)/th pop. 15–69.....                       | 76.4 | 6 ●  |
| 7.3.2 Country-code TLDs/th pop. 15–69.....                                      | 28.7 | 21   |
| 7.3.3 Wikipedia edits/mn pop. 15–69.....  | 6.6  | 23   |
| 7.3.4 Video uploads on YouTube/pop. 15–69.....                                  | 58.6 | 9    |

NOTES: ● indicates a strength; ○ a weakness; \* an index; † a survey question.

Ⓢ indicates that the country's data are older than the base year; see Appendix II for details, including the year of the data, at <http://globalinnovationindex.org>.

Square brackets indicate that the data minimum coverage (DMC) requirements were not met at the sub-pillar or pillar level; see page 181 of this appendix for details.

## Key indicators

|                            |                                 |
|----------------------------|---------------------------------|
| Population (millions)..... | 18.1                            |
| GDP (US\$ billions).....   | 234.9                           |
| GDP per capita, PPP\$..... | 23,459.6                        |
| Income group.....          | High income                     |
| Region.....                | Latin America and the Caribbean |

|  | Score 0–100<br>or value (hard data) | Rank      |
|--|-------------------------------------|-----------|
| <b>Global Innovation Index (out of 127).....</b> | <b>38.7</b>                         | <b>46</b> |
| Innovation Output Sub-Index.....                 | 29.1                                | 53        |
| Innovation Input Sub-Index.....                  | 48.3                                | 42        |
| Innovation Efficiency Ratio.....                 | 0.6                                 | 77        |
| Global Innovation Index 2016 (out of 128).....   | 38.4                                | 44        |

|  |             |           |
|--|-------------|-----------|
| <b>1 Institutions.....</b>                                     | <b>70.3</b> | <b>41</b> |
| 1.1 Political environment.....                                 | 71.8        | 38        |
| 1.1.1 Political stability & safety*.....                       | 73.6        | 44        |
| 1.1.2 Government effectiveness*.....                           | 69.9        | 29        |
| 1.2 Regulatory environment.....                                | 69.6        | 45        |
| 1.2.1 Regulatory quality*.....                                 | 76.7        | 18 ●      |
| 1.2.2 Rule of law*.....  | 78.4        | 22 ●      |
| 1.2.3 Cost of redundancy dismissal, salary weeks.....          | 27.4        | 107 ○     |
| 1.3 Business environment.....                                  | 69.7        | 68        |
| 1.3.1 Ease of starting a business*.....                        | 89.8        | 50        |
| 1.3.2 Ease of resolving insolvency*.....                       | 55.5        | 52        |
| 1.3.3 Ease of paying taxes*.....                               | 63.9        | 87        |
| <b>2 Human capital &amp; research.....</b>                     | <b>32.8</b> | <b>61</b> |
| 2.1 Education.....   | 46.5        | 65        |
| 2.1.1 Expenditure on education, % GDP.....                     | 4.8         | 60        |
| 2.1.2 Gov't expenditure/pupil, secondary, % GDP/cap.....       | 15.2        | 80 ○      |
| 2.1.3 School life expectancy, years.....                       | 16.5        | 22        |
| 2.1.4 PISA scales in reading, maths, & science.....            | 442.7       | 44        |
| 2.1.5 Pupil-teacher ratio, secondary <sup>Ⓐ</sup> .....        | 21.0        | 83 ○      |
| 2.2 Tertiary education.....                                    | 37.7        | 55        |
| 2.2.1 Tertiary enrolment, % gross.....                         | 88.6        | 5 ●       |
| 2.2.2 Graduates in science & engineering, % <sup>Ⓐ</sup> ..... | 19.2        | 62        |
| 2.2.3 Tertiary inbound mobility, %.....                        | 0.3         | 96 ○      |
| 2.3 Research & development (R&D).....                          | 14.1        | 50        |
| 2.3.1 Researchers, FTE/mn pop.....                             | 455.5       | 64        |
| 2.3.2 Gross expenditure on R&D, % GDP.....                     | 0.4         | 71        |
| 2.3.3 Global R&D companies, avg. expend. top 3, mn \$US.....   | 0.0         | 43 ○      |
| 2.3.4 QS university ranking, average score top 3*.....         | 42.5        | 31        |
| <b>3 Infrastructure.....</b>                                   | <b>52.1</b> | <b>47</b> |
| 3.1 Information & communication technologies (ICTs).....       | 67.3        | 40        |
| 3.1.1 ICT access*.....   | 68.1        | 56        |
| 3.1.2 ICT use*.....  | 49.1        | 59        |
| 3.1.3 Government's online service*.....                        | 77.5        | 28        |
| 3.1.4 E-participation*.....                                    | 74.6        | 32        |
| 3.2 General infrastructure.....                                | 38.8        | 54        |
| 3.2.1 Electricity output, kWh/cap.....                         | 4,118.8     | 52        |
| 3.2.2 Logistics performance*.....                              | 54.8        | 45        |
| 3.2.3 Gross capital formation, % GDP.....                      | 22.3        | 63        |
| 3.3 Ecological sustainability.....                             | 50.1        | 46        |
| 3.3.1 GDP/unit of energy use.....                              | 10.4        | 43        |
| 3.3.2 Environmental performance*.....                          | 77.7        | 51        |
| 3.3.3 ISO 14001 environmental certificates/bn PPP\$ GDP.....   | 2.9         | 39        |
| <b>4 Market sophistication.....</b>                            | <b>49.8</b> | <b>50</b> |
| 4.1 Credit.....  | 35.8        | 61        |
| 4.1.1 Ease of getting credit*.....                             | 50.0        | 72        |
| 4.1.2 Domestic credit to private sector, % GDP.....            | 111.0       | 24 ●      |
| 4.1.3 Microfinance gross loans, % GDP.....                     | 0.7         | 28        |

|  |             |           |
|--|-------------|-----------|
| 4.2 Investment.....  | 41.6        | 58        |
| 4.2.1 Ease of protecting minority investors*.....                      | 65.0        | 31        |
| 4.2.2 Market capitalization, % GDP.....                                | 79.1        | 20        |
| 4.2.3 Venture capital deals/bn PPP\$ GDP.....                          | 0.0         | 71 ○      |
| 4.3 Trade, competition, & market scale.....                            | 72.0        | 30        |
| 4.3.1 Applied tariff rate, weighted mean, %.....                       | 0.6         | 8 ●       |
| 4.3.2 Intensity of local competition <sup>†</sup> .....                | 70.0        | 61        |
| 4.3.3 Domestic market scale, bn PPP\$.....                             | 436.1       | 41        |
| <b>5 Business sophistication.....</b>                                  | <b>36.5</b> | <b>46</b> |
| 5.1 Knowledge workers.....   | 46.0        | 44        |
| 5.1.1 Knowledge-intensive employment, %.....                           | 25.0        | 54        |
| 5.1.2 Firms offering formal training, % firms <sup>Ⓐ</sup> .....       | 57.5        | 10 ●      |
| 5.1.3 GERD performed by business, % of GDP.....                        | 0.1         | 58        |
| 5.1.4 GERD financed by business, %.....                                | 32.8        | 46        |
| 5.1.5 Females employed w/advanced degrees, % total.....                | 15.9        | 38        |
| 5.2 Innovation linkages.....   | 24.9        | 74        |
| 5.2.1 University/industry research collaboration <sup>†</sup> .....    | 41.1        | 61        |
| 5.2.2 State of cluster development <sup>†</sup> .....                  | 39.8        | 85 ○      |
| 5.2.3 GERD financed by abroad, %.....                                  | 12.9        | 37        |
| 5.2.4 JV-strategic alliance deals/bn PPP\$ GDP.....                    | 0.0         | 54        |
| 5.2.5 Patent families 2+ offices/bn PPP\$ GDP.....                     | 0.2         | 49        |
| 5.3 Knowledge absorption.....  | 38.7        | 37        |
| 5.3.1 Intellectual property payments, % total trade <sup>Ⓐ</sup> ..... | 1.8         | 11 ●      |
| 5.3.2 High-tech imports less re-imports, % total trade.....            | 10.3        | 40        |
| 5.3.3 ICT services imports, % total trade <sup>Ⓐ</sup> .....           | 0.8         | 75        |
| 5.3.4 FDI net inflows, % GDP.....                                      | 8.0         | 16 ●      |
| 5.3.5 Research talent, % in business enterprise.....                   | 27.4        | 48        |
| <b>6 Knowledge &amp; technology outputs.....</b>                       | <b>26.0</b> | <b>49</b> |
| 6.1 Knowledge creation.....  | 11.1        | 61        |
| 6.1.1 Patents by origin/bn PPP\$ GDP.....                              | 1.0         | 63        |
| 6.1.2 PCT patent applications/bn PPP\$ GDP.....                        | 0.5         | 39        |
| 6.1.3 Utility models by origin/bn PPP\$ GDP.....                       | 0.2         | 42        |
| 6.1.4 Scientific & technical articles/bn PPP\$ GDP.....                | 18.5        | 41        |
| 6.1.5 Citable documents H index.....                                   | 21.3        | 37        |
| 6.2 Knowledge impact.....  | 33.8        | 52        |
| 6.2.1 Growth rate of PPP\$ GDP/worker, %.....                          | 0.3         | 77 ○      |
| 6.2.2 New businesses/th pop. 15–64.....                                | 8.0         | 14 ●      |
| 6.2.3 Computer software spending, % GDP.....                           | 0.3         | 49        |
| 6.2.4 ISO 9001 quality certificates/bn PPP\$ GDP.....                  | 12.5        | 28        |
| 6.2.5 High- & medium-high-tech manufactures, % <sup>Ⓐ</sup> .....      | 0.2         | 63        |
| 6.3 Knowledge diffusion.....   | 33.3        | 34        |
| 6.3.1 Intellectual property receipts, % total trade <sup>Ⓐ</sup> ..... | 0.1         | 52        |
| 6.3.2 High-tech exports less re-exports, % total trade.....            | 0.8         | 70        |
| 6.3.3 ICT services exports, % total trade <sup>Ⓐ</sup> .....           | 0.5         | 99 ○      |
| 6.3.4 FDI net outflows, % GDP.....                                     | 5.0         | 10 ●      |
| <b>7 Creative outputs.....</b>   | <b>32.1</b> | <b>59</b> |
| 7.1 Intangible assets.....   | 46.3        | 51        |
| 7.1.1 Trademarks by origin/bn PPP\$ GDP.....                           | 68.3        | 27        |
| 7.1.2 Industrial designs by origin/bn PPP\$ GDP.....                   | 0.1         | 106 ○     |
| 7.1.3 ICTs & business model creation <sup>†</sup> .....                | 71.5        | 28        |
| 7.1.4 ICTs & organizational model creation <sup>†</sup> .....          | 55.4        | 54        |
| 7.2 Creative goods & services.....                                     | 10.1        | 89 ○      |
| 7.2.1 Cultural & creative services exports, % of total trade.....      | n/a         | n/a       |
| 7.2.2 National feature films/mn pop. 15–69.....                        | 2.9         | 56        |
| 7.2.3 Global ent. & media market/th pop. 15–69.....                    | 11.2        | 33        |
| 7.2.4 Printing & publishing manufactures, % <sup>Ⓐ</sup> .....         | 1.1         | 61        |
| 7.2.5 Creative goods exports, % total trade.....                       | 0.2         | 82        |
| 7.3 Online creativity.....   | 26.0        | 45        |
| 7.3.1 Generic top-level domains (TLDs)/th pop. 15–69.....              | 2.2         | 75        |
| 7.3.2 Country-code TLDs/th pop. 15–69.....                             | 11.8        | 37        |
| 7.3.3 Wikipedia edits/mn pop. 15–69.....                               | 5.6         | 49        |
| 7.3.4 Video uploads on YouTube/pop. 15–69.....                         | 36.0        | 38        |

NOTES: ● indicates a strength; ○ a weakness; \* an index; † a survey question.

Ⓐ indicates that the country's data are older than the base year; see Appendix II for details, including the year of the data, at <http://globalinnovationindex.org>.

Square brackets indicate that the data minimum coverage (DMC) requirements were not met at the sub-pillar or pillar level; see page 181 of this appendix for details.



## Key indicators

|                             |   |
|-----------------------------|---|
| Population (millions) ..... | 1,382.3                                 |
| GDP (US\$ billions) .....   | 11,391.6                                |
| GDP per capita, PPP\$ ..... | 14,107.4                                |
| Income group .....          | Upper-middle income                     |
| Region .....                | South East Asia, East Asia, and Oceania |

|   | Score 0–100<br>or value (hard data) | Rank      |
|---|-------------------------------------|-----------|
| <b>Global Innovation Index (out of 127)</b> .....             | <b>52.5</b>                         | <b>22</b> |
| Innovation Output Sub-Index .....                             | 50.9                                | 11        |
| Innovation Input Sub-Index .....                              | 54.2                                | 31        |
| Innovation Efficiency Ratio .....                             | 0.9                                 | 3 ●       |
| Global Innovation Index 2016 (out of 128) .....               | 50.6                                | 25        |
| <b>1 Institutions</b> .....                                   | <b>54.8</b>                         | <b>78</b> |
| 1.1 Political environment .....                               | 51.6                                | 64        |
| 1.1.1 Political stability & safety* .....                     | 50.2                                | 90        |
| 1.1.2 Government effectiveness* .....                         | 53.0                                | 47        |
| 1.2 Regulatory environment .....                              | 47.0                                | 107 ○     |
| 1.2.1 Regulatory quality* .....                               | 35.3                                | 87        |
| 1.2.2 Rule of law* .....                                      | 29.6                                | 78        |
| 1.2.3 Cost of redundancy dismissal, salary weeks .....        | 27.4                                | 107 ○     |
| 1.3 Business environment .....                                | 65.8                                | 75        |
| 1.3.1 Ease of starting a business* .....                      | 81.0                                | 96        |
| 1.3.2 Ease of resolving insolvency* .....                     | 55.8                                | 50        |
| 1.3.3 Ease of paying taxes* .....                             | 60.5                                | 94        |
| <b>2 Human capital &amp; research</b> .....                   | <b>49.2</b>                         | <b>25</b> |
| 2.1 Education .....   | 69.6                                | 8         |
| 2.1.1 Expenditure on education, % GDP .....                   | n/a                                 | n/a       |
| 2.1.2 Gov't expenditure/pupil, secondary, % GDP/cap .....     | n/a                                 | n/a       |
| 2.1.3 School life expectancy, years .....                     | 14.1                                | 62        |
| 2.1.4 PISA scales in reading, maths, & science .....          | 514.3                               | 8         |
| 2.1.5 Pupil-teacher ratio, secondary .....                    | 13.8                                | 55        |
| 2.2 Tertiary education .....                                  | 19.5                                | 104 ○     |
| 2.2.1 Tertiary enrolment, % gross .....                       | 43.4                                | 62        |
| 2.2.2 Graduates in science & engineering, % .....             | n/a                                 | n/a       |
| 2.2.3 Tertiary inbound mobility, % .....                      | 0.3                                 | 98 ○      |
| 2.3 Research & development (R&D) .....                        | 58.5                                | 17        |
| 2.3.1 Researchers, FTE/mn pop. .....                          | 1,176.6                             | 45        |
| 2.3.2 Gross expenditure on R&D, % GDP .....                   | 2.1                                 | 17        |
| 2.3.3 Global R&D companies, avg. expend. top 3, mn \$US ..... | 89.1                                | 6         |
| 2.3.4 QS university ranking, average score top 3* .....       | 82.2                                | 4 ●       |
| <b>3 Infrastructure</b> .....                                 | <b>57.9</b>                         | <b>27</b> |
| 3.1 Information & communication technologies (ICTs) .....     | 64.6                                | 48        |
| 3.1.1 ICT access* .....                                       | 54.5                                | 77        |
| 3.1.2 ICT use* .....  | 45.8                                | 61        |
| 3.1.3 Government's online service* .....                      | 76.8                                | 31        |
| 3.1.4 E-participation* .....                                  | 81.4                                | 22        |
| 3.2 General infrastructure .....                              | 67.5                                | 3 ●       |
| 3.2.1 Electricity output, kWh/cap .....                       | 4,152.9                             | 51        |
| 3.2.2 Logistics performance* .....                            | 73.9                                | 26        |
| 3.2.3 Gross capital formation, % GDP .....                    | 43.7                                | 3 ●       |
| 3.3 Ecological sustainability .....                           | 41.4                                | 78        |
| 3.3.1 GDP/unit of energy use .....                            | 5.5                                 | 98 ○      |
| 3.3.2 Environmental performance* .....                        | 65.1                                | 93        |
| 3.3.3 ISO 14001 environmental certificates/bn PPP\$ GDP ..... | 5.8                                 | 18        |
| <b>4 Market sophistication</b> .....                          | <b>54.7</b>                         | <b>28</b> |
| 4.1 Credit .....  | 40.5                                | 48        |
| 4.1.1 Ease of getting credit* .....                           | 60.0                                | 55        |
| 4.1.2 Domestic credit to private sector, % GDP .....          | 153.3                               | 7         |
| 4.1.3 Microfinance gross loans, % GDP .....                   | 0.0                                 | 73 ○      |

|  |          |      |
|--|----------|------|
| 4.2 Investment .....                               | 35.0     | 85   |
| 4.2.1 Ease of protecting minority investors* ..... | 45.0     | 98 ○ |
| 4.2.2 Market capitalization, % GDP .....           | 74.4     | 21   |
| 4.2.3 Venture capital deals/bn PPP\$ GDP .....     | 0.1      | 26   |
| 4.3 Trade, competition, & market scale .....       | 88.4     | 2 ●  |
| 4.3.1 Applied tariff rate, weighted mean, % .....  | 3.4      | 76   |
| 4.3.2 Intensity of local competition† .....        | 73.5     | 35   |
| 4.3.3 Domestic market scale, bn PPP\$ .....        | 21,269.0 | 1 ●  |

|  |             |          |
|--|-------------|----------|
| <b>5 Business sophistication</b> .....                           | <b>54.5</b> | <b>9</b> |
| 5.1 Knowledge workers .....                                      | 84.9        | 1 ●      |
| 5.1.1 Knowledge-intensive employment, % .....                    | n/a         | n/a      |
| 5.1.2 Firms offering formal training, % firms <sup>Ⓔ</sup> ..... | 79.2        | 1 ●      |
| 5.1.3 GERD performed by business, % of GDP .....                 | 1.6         | 13       |
| 5.1.4 GERD financed by business, % .....                         | 74.7        | 2 ●      |
| 5.1.5 Females employed w/advanced degrees, % total .....         | n/a         | n/a      |
| 5.2 Innovation linkages .....                                    | 28.6        | 62       |
| 5.2.1 University/industry research collaboration† .....          | 55.3        | 29       |
| 5.2.2 State of cluster development† .....                        | 60.9        | 20       |
| 5.2.3 GERD financed by abroad, % .....                           | 0.7         | 90 ○     |
| 5.2.4 JV-strategic alliance deals/bn PPP\$ GDP .....             | 0.0         | 45       |
| 5.2.5 Patent families 2+ offices/bn PPP\$ GDP .....              | 0.9         | 29       |
| 5.3 Knowledge absorption .....                                   | 50.1        | 13       |
| 5.3.1 Intellectual property payments, % total trade .....        | 1.0         | 32       |
| 5.3.2 High-tech imports less re-imports, % total trade .....     | 19.3        | 6        |
| 5.3.3 ICT services imports, % total trade .....                  | 0.5         | 99 ○     |
| 5.3.4 FDI net inflows, % GDP .....                               | 2.6         | 68       |
| 5.3.5 Research talent, % in business enterprise .....            | 62.7        | 9        |

|   |             |            |
|---|-------------|------------|
| <b>6 Knowledge &amp; technology outputs</b> .....                 | <b>56.4</b> | <b>4 ●</b> |
| 6.1 Knowledge creation .....                                      | 66.0        | 5          |
| 6.1.1 Patents by origin/bn PPP\$ GDP .....                        | 49.2        | 1 ●        |
| 6.1.2 PCT patent applications/bn PPP\$ GDP .....                  | 2.0         | 17         |
| 6.1.3 Utility models by origin/bn PPP\$ GDP .....                 | 56.9        | 1 ●        |
| 6.1.4 Scientific & technical articles/bn PPP\$ GDP .....          | 14.1        | 54         |
| 6.1.5 Citable documents H index .....                             | 49.9        | 14         |
| 6.2 Knowledge impact .....  | 64.3        | 1 ●        |
| 6.2.1 Growth rate of PPP\$ GDP/worker, % .....                    | 6.6         | 2 ●        |
| 6.2.2 New businesses/th pop. 15–64 .....                          | n/a         | n/a        |
| 6.2.3 Computer software spending, % GDP .....                     | 0.4         | 26         |
| 6.2.4 ISO 9001 quality certificates/bn PPP\$ GDP .....            | 14.9        | 25         |
| 6.2.5 High- & medium-high-tech manufactures, % <sup>Ⓔ</sup> ..... | 0.4         | 14         |
| 6.3 Knowledge diffusion .....                                     | 38.8        | 24         |
| 6.3.1 Intellectual property receipts, % total trade .....         | 0.0         | 67         |
| 6.3.2 High-tech exports less re-exports, % total trade .....      | 29.4        | 1 ●        |
| 6.3.3 ICT services exports, % total trade .....                   | 1.1         | 77         |
| 6.3.4 FDI net outflows, % GDP .....                               | 1.2         | 45         |

|  |             |           |
|--|-------------|-----------|
| <b>7 Creative outputs</b> .....                                    | <b>45.3</b> | <b>26</b> |
| 7.1 Intangible assets .....  | 71.1        | 2 ●       |
| 7.1.1 Trademarks by origin/bn PPP\$ GDP .....                      | 135.0       | 4 ●       |
| 7.1.2 Industrial designs by origin/bn PPP\$ GDP .....              | 28.0        | 1 ●       |
| 7.1.3 ICTs & business model creation† .....                        | 65.4        | 46        |
| 7.1.4 ICTs & organizational model creation† .....                  | 64.4        | 29        |
| 7.2 Creative goods & services .....                                | 31.3        | 29        |
| 7.2.1 Cultural & creative services exports, % of total trade ..... | 0.0         | 70        |
| 7.2.2 National feature films/mn pop. 15–69 .....                   | 0.6         | 88 ○      |
| 7.2.3 Global ent. & media market/th pop. 15–69 .....               | 5.0         | 44        |
| 7.2.4 Printing & publishing manufactures, % <sup>Ⓔ</sup> .....     | 0.5         | 89 ○      |
| 7.2.5 Creative goods exports, % total trade .....                  | 12.8        | 1 ●       |
| 7.3 Online creativity .....  | 7.8         | 104 ○     |
| 7.3.1 Generic top-level domains (TLDs)/th pop. 15–69 .....         | 2.4         | 74        |
| 7.3.2 Country-code TLDs/th pop. 15–69 .....                        | 5.8         | 46        |
| 7.3.3 Wikipedia edits/mn pop. 15–69 .....                          | 1.6         | 110 ○     |
| 7.3.4 Video uploads on YouTube/pop. 15–69 .....                    | n/a         | n/a       |

NOTES: ● indicates a strength; ○ a weakness; \* an index; † a survey question.

Ⓔ indicates that the country's data are older than the base year; see Appendix II for details, including the year of the data, at <http://globalinnovationindex.org>.

Square brackets indicate that the data minimum coverage (DMC) requirements were not met at the sub-pillar or pillar level; see page 181 of this appendix for details.

## Colombia

## Key indicators

|                            |                                 |
|----------------------------|---------------------------------|
| Population (millions)..... | 48.7                            |
| GDP (US\$ billions).....   | 274.1                           |
| GDP per capita, PPP\$..... | 13,846.5                        |
| Income group.....          | Upper-middle income             |
| Region.....                | Latin America and the Caribbean |

|  | Score 0–100<br>or value (hard data) | Rank      |
|--|-------------------------------------|-----------|
| <b>Global Innovation Index (out of 127).....</b> | <b>34.8</b>                         | <b>65</b> |
| Innovation Output Sub-Index.....                 | 23.8                                | 75        |
| Innovation Input Sub-Index.....                  | 45.8                                | 52        |
| Innovation Efficiency Ratio.....                 | 0.5                                 | 100 ○     |
| Global Innovation Index 2016 (out of 128).....   | 34.2                                | 63        |

|   |             |           |
|---|-------------|-----------|
| <b>1 Institutions.....</b>                            | <b>58.5</b> | <b>69</b> |
| 1.1 Political environment.....                        | 39.7        | 98 ○      |
| 1.1.1 Political stability & safety*.....              | 38.1        | 113 ○     |
| 1.1.2 Government effectiveness*.....                  | 41.3        | 72        |
| 1.2 Regulatory environment.....                       | 62.4        | 68        |
| 1.2.1 Regulatory quality*.....                        | 53.7        | 52        |
| 1.2.2 Rule of law*.....                               | 30.4        | 76        |
| 1.2.3 Cost of redundancy dismissal, salary weeks..... | 16.7        | 68        |
| 1.3 Business environment.....                         | 73.4        | 57        |
| 1.3.1 Ease of starting a business*.....               | 89.6        | 52        |
| 1.3.2 Ease of resolving insolvency*.....              | 71.7        | 31        |
| 1.3.3 Ease of paying taxes*.....                      | 58.9        | 97        |

|  |             |           |
|--|-------------|-----------|
| <b>2 Human capital &amp; research.....</b>                   | <b>31.7</b> | <b>66</b> |
| 2.1 Education.....   | 39.0        | 91        |
| 2.1.1 Expenditure on education, % GDP.....                   | 4.5         | 68        |
| 2.1.2 Gov't expenditure/pupil, secondary, % GDP/cap.....     | 16.0        | 75        |
| 2.1.3 School life expectancy, years.....                     | 14.4        | 59        |
| 2.1.4 PISA scales in reading, maths, & science.....          | 410.1       | 59 ○      |
| 2.1.5 Pupil-teacher ratio, secondary.....                    | 25.6        | 95 ○      |
| 2.2 Tertiary education.....                                  | 34.1        | 69        |
| 2.2.1 Tertiary enrolment, % gross.....                       | 55.6        | 47        |
| 2.2.2 Graduates in science & engineering, %.....             | 22.7        | 38        |
| 2.2.3 Tertiary inbound mobility, %.....                      | 0.2         | 101 ○     |
| 2.3 Research & development (R&D).....                        | 22.1        | 43        |
| 2.3.1 Researchers, FTE/mn pop. <sup>Ⓔ</sup> .....            | 114.9       | 84 ○      |
| 2.3.2 Gross expenditure on R&D, % GDP.....                   | 0.2         | 86 ○      |
| 2.3.3 Global R&D companies, avg. expend. top 3, mn \$US..... | 46.0        | 33        |
| 2.3.4 QS university ranking, average score top 3*.....       | 35.9        | 34        |

|  |             |           |
|--|-------------|-----------|
| <b>3 Infrastructure.....</b>                                 | <b>52.5</b> | <b>44</b> |
| 3.1 Information & communication technologies (ICTs).....     | 63.0        | 52        |
| 3.1.1 ICT access*.....                                       | 58.3        | 73        |
| 3.1.2 ICT use*.....  | 38.5        | 72        |
| 3.1.3 Government's online service*.....                      | 79.0        | 27        |
| 3.1.4 E-participation*.....                                  | 76.3        | 27        |
| 3.2 General infrastructure.....                              | 32.1        | 86        |
| 3.2.1 Electricity output, kWh/cap.....                       | 1,463.1     | 89        |
| 3.2.2 Logistics performance*.....                            | 25.4        | 92        |
| 3.2.3 Gross capital formation, % GDP.....                    | 25.0        | 44        |
| 3.3 Ecological sustainability.....                           | 62.4        | 13 ●      |
| 3.3.1 GDP/unit of energy use.....                            | 17.5        | 4 ●       |
| 3.3.2 Environmental performance*.....                        | 75.9        | 55        |
| 3.3.3 ISO 14001 environmental certificates/bn PPP\$ GDP..... | 4.2         | 23 ●      |

|   |             |           |
|---|-------------|-----------|
| <b>4 Market sophistication.....</b>                 | <b>53.1</b> | <b>31</b> |
| 4.1 Credit.....                                     | 48.0        | 33        |
| 4.1.1 Ease of getting credit*.....                  | 95.0        | 2 ●       |
| 4.1.2 Domestic credit to private sector, % GDP..... | 47.1        | 74        |
| 4.1.3 Microfinance gross loans, % GDP.....          | 1.7         | 17 ●      |

|  |       |      |
|--|-------|------|
| 4.2 Investment.....  | 40.6  | 61   |
| 4.2.1 Ease of protecting minority investors*.....              | 73.3  | 13 ● |
| 4.2.2 Market capitalization, % GDP.....                        | 29.4  | 49   |
| 4.2.3 Venture capital deals/bn PPP\$ GDP.....                  | 0.0   | 69   |
| 4.3 Trade, competition, & market scale.....                    | 70.7  | 33   |
| 4.3.1 Applied tariff rate, weighted mean, % <sup>Ⓔ</sup> ..... | 4.2   | 81   |
| 4.3.2 Intensity of local competition <sup>†</sup> .....        | 76.3  | 23 ● |
| 4.3.3 Domestic market scale, bn PPP\$.....                     | 690.4 | 30   |

|   |             |           |
|---|-------------|-----------|
| <b>5 Business sophistication.....</b>                                 | <b>32.9</b> | <b>64</b> |
| 5.1 Knowledge workers.....  | 43.0        | 48        |
| 5.1.1 Knowledge-intensive employment, % <sup>Ⓔ</sup> .....            | 16.8        | 83 ○      |
| 5.1.2 Firms offering formal training, % firms <sup>Ⓔ</sup> .....      | 65.1        | 4 ●       |
| 5.1.3 GERD performed by business, % of GDP.....                       | 0.1         | 63        |
| 5.1.4 GERD financed by business, %.....                               | 33.6        | 44        |
| 5.1.5 Females employed w/advanced degrees, % total <sup>Ⓔ</sup> ..... | 12.1        | 58        |
| 5.2 Innovation linkages.....  | 20.5        | 103 ○     |
| 5.2.1 University/industry research collaboration <sup>†</sup> .....   | 44.3        | 46        |
| 5.2.2 State of cluster development <sup>†</sup> .....                 | 43.5        | 75        |
| 5.2.3 GERD financed by abroad, %.....                                 | 2.4         | 72        |
| 5.2.4 JV-strategic alliance deals/bn PPP\$ GDP.....                   | 0.0         | 88 ○      |
| 5.2.5 Patent families 2+ offices/bn PPP\$ GDP.....                    | 0.1         | 66        |
| 5.3 Knowledge absorption.....   | 35.3        | 52        |
| 5.3.1 Intellectual property payments, % total trade.....              | 0.8         | 42        |
| 5.3.2 High-tech imports less re-imports, % total trade.....           | 18.7        | 8 ●       |
| 5.3.3 ICT services imports, % total trade.....                        | 0.9         | 71        |
| 5.3.4 FDI net inflows, % GDP.....                                     | 4.2         | 35        |
| 5.3.5 Research talent, % in business enterprise <sup>Ⓔ</sup> .....    | 0.6         | 80 ○      |

|   |             |           |
|---|-------------|-----------|
| <b>6 Knowledge &amp; technology outputs.....</b>                  | <b>19.1</b> | <b>81</b> |
| 6.1 Knowledge creation.....                                       | 6.5         | 78        |
| 6.1.1 Patents by origin/bn PPP\$ GDP.....                         | 0.5         | 77        |
| 6.1.2 PCT patent applications/bn PPP\$ GDP.....                   | 0.1         | 58        |
| 6.1.3 Utility models by origin/bn PPP\$ GDP.....                  | 0.3         | 39        |
| 6.1.4 Scientific & technical articles/bn PPP\$ GDP.....           | 6.0         | 91        |
| 6.1.5 Citable documents H index.....                              | 14.7        | 48        |
| 6.2 Knowledge impact.....   | 30.4        | 69        |
| 6.2.1 Growth rate of PPP\$ GDP/worker, %.....                     | 0.7         | 68        |
| 6.2.2 New businesses/th pop. 15–64 <sup>Ⓔ</sup> .....             | 2.0         | 48        |
| 6.2.3 Computer software spending, % GDP.....                      | 0.2         | 69        |
| 6.2.4 ISO 9001 quality certificates/bn PPP\$ GDP.....             | 18.5        | 21 ●      |
| 6.2.5 High- & medium-high-tech manufactures, % <sup>Ⓔ</sup> ..... | 0.2         | 58        |
| 6.3 Knowledge diffusion.....                                      | 20.3        | 75        |
| 6.3.1 Intellectual property receipts, % total trade.....          | 0.1         | 56        |
| 6.3.2 High-tech exports less re-exports, % total trade.....       | 1.5         | 60        |
| 6.3.3 ICT services exports, % total trade.....                    | 0.5         | 100 ○     |
| 6.3.4 FDI net outflows, % GDP.....                                | 1.5         | 40        |

|   |             |           |
|---|-------------|-----------|
| <b>7 Creative outputs.....</b>  | <b>28.6</b> | <b>73</b> |
| 7.1 Intangible assets.....  | 39.5        | 76        |
| 7.1.1 Trademarks by origin/bn PPP\$ GDP.....                                    | 36.2        | 62        |
| 7.1.2 Industrial designs by origin/bn PPP\$ GDP.....                            | 0.5         | 76        |
| 7.1.3 ICTs & business model creation <sup>†</sup> .....                         | 61.5        | 58        |
| 7.1.4 ICTs & organizational model creation <sup>†</sup> .....                   | 57.2        | 47        |
| 7.2 Creative goods & services.....  | 14.1        | 75        |
| 7.2.1 Cultural & creative services exports, % of total trade <sup>Ⓔ</sup> ..... | 0.1         | 51        |
| 7.2.2 National feature films/mn pop. 15–69.....                                 | 1.6         | 66        |
| 7.2.3 Global ent. & media market/th pop. 15–69.....                             | 4.7         | 47        |
| 7.2.4 Printing & publishing manufactures, % <sup>Ⓔ</sup> .....                  | 2.2         | 18 ●      |
| 7.2.5 Creative goods exports, % total trade.....                                | 0.2         | 71        |
| 7.3 Online creativity.....  | 21.1        | 59        |
| 7.3.1 Generic top-level domains (TLDs)/th pop. 15–69.....                       | 2.9         | 67        |
| 7.3.2 Country-code TLDs/th pop. 15–69.....                                      | 17.2        | 31        |
| 7.3.3 Wikipedia edits/mn pop. 15–69.....  | 4.2         | 76        |
| 7.3.4 Video uploads on YouTube/pop. 15–69.....                                  | 23.4        | 54        |

NOTES: ● indicates a strength; ○ a weakness; \* an index; † a survey question.

Ⓔ indicates that the country's data are older than the base year; see Appendix II for details, including the year of the data, at <http://globalinnovationindex.org>.

Square brackets indicate that the data minimum coverage (DMC) requirements were not met at the sub-pillar or pillar level; see page 181 of this appendix for details.



## Key indicators

|                            |                                 |
|----------------------------|---------------------------------|
| Population (millions)..... | 4.9                             |
| GDP (US\$ billions).....   | 57.7                            |
| GDP per capita, PPP\$..... | 15,482.3                        |
| Income group.....          | Upper-middle income             |
| Region.....                | Latin America and the Caribbean |

|  | Score 0–100<br>or value (hard data) | Rank      |
|--|-------------------------------------|-----------|
| <b>Global Innovation Index (out of 127).....</b> | <b>37.1</b>                         | <b>53</b> |
| Innovation Output Sub-Index.....                 | 30.2                                | 50        |
| Innovation Input Sub-Index.....                  | 44.0                                | 57        |
| Innovation Efficiency Ratio.....                 | 0.7                                 | 43        |
| Global Innovation Index 2016 (out of 128).....   | 38.4                                | 45        |

**1 Institutions.....66.0 56**

|   |      |    |
|---|------|----|
| 1.1 Political environment.....                        | 64.9 | 44 |
| 1.1.1 Political stability & safety*.....              | 77.9 | 38 |
| 1.1.2 Government effectiveness*.....                  | 51.9 | 49 |
| 1.2 Regulatory environment.....                       | 66.4 | 56 |
| 1.2.1 Regulatory quality*.....                        | 54.7 | 49 |
| 1.2.2 Rule of law*.....                               | 53.4 | 42 |
| 1.2.3 Cost of redundancy dismissal, salary weeks..... | 18.7 | 76 |
| 1.3 Business environment.....                         | 66.7 | 72 |
| 1.3.1 Ease of starting a business*.....               | 81.6 | 95 |
| 1.3.2 Ease of resolving insolvency*.....              | 39.6 | 95 |
| 1.3.3 Ease of paying taxes*.....                      | 79.0 | 53 |

**2 Human capital & research.....32.7 62**

|  |       |      |
|--|-------|------|
| 2.1 Education.....   | 57.9  | 33   |
| 2.1.1 Expenditure on education, % GDP.....                   | 7.6   | 8 ●  |
| 2.1.2 Gov't expenditure/pupil, secondary, % GDP/cap.....     | 26.7  | 21   |
| 2.1.3 School life expectancy, years.....                     | 15.2  | 43   |
| 2.1.4 PISA scales in reading, maths, & science.....          | 415.8 | 54   |
| 2.1.5 Pupil-teacher ratio, secondary.....                    | 14.0  | 57   |
| 2.2 Tertiary education.....                                  | 30.7  | 78   |
| 2.2.1 Tertiary enrolment, % gross.....                       | 53.6  | 49   |
| 2.2.2 Graduates in science & engineering, %.....             | 13.1  | 91 ○ |
| 2.2.3 Tertiary inbound mobility, %.....                      | n/a   | n/a  |
| 2.3 Research & development (R&D).....                        | 9.5   | 59   |
| 2.3.1 Researchers, FTE/mn pop. <sup>Ⓐ</sup> .....            | 573.0 | 62   |
| 2.3.2 Gross expenditure on R&D, % GDP <sup>Ⓐ</sup> .....     | 0.6   | 57   |
| 2.3.3 Global R&D companies, avg. expend. top 3, mn \$US..... | 0.0   | 43 ○ |
| 2.3.4 QS university ranking, average score top 3*.....       | 18.1  | 52   |

**3 Infrastructure.....47.6 61**

|  |         |       |
|--|---------|-------|
| 3.1 Information & communication technologies (ICTs).....     | 62.6    | 54    |
| 3.1.1 ICT access*.....                                       | 64.4    | 65    |
| 3.1.2 ICT use*.....  | 58.0    | 43    |
| 3.1.3 Government's online service*.....                      | 63.8    | 55    |
| 3.1.4 E-participation*.....                                  | 64.4    | 54    |
| 3.2 General infrastructure.....                              | 26.2    | 104 ○ |
| 3.2.1 Electricity output, kWh/cap.....                       | 2,146.4 | 76    |
| 3.2.2 Logistics performance*.....                            | 27.1    | 87    |
| 3.2.3 Gross capital formation, % GDP.....                    | 18.8    | 93    |
| 3.3 Ecological sustainability.....                           | 54.0    | 33    |
| 3.3.1 GDP/unit of energy use.....                            | 13.5    | 15 ●  |
| 3.3.2 Environmental performance*.....                        | 80.0    | 42    |
| 3.3.3 ISO 14001 environmental certificates/bn PPP\$ GDP..... | 1.5     | 57    |

**4 Market sophistication.....38.4 101**

|   |      |      |
|---|------|------|
| 4.1 Credit.....                                     | 35.8 | 62   |
| 4.1.1 Ease of getting credit*.....                  | 85.0 | 7 ●  |
| 4.1.2 Domestic credit to private sector, % GDP..... | 56.8 | 55   |
| 4.1.3 Microfinance gross loans, % GDP.....          | 0.0  | 67 ○ |

|  |      |       |
|--|------|-------|
| 4.2 Investment.....  | 18.8 | 127 ○ |
| 4.2.1 Ease of protecting minority investors*.....              | 35.0 | 121 ○ |
| 4.2.2 Market capitalization, % GDP <sup>Ⓐ</sup> .....          | 3.5  | 83 ○  |
| 4.2.3 Venture capital deals/bn PPP\$ GDP.....                  | 0.0  | 62    |
| 4.3 Trade, competition, & market scale.....                    | 60.5 | 65    |
| 4.3.1 Applied tariff rate, weighted mean, % <sup>Ⓐ</sup> ..... | 2.7  | 61    |
| 4.3.2 Intensity of local competition <sup>†</sup> .....        | 71.6 | 48    |
| 4.3.3 Domestic market scale, bn PPP\$.....                     | 79.3 | 80    |

**5 Business sophistication.....35.2 52**

|   |      |      |
|---|------|------|
| 5.1 Knowledge workers.....  | 36.5 | 68   |
| 5.1.1 Knowledge-intensive employment, %.....                        | 21.6 | 66   |
| 5.1.2 Firms offering formal training, % firms <sup>Ⓐ</sup> .....    | 54.7 | 16 ● |
| 5.1.3 GERD performed by business, % of GDP <sup>Ⓐ</sup> .....       | 0.2  | 51   |
| 5.1.4 GERD financed by business, % <sup>Ⓐ</sup> .....               | 1.5  | 85 ○ |
| 5.1.5 Females employed w/advanced degrees, % total.....             | 13.0 | 48   |
| 5.2 Innovation linkages.....  | 21.3 | 92   |
| 5.2.1 University/industry research collaboration <sup>†</sup> ..... | 40.9 | 62   |
| 5.2.2 State of cluster development <sup>†</sup> .....               | 48.7 | 48   |
| 5.2.3 GERD financed by abroad, % <sup>Ⓐ</sup> .....                 | 1.4  | 83 ○ |
| 5.2.4 JV-strategic alliance deals/bn PPP\$ GDP.....                 | 0.0  | 69   |
| 5.2.5 Patent families 2+ offices/bn PPP\$ GDP.....                  | 0.0  | 97 ○ |
| 5.3 Knowledge absorption.....                                       | 47.6 | 17 ● |
| 5.3.1 Intellectual property payments, % total trade.....            | 1.1  | 27   |
| 5.3.2 High-tech imports less re-imports, % total trade.....         | 11.8 | 24   |
| 5.3.3 ICT services imports, % total trade.....                      | 0.7  | 84   |
| 5.3.4 FDI net inflows, % GDP.....                                   | 6.0  | 22 ● |
| 5.3.5 Research talent, % in business enterprise <sup>Ⓐ</sup> .....  | 69.2 | 5 ●  |

**6 Knowledge & technology outputs.....22.1 59**

|  |       |      |
|--|-------|------|
| 6.1 Knowledge creation.....  | 4.3   | 96   |
| 6.1.1 Patents by origin/bn PPP\$ GDP.....                              | 0.2   | 93   |
| 6.1.2 PCT patent applications/bn PPP\$ GDP.....                        | 0.1   | 77   |
| 6.1.3 Utility models by origin/bn PPP\$ GDP.....                       | 0.1   | 52 ○ |
| 6.1.4 Scientific & technical articles/bn PPP\$ GDP.....                | 7.5   | 75   |
| 6.1.5 Citable documents H index.....                                   | 10.1  | 61   |
| 6.2 Knowledge impact.....  | 22.4  | 99   |
| 6.2.1 Growth rate of PPP\$ GDP/worker, %.....                          | (0.0) | 88   |
| 6.2.2 New businesses/th pop. 15–64.....                                | 1.1   | 66   |
| 6.2.3 Computer software spending, % GDP.....                           | 0.3   | 52   |
| 6.2.4 ISO 9001 quality certificates/bn PPP\$ GDP.....                  | 3.7   | 71   |
| 6.2.5 High- & medium-high-tech manufactures, % <sup>Ⓐ</sup> .....      | 0.1   | 77   |
| 6.3 Knowledge diffusion.....   | 39.6  | 22 ● |
| 6.3.1 Intellectual property receipts, % total trade <sup>Ⓐ</sup> ..... | 0.0   | 79   |
| 6.3.2 High-tech exports less re-exports, % total trade.....            | 5.1   | 33   |
| 6.3.3 ICT services exports, % total trade.....                         | 14.6  | 1 ●  |
| 6.3.4 FDI net outflows, % GDP.....                                     | 1.1   | 50   |

**7 Creative outputs.....38.3 40**

|   |      |       |
|---|------|-------|
| 7.1 Intangible assets.....  | 48.6 | 44    |
| 7.1.1 Trademarks by origin/bn PPP\$ GDP.....                      | 79.8 | 22 ●  |
| 7.1.2 Industrial designs by origin/bn PPP\$ GDP.....              | 0.1  | 103 ○ |
| 7.1.3 ICTs & business model creation <sup>†</sup> .....           | 67.0 | 41    |
| 7.1.4 ICTs & organizational model creation <sup>†</sup> .....     | 62.3 | 33    |
| 7.2 Creative goods & services.....                                | 36.4 | 15 ●  |
| 7.2.1 Cultural & creative services exports, % of total trade..... | 10.1 | 1 ●   |
| 7.2.2 National feature films/mn pop. 15–69.....                   | 4.0  | 48    |
| 7.2.3 Global ent. & media market/th pop. 15–69.....               | n/a  | n/a   |
| 7.2.4 Printing & publishing manufactures, % <sup>Ⓐ</sup> .....    | 2.4  | 16 ●  |
| 7.2.5 Creative goods exports, % total trade.....                  | 0.5  | 57    |
| 7.3 Online creativity.....  | 19.5 | 62    |
| 7.3.1 Generic top-level domains (TLDs)/th pop. 15–69.....         | 11.5 | 37    |
| 7.3.2 Country-code TLDs/th pop. 15–69.....                        | 1.6  | 68    |
| 7.3.3 Wikipedia edits/mn pop. 15–69 <sup>Ⓐ</sup> .....            | 4.7  | 65    |
| 7.3.4 Video uploads on YouTube/pop. 15–69.....                    | n/a  | n/a   |

NOTES: ● indicates a strength; ○ a weakness; \* an index; † a survey question.

Ⓐ indicates that the country's data are older than the base year; see Appendix II for details, including the year of the data, at <http://globalinnovationindex.org>.

Square brackets indicate that the data minimum coverage (DMC) requirements were not met at the sub-pillar or pillar level; see page 181 of this appendix for details.

## Key indicators

|                             |                     |
|-----------------------------|---------------------|
| Population (millions) ..... | 23.3                |
| GDP (US\$ billions) .....   | 34.6                |
| GDP per capita, PPP\$ ..... | 3,315.8             |
| Income group .....          | Lower-middle income |
| Region .....                | Sub-Saharan Africa  |

|  | Score 0–100<br>or value (hard data) | Rank       |
|--|-------------------------------------|------------|
| <b>Global Innovation Index (out of 127).....</b> | <b>24.0</b>                         | <b>112</b> |
| Innovation Output Sub-Index .....                | 19.5                                | 94         |
| Innovation Input Sub-Index .....                 | 28.4                                | 121 ○      |
| Innovation Efficiency Ratio .....                | 0.7                                 | 40 ●       |
| Global Innovation Index 2016 (out of 128) .....  | 25.8                                | 108        |

|  |             |           |
|--|-------------|-----------|
| <b>1 Institutions.....</b>                             | <b>51.0</b> | <b>94</b> |
| 1.1 Political environment .....                        | 34.2        | 107       |
| 1.1.1 Political stability & safety* .....              | 43.0        | 99        |
| 1.1.2 Government effectiveness* .....                  | 25.4        | 105       |
| 1.2 Regulatory environment .....                       | 57.5        | 77        |
| 1.2.1 Regulatory quality* .....                        | 28.9        | 101       |
| 1.2.2 Rule of law* .....                               | 21.3        | 99        |
| 1.2.3 Cost of redundancy dismissal, salary weeks ..... | 13.1        | 50 ●      |
| 1.3 Business environment .....                         | 61.3        | 91        |
| 1.3.1 Ease of starting a business* .....               | 91.4        | 43 ●      |
| 1.3.2 Ease of resolving insolvency* .....              | 49.1        | 63 ●      |
| 1.3.3 Ease of paying taxes* .....                      | 43.4        | 121 ○     |

|   |             |            |
|---|-------------|------------|
| <b>2 Human capital &amp; research.....</b>                | <b>14.4</b> | <b>117</b> |
| 2.1 Education .....                                       | 35.0        | 99         |
| 2.1.1 Expenditure on education, % GDP .....               | 4.7         | 61 ●       |
| 2.1.2 Gov't expenditure/pupil, secondary, % GDP/cap ..... | 27.4        | 18 ●       |
| 2.1.3 School life expectancy, years .....                 | 9.2         | 105        |
| 2.1.4 PISA scales in reading, maths, & science .....      | n/a         | n/a        |
| 2.1.5 Pupil-teacher ratio, secondary .....                | 26.6        | 98         |
| 2.2 Tertiary education .....                              | 8.3         | 113        |
| 2.2.1 Tertiary enrolment, % gross .....                   | 9.2         | 108        |
| 2.2.2 Graduates in science & engineering, % .....         | n/a         | n/a        |
| 2.2.3 Tertiary inbound mobility, % .....                  | 1.8         | 72         |

|   |     |       |
|---|-----|-------|
| 2.3 Research & development (R&D) .....                        | 0.0 | 115 ○ |
| 2.3.1 Researchers, FTE/mn pop. ....                           | n/a | n/a   |
| 2.3.2 Gross expenditure on R&D, % GDP .....                   | n/a | n/a   |
| 2.3.3 Global R&D companies, avg. expend. top 3, mn \$US ..... | 0.0 | 43 ○  |
| 2.3.4 QS university ranking, average score top 3* .....       | 0.0 | 75 ○  |

|   |             |            |
|---|-------------|------------|
| <b>3 Infrastructure.....</b>                                  | <b>26.5</b> | <b>114</b> |
| 3.1 Information & communication technologies (ICTs) .....     | 23.2        | 114        |
| 3.1.1 ICT access* .....                                       | 37.9        | 101        |
| 3.1.2 ICT use* .....  | 20.8        | 98         |
| 3.1.3 Government's online service* .....                      | 18.8        | 116 ○      |
| 3.1.4 E-participation* .....                                  | 15.3        | 119 ○      |
| 3.2 General infrastructure .....                              | 25.6        | 105        |
| 3.2.1 Electricity output, kWh/cap .....                       | 373.9       | 106        |
| 3.2.2 Logistics performance* .....                            | 25.0        | 93         |
| 3.2.3 Gross capital formation, % GDP .....                    | 20.2        | 79         |
| 3.3 Ecological sustainability .....                           | 30.8        | 114        |
| 3.3.1 GDP/unit of energy use .....                            | 4.9         | 104        |
| 3.3.2 Environmental performance* .....                        | 59.9        | 101        |
| 3.3.3 ISO 14001 environmental certificates/bn PPP\$ GDP ..... | 0.3         | 100        |

|  |             |              |
|--|-------------|--------------|
| <b>4 Market sophistication .....</b>                 | <b>29.1</b> | <b>123</b> ○ |
| 4.1 Credit .....                                     | 14.9        | 119 ○        |
| 4.1.1 Ease of getting credit* .....                  | 30.0        | 108 ○        |
| 4.1.2 Domestic credit to private sector, % GDP ..... | 23.1        | 106          |
| 4.1.3 Microfinance gross loans, % GDP .....          | 0.4         | 37 ●         |

|   |      |       |
|---|------|-------|
| 4.2 Investment .....  | 25.2 | 123 ○ |
| 4.2.1 Ease of protecting minority investors* .....          | 40.0 | 111 ○ |
| 4.2.2 Market capitalization, % GDP .....                    | 39.3 | 39 ●  |
| 4.2.3 Venture capital deals/bn PPP\$ GDP <sup>Ⓔ</sup> ..... | 0.0  | 61    |
| 4.3 Trade, competition, & market scale .....                | 47.3 | 110   |
| 4.3.1 Applied tariff rate, weighted mean, % .....           | 10.6 | 115   |
| 4.3.2 Intensity of local competition <sup>†</sup> .....     | 62.9 | 90    |
| 4.3.3 Domestic market scale, bn PPP\$ .....                 | 87.1 | 75    |

|  |             |              |
|--|-------------|--------------|
| <b>5 Business sophistication .....</b>                                 | <b>20.9</b> | <b>121</b> ○ |
| 5.1 Knowledge workers .....  | 20.7        | [110]        |
| 5.1.1 Knowledge-intensive employment, % .....                          | n/a         | n/a          |
| 5.1.2 Firms offering formal training, % firms <sup>Ⓔ</sup> .....       | 19.1        | 77           |
| 5.1.3 GERD performed by business, % of GDP .....                       | n/a         | n/a          |
| 5.1.4 GERD financed by business, % .....                               | n/a         | n/a          |
| 5.1.5 Females employed w/advanced degrees, % total .....               | n/a         | n/a          |
| 5.2 Innovation linkages .....  | 20.2        | 104          |
| 5.2.1 University/industry research collaboration <sup>†</sup> .....    | 38.2        | 81           |
| 5.2.2 State of cluster development <sup>†</sup> .....                  | 30.8        | 120 ○        |
| 5.2.3 GERD financed by abroad, % .....                                 | n/a         | n/a          |
| 5.2.4 JV-strategic alliance deals/bn PPP\$ GDP .....                   | 0.0         | 100          |
| 5.2.5 Patent families 2+ offices/bn PPP\$ GDP .....                    | 0.0         | 94           |
| 5.3 Knowledge absorption .....   | 21.7        | 116          |
| 5.3.1 Intellectual property payments, % total trade <sup>Ⓔ</sup> ..... | 0.0         | 110 ○        |
| 5.3.2 High-tech imports less re-imports, % total trade .....           | 5.6         | 101          |
| 5.3.3 ICT services imports, % total trade <sup>Ⓔ</sup> .....           | 0.7         | 81           |
| 5.3.4 FDI net inflows, % GDP .....                                     | 1.3         | 100          |
| 5.3.5 Research talent, % in business enterprise .....                  | n/a         | n/a          |

|  |             |           |
|--|-------------|-----------|
| <b>6 Knowledge &amp; technology outputs .....</b>                      | <b>20.4</b> | <b>75</b> |
| 6.1 Knowledge creation .....   | 2.7         | 117       |
| 6.1.1 Patents by origin/bn PPP\$ GDP .....                             | 0.3         | 86        |
| 6.1.2 PCT patent applications/bn PPP\$ GDP .....                       | 0.0         | 96        |
| 6.1.3 Utility models by origin/bn PPP\$ GDP .....                      | n/a         | n/a       |
| 6.1.4 Scientific & technical articles/bn PPP\$ GDP .....               | 2.9         | 111       |
| 6.1.5 Citable documents H index .....                                  | 5.6         | 90        |
| 6.2 Knowledge impact .....   | 44.8        | 16 ●      |
| 6.2.1 Growth rate of PPP\$ GDP/worker, % .....                         | 5.4         | 4 ●       |
| 6.2.2 New businesses/th pop. 15–64 .....                               | n/a         | n/a       |
| 6.2.3 Computer software spending, % GDP .....                          | 0.0         | 120 ○     |
| 6.2.4 ISO 9001 quality certificates/bn PPP\$ GDP .....                 | 2.0         | 91        |
| 6.2.5 High- & medium-high-tech manufactures, % .....                   | n/a         | n/a       |
| 6.3 Knowledge diffusion .....  | 13.6        | 117       |
| 6.3.1 Intellectual property receipts, % total trade <sup>Ⓔ</sup> ..... | 0.0         | 91        |
| 6.3.2 High-tech exports less re-exports, % total trade .....           | 0.6         | 76        |
| 6.3.3 ICT services exports, % total trade <sup>Ⓔ</sup> .....           | 0.7         | 90        |
| 6.3.4 FDI net outflows, % GDP .....                                    | 0.0         | 103       |

|  |             |            |
|--|-------------|------------|
| <b>7 Creative outputs .....</b>                                    | <b>18.7</b> | <b>108</b> |
| 7.1 Intangible assets .....  | 33.1        | 96         |
| 7.1.1 Trademarks by origin/bn PPP\$ GDP .....                      | 9.5         | 104        |
| 7.1.2 Industrial designs by origin/bn PPP\$ GDP .....              | 1.6         | 50 ●       |
| 7.1.3 ICTs & business model creation <sup>†</sup> .....            | 56.3        | 81         |
| 7.1.4 ICTs & organizational model creation <sup>†</sup> .....      | 50.8        | 72 ●       |
| 7.2 Creative goods & services .....                                | 2.8         | [117]      |
| 7.2.1 Cultural & creative services exports, % of total trade ..... | 0.0         | 72         |
| 7.2.2 National feature films/mn pop. 15–69 .....                   | n/a         | n/a        |
| 7.2.3 Global ent. & media market/th pop. 15–69 .....               | n/a         | n/a        |
| 7.2.4 Printing & publishing manufactures, % .....                  | n/a         | n/a        |
| 7.2.5 Creative goods exports, % total trade .....                  | 0.1         | 90         |
| 7.3 Online creativity .....  | 5.7         | 108        |
| 7.3.1 Generic top-level domains (TLDs)/th pop. 15–69 .....         | 0.5         | 106        |
| 7.3.2 Country-code TLDs/th pop. 15–69 .....                        | 0.1         | 104        |
| 7.3.3 Wikipedia edits/mn pop. 15–69 <sup>Ⓔ</sup> .....             | 1.7         | 108        |
| 7.3.4 Video uploads on YouTube/pop. 15–69 .....                    | n/a         | n/a        |

NOTES: ● indicates a strength; ○ a weakness; \* an index; † a survey question.

Ⓔ indicates that the country's data are older than the base year; see Appendix II for details, including the year of the data, at <http://globalinnovationindex.org>.

Square brackets indicate that the data minimum coverage (DMC) requirements were not met at the sub-pillar or pillar level; see page 181 of this appendix for details.

## Key indicators

|                            |             |
|----------------------------|-------------|
| Population (millions)..... | 4.2         |
| GDP (US\$ billions).....   | 49.9        |
| GDP per capita, PPP\$..... | 21,581.4    |
| Income group.....          | High income |
| Region.....                | Europe      |

|  | Score 0–100<br>or value (hard data) | Rank      |
|--|-------------------------------------|-----------|
| <b>Global Innovation Index (out of 127).....</b> | <b>39.8</b>                         | <b>41</b> |
| Innovation Output Sub-Index.....                 | 31.6                                | 46        |
| Innovation Input Sub-Index.....                  | 48.0                                | 44        |
| Innovation Efficiency Ratio.....                 | 0.7                                 | 52        |
| Global Innovation Index 2016 (out of 128).....   | 38.3                                | 47        |

**1 Institutions.....69.3 42**

|   |      |    |
|---|------|----|
| 1.1 Political environment.....                        | 66.5 | 43 |
| 1.1.1 Political stability & safety*.....              | 77.8 | 39 |
| 1.1.2 Government effectiveness*.....                  | 55.2 | 44 |
| 1.2 Regulatory environment.....                       | 67.1 | 51 |
| 1.2.1 Regulatory quality*.....                        | 51.4 | 57 |
| 1.2.2 Rule of law*.....                               | 45.3 | 52 |
| 1.2.3 Cost of redundancy dismissal, salary weeks..... | 15.1 | 60 |
| 1.3 Business environment.....                         | 74.3 | 55 |
| 1.3.1 Ease of starting a business*.....               | 85.6 | 76 |
| 1.3.2 Ease of resolving insolvency*.....              | 55.6 | 51 |
| 1.3.3 Ease of paying taxes*.....                      | 81.7 | 42 |

**2 Human capital & research.....37.4 47**

|  |         |      |
|--|---------|------|
| 2.1 Education.....   | 62.3    | 15 ● |
| 2.1.1 Expenditure on education, % GDP.....                     | 4.6     | 65   |
| 2.1.2 Gov't expenditure/pupil, secondary, % GDP/cap.....       | n/a     | n/a  |
| 2.1.3 School life expectancy, years.....                       | 15.3    | 42   |
| 2.1.4 PISA scales in reading, maths, & science.....            | 475.4   | 34   |
| 2.1.5 Pupil-teacher ratio, secondary <sup>Ⓢ</sup> .....        | 8.0     | 7 ●  |
| 2.2 Tertiary education.....                                    | 38.7    | 52   |
| 2.2.1 Tertiary enrolment, % gross <sup>Ⓢ</sup> .....           | 69.5    | 27   |
| 2.2.2 Graduates in science & engineering, % <sup>Ⓢ</sup> ..... | 23.8    | 33   |
| 2.2.3 Tertiary inbound mobility, % <sup>Ⓢ</sup> .....          | 0.4     | 93 ○ |
| 2.3 Research & development (R&D).....                          | 11.0    | 56   |
| 2.3.1 Researchers, FTE/mn pop.....                             | 1,501.5 | 43   |
| 2.3.2 Gross expenditure on R&D, % GDP.....                     | 0.9     | 42   |
| 2.3.3 Global R&D companies, avg. expend. top 3, mn \$US.....   | 0.0     | 43 ○ |
| 2.3.4 QS university ranking, average score top 3*.....         | 6.4     | 65   |

**3 Infrastructure.....55.9 33**

|  |         |      |
|--|---------|------|
| 3.1 Information & communication technologies (ICTs).....     | 72.4    | 33   |
| 3.1.1 ICT access*.....                                       | 75.8    | 36   |
| 3.1.2 ICT use*.....  | 61.3    | 37   |
| 3.1.3 Government's online service*.....                      | 74.6    | 33   |
| 3.1.4 E-participation*.....                                  | 78.0    | 25 ● |
| 3.2 General infrastructure.....                              | 32.9    | 83   |
| 3.2.1 Electricity output, kWh/cap.....                       | 3,168.9 | 61   |
| 3.2.2 Logistics performance*.....                            | 50.8    | 50   |
| 3.2.3 Gross capital formation, % GDP.....                    | 18.7    | 95 ○ |
| 3.3 Ecological sustainability.....                           | 62.4    | 12 ● |
| 3.3.1 GDP/unit of energy use.....                            | 10.0    | 50   |
| 3.3.2 Environmental performance*.....                        | 87.0    | 15 ● |
| 3.3.3 ISO 14001 environmental certificates/bn PPP\$ GDP..... | 9.7     | 8 ●  |

**4 Market sophistication.....42.1 88**

|  |      |      |
|--|------|------|
| 4.1 Credit.....  | 26.9 | 92 ○ |
| 4.1.1 Ease of getting credit*.....                       | 55.0 | 67   |
| 4.1.2 Domestic credit to private sector, % GDP.....      | 65.5 | 47   |
| 4.1.3 Microfinance gross loans, % GDP <sup>Ⓢ</sup> ..... | 0.0  | 70 ○ |

|  |      |      |
|--|------|------|
| 4.2 Investment.....  | 38.0 | 76   |
| 4.2.1 Ease of protecting minority investors*.....              | 66.7 | 26   |
| 4.2.2 Market capitalization, % GDP <sup>Ⓢ</sup> .....          | 36.2 | 41   |
| 4.2.3 Venture capital deals/bn PPP\$ GDP.....                  | 0.0  | 68 ○ |
| 4.3 Trade, competition, & market scale.....                    | 61.4 | 62   |
| 4.3.1 Applied tariff rate, weighted mean, % <sup>Ⓢ</sup> ..... | 1.3  | 18 ● |
| 4.3.2 Intensity of local competition <sup>†</sup> .....        | 63.3 | 87 ○ |
| 4.3.3 Domestic market scale, bn PPP\$.....                     | 94.2 | 73   |

**5 Business sophistication.....35.1 53**

|   |      |       |
|---|------|-------|
| 5.1 Knowledge workers.....  | 52.0 | 32    |
| 5.1.1 Knowledge-intensive employment, %.....                        | 35.6 | 36    |
| 5.1.2 Firms offering formal training, % firms.....                  | 49.3 | 23    |
| 5.1.3 GERD performed by business, % of GDP.....                     | 0.4  | 37    |
| 5.1.4 GERD financed by business, %.....                             | 46.6 | 23    |
| 5.1.5 Females employed w/advanced degrees, % total.....             | 16.0 | 37    |
| 5.2 Innovation linkages.....  | 21.6 | 89    |
| 5.2.1 University/industry research collaboration <sup>†</sup> ..... | 31.1 | 103 ○ |
| 5.2.2 State of cluster development <sup>†</sup> .....               | 32.7 | 113 ○ |
| 5.2.3 GERD financed by abroad, %.....                               | 14.5 | 33    |
| 5.2.4 JV-strategic alliance deals/bn PPP\$ GDP.....                 | 0.0  | 74    |
| 5.2.5 Patent families 2+ offices/bn PPP\$ GDP.....                  | 0.1  | 62    |
| 5.3 Knowledge absorption.....                                       | 31.7 | 70    |
| 5.3.1 Intellectual property payments, % total trade.....            | 1.2  | 24 ●  |
| 5.3.2 High-tech imports less re-imports, % total trade.....         | 7.5  | 70    |
| 5.3.3 ICT services imports, % total trade.....                      | 1.6  | 36    |
| 5.3.4 FDI net inflows, % GDP.....                                   | 3.0  | 57    |
| 5.3.5 Research talent, % in business enterprise.....                | 16.7 | 58    |

**6 Knowledge & technology outputs.....25.4 51**

|   |       |      |
|---|-------|------|
| 6.1 Knowledge creation.....                                 | 19.3  | 48   |
| 6.1.1 Patents by origin/bn PPP\$ GDP.....                   | 2.0   | 46   |
| 6.1.2 PCT patent applications/bn PPP\$ GDP.....             | 0.4   | 41   |
| 6.1.3 Utility models by origin/bn PPP\$ GDP.....            | 0.8   | 31   |
| 6.1.4 Scientific & technical articles/bn PPP\$ GDP.....     | 35.2  | 19 ● |
| 6.1.5 Citable documents H index.....                        | 15.4  | 44   |
| 6.2 Knowledge impact.....                                   | 31.5  | 60   |
| 6.2.1 Growth rate of PPP\$ GDP/worker, %.....               | (0.0) | 89 ○ |
| 6.2.2 New businesses/th pop. 15–64.....                     | 4.6   | 25   |
| 6.2.3 Computer software spending, % GDP.....                | 0.1   | 98 ○ |
| 6.2.4 ISO 9001 quality certificates/bn PPP\$ GDP.....       | 27.7  | 10 ● |
| 6.2.5 High- & medium-high-tech manufactures, %.....         | n/a   | n/a  |
| 6.3 Knowledge diffusion.....                                | 25.4  | 52   |
| 6.3.1 Intellectual property receipts, % total trade.....    | 0.2   | 38   |
| 6.3.2 High-tech exports less re-exports, % total trade..... | 3.9   | 40   |
| 6.3.3 ICT services exports, % total trade.....              | 2.5   | 45   |
| 6.3.4 FDI net outflows, % GDP.....                          | 1.2   | 47   |

**7 Creative outputs.....37.9 43**

|   |      |      |
|---|------|------|
| 7.1 Intangible assets.....  | 43.6 | 60   |
| 7.1.1 Trademarks by origin/bn PPP\$ GDP.....                                    | 50.6 | 47   |
| 7.1.2 Industrial designs by origin/bn PPP\$ GDP.....                            | 5.5  | 21 ● |
| 7.1.3 ICTs & business model creation <sup>†</sup> .....                         | 57.8 | 74   |
| 7.1.4 ICTs & organizational model creation <sup>†</sup> .....                   | 54.3 | 60   |
| 7.2 Creative goods & services.....  | 36.0 | 17 ● |
| 7.2.1 Cultural & creative services exports, % of total trade <sup>Ⓢ</sup> ..... | 1.5  | 6 ●  |
| 7.2.2 National feature films/mn pop. 15–69.....                                 | 4.6  | 44   |
| 7.2.3 Global ent. & media market/th pop. 15–69.....                             | n/a  | n/a  |
| 7.2.4 Printing & publishing manufactures, %.....                                | n/a  | n/a  |
| 7.2.5 Creative goods exports, % total trade.....                                | 0.9  | 44   |
| 7.3 Online creativity.....  | 28.3 | 42   |
| 7.3.1 Generic top-level domains (TLDs)/th pop. 15–69.....                       | 14.1 | 32   |
| 7.3.2 Country-code TLDs/th pop. 15–69.....                                      | 9.5  | 40   |
| 7.3.3 Wikipedia edits/mn pop. 15–69.....  | 6.2  | 37   |
| 7.3.4 Video uploads on YouTube/pop. 15–69.....                                  | 30.3 | 43   |

NOTES: ● indicates a strength; ○ a weakness; \* an index; † a survey question.

Ⓢ indicates that the country's data are older than the base year; see Appendix II for details, including the year of the data, at <http://globalinnovationindex.org>.

Square brackets indicate that the data minimum coverage (DMC) requirements were not met at the sub-pillar or pillar level; see page 181 of this appendix for details.

## Key indicators

|                            |                                  |
|----------------------------|----------------------------------|
| Population (millions)..... | 1.2                              |
| GDP (US\$ billions).....   | 19.9                             |
| GDP per capita, PPP\$..... | 32,785.5                         |
| Income group.....          | High income                      |
| Region.....                | Northern Africa and Western Asia |

|  | Score 0–100<br>or value (hard data) | Rank      |
|--|-------------------------------------|-----------|
| <b>Global Innovation Index (out of 127).....</b> | <b>46.8</b>                         | <b>30</b> |
| Innovation Output Sub-Index.....                 | 39.7                                | 28        |
| Innovation Input Sub-Index.....                  | 53.9                                | 32        |
| Innovation Efficiency Ratio.....                 | 0.7                                 | 28        |
| Global Innovation Index 2016 (out of 128).....   | 46.3                                | 31        |

**1 Institutions..... 81.0 21**

|   |      |    |
|---|------|----|
| 1.1 Political environment.....                        | 72.9 | 34 |
| 1.1.1 Political stability & safety*.....              | 77.0 | 41 |
| 1.1.2 Government effectiveness*.....                  | 68.8 | 32 |
| 1.2 Regulatory environment.....                       | 84.6 | 20 |
| 1.2.1 Regulatory quality*.....                        | 69.2 | 32 |
| 1.2.2 Rule of law*.....                               | 69.0 | 28 |
| 1.2.3 Cost of redundancy dismissal, salary weeks..... | 8.0  | 1  |
| 1.3 Business environment.....                         | 85.7 | 20 |
| 1.3.1 Ease of starting a business*.....               | 91.2 | 45 |
| 1.3.2 Ease of resolving insolvency*.....              | 81.4 | 15 |
| 1.3.3 Ease of paying taxes*.....                      | 84.5 | 30 |

**2 Human capital & research..... 39.9 40**

|  |         |    |
|--|---------|----|
| 2.1 Education.....   | 60.2    | 21 |
| 2.1.1 Expenditure on education, % GDP.....                   | 6.4     | 16 |
| 2.1.2 Gov't expenditure/pupil, secondary, % GDP/cap.....     | 37.9    | 7  |
| 2.1.3 School life expectancy, years.....                     | 14.6    | 57 |
| 2.1.4 PISA scales in reading, maths, & science.....          | 437.5   | 46 |
| 2.1.5 Pupil-teacher ratio, secondary.....                    | 10.4    | 29 |
| 2.2 Tertiary education.....                                  | 53.7    | 16 |
| 2.2.1 Tertiary enrolment, % gross.....                       | 60.1    | 42 |
| 2.2.2 Graduates in science & engineering, %.....             | 19.0    | 65 |
| 2.2.3 Tertiary inbound mobility, %.....                      | 17.6    | 8  |
| 2.3 Research & development (R&D).....                        | 5.6     | 74 |
| 2.3.1 Researchers, FTE/mn pop.....                           | 1,013.8 | 48 |
| 2.3.2 Gross expenditure on R&D, % GDP.....                   | 0.5     | 67 |
| 2.3.3 Global R&D companies, avg. expend. top 3, mn \$US..... | 0.0     | 43 |
| 2.3.4 QS university ranking, average score top 3*.....       | 0.0     | 75 |

**3 Infrastructure..... 48.1 59**

|  |         |     |
|--|---------|-----|
| 3.1 Information & communication technologies (ICTs).....     | 57.7    | 65  |
| 3.1.1 ICT access*.....                                       | 70.2    | 51  |
| 3.1.2 ICT use*.....  | 54.6    | 50  |
| 3.1.3 Government's online service*.....                      | 53.6    | 78  |
| 3.1.4 E-participation*.....                                  | 52.5    | 82  |
| 3.2 General infrastructure.....                              | 23.4    | 113 |
| 3.2.1 Electricity output, kWh/cap.....                       | 5,058.1 | 41  |
| 3.2.2 Logistics performance*.....                            | 43.3    | 58  |
| 3.2.3 Gross capital formation, % GDP.....                    | 10.4    | 121 |
| 3.3 Ecological sustainability.....                           | 63.2    | 10  |
| 3.3.1 GDP/unit of energy use.....                            | 13.0    | 20  |
| 3.3.2 Environmental performance*.....                        | 80.2    | 40  |
| 3.3.3 ISO 14001 environmental certificates/bn PPP\$ GDP..... | 4.88    | 9   |

**4 Market sophistication..... 57.9 19**

|   |       |     |
|---|-------|-----|
| 4.1 Credit.....                                     | 80.0  | 2   |
| 4.1.1 Ease of getting credit*.....                  | 60.0  | 55  |
| 4.1.2 Domestic credit to private sector, % GDP..... | 247.6 | 1   |
| 4.1.3 Microfinance gross loans, % GDP.....          | n/a   | n/a |

|   |      |     |
|---|------|-----|
| 4.2 Investment.....                                     | 37.5 | 77  |
| 4.2.1 Ease of protecting minority investors*.....       | 66.7 | 26  |
| 4.2.2 Market capitalization, % GDP.....                 | 13.8 | 71  |
| 4.2.3 Venture capital deals/bn PPP\$ GDP.....           | 0.0  | 38  |
| 4.3 Trade, competition, & market scale.....             | 56.3 | 86  |
| 4.3.1 Applied tariff rate, weighted mean, %.....        | 1.6  | 23  |
| 4.3.2 Intensity of local competition <sup>†</sup> ..... | 71.9 | 42  |
| 4.3.3 Domestic market scale, bn PPP\$.....              | 29.3 | 109 |

**5 Business sophistication..... 42.7 31**

|   |      |     |
|---|------|-----|
| 5.1 Knowledge workers.....  | 42.7 | 49  |
| 5.1.1 Knowledge-intensive employment, %.....                        | 35.2 | 38  |
| 5.1.2 Firms offering formal training, % firms.....                  | n/a  | n/a |
| 5.1.3 GERD performed by business, % of GDP.....                     | 0.1  | 65  |
| 5.1.4 GERD financed by business, % <sup>Ⓔ</sup> .....               | 13.7 | 67  |
| 5.1.5 Females employed w/advanced degrees, % total.....             | 24.0 | 11  |
| 5.2 Innovation linkages.....  | 41.7 | 26  |
| 5.2.1 University/industry research collaboration <sup>†</sup> ..... | 39.2 | 73  |
| 5.2.2 State of cluster development <sup>†</sup> .....               | 46.7 | 55  |
| 5.2.3 GERD financed by abroad, % <sup>Ⓔ</sup> .....                 | 23.7 | 17  |
| 5.2.4 JV-strategic alliance deals/bn PPP\$ GDP.....                 | 0.2  | 6   |
| 5.2.5 Patent families 2+ offices/bn PPP\$ GDP.....                  | 2.4  | 22  |
| 5.3 Knowledge absorption.....                                       | 43.7 | 26  |
| 5.3.1 Intellectual property payments, % total trade.....            | 0.6  | 53  |
| 5.3.2 High-tech imports less re-imports, % total trade.....         | 3.5  | 118 |
| 5.3.3 ICT services imports, % total trade.....                      | 7.7  | 1   |
| 5.3.4 FDI net inflows, % GDP.....                                   | 4.2  | 34  |
| 5.3.5 Research talent, % in business enterprise.....                | 21.5 | 53  |

**6 Knowledge & technology outputs..... 41.3 17**

|  |      |     |
|--|------|-----|
| 6.1 Knowledge creation.....  | 22.8 | 42  |
| 6.1.1 Patents by origin/bn PPP\$ GDP.....                              | 1.5  | 55  |
| 6.1.2 PCT patent applications/bn PPP\$ GDP.....                        | 1.2  | 26  |
| 6.1.3 Utility models by origin/bn PPP\$ GDP.....                       | n/a  | n/a |
| 6.1.4 Scientific & technical articles/bn PPP\$ GDP.....                | 41.0 | 15  |
| 6.1.5 Citable documents H index.....                                   | 9.2  | 70  |
| 6.2 Knowledge impact.....  | 42.7 | 23  |
| 6.2.1 Growth rate of PPP\$ GDP/worker, %.....                          | 0.7  | 66  |
| 6.2.2 New businesses/th pop. 15–64.....                                | 13.7 | 7   |
| 6.2.3 Computer software spending, % GDP.....                           | 0.2  | 78  |
| 6.2.4 ISO 9001 quality certificates/bn PPP\$ GDP.....                  | 29.2 | 9   |
| 6.2.5 High- & medium-high-tech manufactures, %.....                    | 0.1  | 66  |
| 6.3 Knowledge diffusion.....   | 58.5 | 7   |
| 6.3.1 Intellectual property receipts, % total trade <sup>Ⓔ</sup> ..... | 0.0  | 86  |
| 6.3.2 High-tech exports less re-exports, % total trade.....            | 0.5  | 86  |
| 6.3.3 ICT services exports, % total trade <sup>Ⓔ</sup> .....           | 9.6  | 6   |
| 6.3.4 FDI net outflows, % GDP.....                                     | 17.2 | 1   |

**7 Creative outputs..... 38.2 41**

|   |      |     |
|---|------|-----|
| 7.1 Intangible assets.....  | 44.0 | 59  |
| 7.1.1 Trademarks by origin/bn PPP\$ GDP.....                                    | 75.4 | 23  |
| 7.1.2 Industrial designs by origin/bn PPP\$ GDP.....                            | 5.4  | 22  |
| 7.1.3 ICTs & business model creation <sup>†</sup> .....                         | 54.3 | 86  |
| 7.1.4 ICTs & organizational model creation <sup>†</sup> .....                   | 46.6 | 86  |
| 7.2 Creative goods & services.....  | 20.4 | 58  |
| 7.2.1 Cultural & creative services exports, % of total trade <sup>Ⓔ</sup> ..... | 0.5  | 28  |
| 7.2.2 National feature films/mn pop. 15–69.....                                 | 4.6  | 43  |
| 7.2.3 Global ent. & media market/th pop. 15–69.....                             | n/a  | n/a |
| 7.2.4 Printing & publishing manufactures, %.....                                | 2.6  | 13  |
| 7.2.5 Creative goods exports, % total trade.....                                | 0.0  | 107 |
| 7.3 Online creativity.....  | 44.4 | 23  |
| 7.3.1 Generic top-level domains (TLDs)/th pop. 15–69.....                       | 68.2 | 8   |
| 7.3.2 Country-code TLDs/th pop. 15–69.....                                      | 4.7  | 52  |
| 7.3.3 Wikipedia edits/mn pop. 15–69 <sup>Ⓔ</sup> .....                          | 6.2  | 32  |
| 7.3.4 Video uploads on YouTube/pop. 15–69.....                                  | n/a  | n/a |

NOTES: ● indicates a strength; ○ a weakness; \* an index; † a survey question.

Ⓔ indicates that the country's data are older than the base year; see Appendix II for details, including the year of the data, at <http://globalinnovationindex.org>.

Square brackets indicate that the data minimum coverage (DMC) requirements were not met at the sub-pillar or pillar level; see page 181 of this appendix for details.

## Key indicators

|                            |             |
|----------------------------|-------------|
| Population (millions)..... | 10.5        |
| GDP (US\$ billions).....   | 193.5       |
| GDP per capita, PPP\$..... | 31,549.5    |
| Income group.....          | High income |
| Region.....                | Europe      |

|  | Score 0–100<br>or value (hard data) | Rank      |
|--|-------------------------------------|-----------|
| <b>Global Innovation Index (out of 127).....</b>             | <b>51.0</b>                         | <b>24</b> |
| Innovation Output Sub-Index.....                             | 46.2                                | 16 ●      |
| Innovation Input Sub-Index.....                              | 55.7                                | 27        |
| Innovation Efficiency Ratio.....                             | 0.8                                 | 13 ●      |
| Global Innovation Index 2016 (out of 128).....               | 49.4                                | 27        |
| <b>1 Institutions.....</b>                                   | <b>77.6</b>                         | <b>30</b> |
| 1.1 Political environment.....                               | 78.1                                | 24        |
| 1.1.1 Political stability & safety*.....                     | 87.1                                | 18        |
| 1.1.2 Government effectiveness*.....                         | 69.2                                | 31        |
| 1.2 Regulatory environment.....                              | 73.4                                | 37        |
| 1.2.1 Regulatory quality*.....                               | 69.9                                | 31        |
| 1.2.2 Rule of law*.....                                      | 72.2                                | 27        |
| 1.2.3 Cost of redundancy dismissal, salary weeks.....        | 20.2                                | 83 ○      |
| 1.3 Business environment.....                                | 81.3                                | 28        |
| 1.3.1 Ease of starting a business*.....                      | 86.9                                | 66        |
| 1.3.2 Ease of resolving insolvency*.....                     | 76.4                                | 24        |
| 1.3.3 Ease of paying taxes*.....                             | 80.7                                | 45        |
| <b>2 Human capital &amp; research.....</b>                   | <b>47.6</b>                         | <b>30</b> |
| 2.1 Education.....   | 54.5                                | 43        |
| 2.1.1 Expenditure on education, % GDP.....                   | 4.1                                 | 78 ○      |
| 2.1.2 Gov't expenditure/pupil, secondary, % GDP/cap.....     | 23.7                                | 36        |
| 2.1.3 School life expectancy, years.....                     | 16.8                                | 17        |
| 2.1.4 PISA scales in reading, maths, & science.....          | 490.8                               | 28        |
| 2.1.5 Pupil-teacher ratio, secondary <sup>Ⓢ</sup> .....      | 11.5                                | 37        |
| 2.2 Tertiary education.....                                  | 49.6                                | 21        |
| 2.2.1 Tertiary enrolment, % gross <sup>Ⓢ</sup> .....         | 66.0                                | 34        |
| 2.2.2 Graduates in science & engineering, %.....             | 23.2                                | 36        |
| 2.2.3 Tertiary inbound mobility, % <sup>Ⓢ</sup> .....        | 9.8                                 | 21        |
| 2.3 Research & development (R&D).....                        | 38.7                                | 28        |
| 2.3.1 Researchers, FTE/mn pop.....                           | 3,611.9                             | 25        |
| 2.3.2 Gross expenditure on R&D, % GDP.....                   | 2.0                                 | 19        |
| 2.3.3 Global R&D companies, avg. expend. top 3, mn \$US..... | 37.5                                | 40        |
| 2.3.4 QS university ranking, average score top 3*.....       | 27.6                                | 42        |
| <b>3 Infrastructure.....</b>                                 | <b>57.3</b>                         | <b>30</b> |
| 3.1 Information & communication technologies (ICTs).....     | 61.0                                | 56        |
| 3.1.1 ICT access*.....                                       | 74.6                                | 38        |
| 3.1.2 ICT use*.....  | 65.5                                | 28        |
| 3.1.3 Government's online service*.....                      | 47.8                                | 89 ○      |
| 3.1.4 E-participation*.....                                  | 55.9                                | 74 ○      |
| 3.2 General infrastructure.....                              | 51.2                                | 20        |
| 3.2.1 Electricity output, kWh/cap.....                       | 7,823.0                             | 24        |
| 3.2.2 Logistics performance*.....                            | 74.5                                | 25        |
| 3.2.3 Gross capital formation, % GDP.....                    | 26.1                                | 36        |
| 3.3 Ecological sustainability.....                           | 59.8                                | 17 ●      |
| 3.3.1 GDP/unit of energy use.....                            | 7.5                                 | 78 ○      |
| 3.3.2 Environmental performance*.....                        | 84.7                                | 27        |
| 3.3.3 ISO 14001 environmental certificates/bn PPP\$ GDP..... | 11.3                                | 5 ●       |
| <b>4 Market sophistication.....</b>                          | <b>50.2</b>                         | <b>47</b> |
| 4.1 Credit.....  | 44.7                                | 41        |
| 4.1.1 Ease of getting credit*.....                           | 70.0                                | 29        |
| 4.1.2 Domestic credit to private sector, % GDP.....          | 50.3                                | 70 ○      |
| 4.1.3 Microfinance gross loans, % GDP.....                   | n/a                                 | n/a       |

|   |             |             |
|---|-------------|-------------|
| 4.2 Investment.....   | 34.1        | 89 ○        |
| 4.2.1 Ease of protecting minority investors*.....                               | 60.0        | 52          |
| 4.2.2 Market capitalization, % GDP <sup>Ⓢ</sup> .....                           | 17.4        | 63 ○        |
| 4.2.3 Venture capital deals/bn PPP\$ GDP.....                                   | 0.0         | 42          |
| 4.3 Trade, competition, & market scale.....                                     | 71.9        | 31          |
| 4.3.1 Applied tariff rate, weighted mean, %.....                                | 1.6         | 23          |
| 4.3.2 Intensity of local competition <sup>†</sup> .....                         | 79.4        | 14 ●        |
| 4.3.3 Domestic market scale, bn PPP\$.....                                      | 350.9       | 46          |
| <b>5 Business sophistication.....</b>   | <b>45.9</b> | <b>26</b>   |
| 5.1 Knowledge workers.....  | 53.6        | 30          |
| 5.1.1 Knowledge-intensive employment, %.....                                    | 37.6        | 31          |
| 5.1.2 Firms offering formal training, % firms.....                              | 55.1        | 14          |
| 5.1.3 GERD performed by business, % of GDP.....                                 | 1.1         | 21          |
| 5.1.4 GERD financed by business, %.....   | 34.5        | 43          |
| 5.1.5 Females employed w/advanced degrees, % total.....                         | 11.6        | 59 ○        |
| 5.2 Innovation linkages.....  | 36.8        | 40          |
| 5.2.1 University/industry research collaboration <sup>†</sup> .....             | 44.4        | 45          |
| 5.2.2 State of cluster development <sup>†</sup> .....                           | 46.7        | 56          |
| 5.2.3 GERD financed by abroad, %.....   | 32.5        | 14 ●        |
| 5.2.4 JV-strategic alliance deals/bn PPP\$ GDP.....                             | 0.0         | 92 ○        |
| 5.2.5 Patent families 2+ offices/bn PPP\$ GDP.....                              | 0.7         | 31          |
| 5.3 Knowledge absorption.....   | 47.2        | 19          |
| 5.3.1 Intellectual property payments, % total trade.....                        | 0.7         | 47          |
| 5.3.2 High-tech imports less re-imports, % total trade.....                     | 17.7        | 10 ●        |
| 5.3.3 ICT services imports, % total trade.....                                  | 1.1         | 62          |
| 5.3.4 FDI net inflows, % GDP.....   | 2.9         | 59          |
| 5.3.5 Research talent, % in business enterprise.....                            | 50.3        | 24          |
| <b>6 Knowledge &amp; technology outputs.....</b>                                | <b>45.8</b> | <b>14 ●</b> |
| 6.1 Knowledge creation.....   | 46.8        | 14 ●        |
| 6.1.1 Patents by origin/bn PPP\$ GDP.....                                       | 3.2         | 32          |
| 6.1.2 PCT patent applications/bn PPP\$ GDP.....                                 | 0.6         | 35          |
| 6.1.3 Utility models by origin/bn PPP\$ GDP.....                                | 4.0         | 6 ●         |
| 6.1.4 Scientific & technical articles/bn PPP\$ GDP.....                         | 34.7        | 21          |
| 6.1.5 Citable documents H index.....  | 27.4        | 32          |
| 6.2 Knowledge impact.....   | 52.0        | 8 ●         |
| 6.2.1 Growth rate of PPP\$ GDP/worker, %.....                                   | 3.0         | 20          |
| 6.2.2 New businesses/th pop. 15–64.....   | 3.4         | 35          |
| 6.2.3 Computer software spending, % GDP.....                                    | 0.3         | 41          |
| 6.2.4 ISO 9001 quality certificates/bn PPP\$ GDP.....                           | 31.5        | 7 ●         |
| 6.2.5 High- & medium-high-tech manufactures, %.....                             | 0.5         | 7 ●         |
| 6.3 Knowledge diffusion.....  | 38.7        | 25          |
| 6.3.1 Intellectual property receipts, % total trade.....                        | 0.3         | 32          |
| 6.3.2 High-tech exports less re-exports, % total trade.....                     | 16.7        | 7 ●         |
| 6.3.3 ICT services exports, % total trade.....                                  | 1.8         | 57          |
| 6.3.4 FDI net outflows, % GDP.....  | 2.5         | 25          |
| <b>7 Creative outputs.....</b>  | <b>46.7</b> | <b>22</b>   |
| 7.1 Intangible assets.....  | 51.4        | 33          |
| 7.1.1 Trademarks by origin/bn PPP\$ GDP.....                                    | 66.2        | 29          |
| 7.1.2 Industrial designs by origin/bn PPP\$ GDP.....                            | 5.1         | 25          |
| 7.1.3 ICTs & business model creation <sup>†</sup> .....                         | 68.7        | 34          |
| 7.1.4 ICTs & organizational model creation <sup>†</sup> .....                   | 63.6        | 30          |
| 7.2 Creative goods & services.....  | 39.9        | 9 ●         |
| 7.2.1 Cultural & creative services exports, % of total trade <sup>Ⓢ</sup> ..... | 0.5         | 27          |
| 7.2.2 National feature films/mn pop. 15–69.....                                 | 7.2         | 22          |
| 7.2.3 Global ent. & media market/th pop. 15–69.....                             | 20.3        | 26          |
| 7.2.4 Printing & publishing manufactures, %.....                                | 1.0         | 65 ○        |
| 7.2.5 Creative goods exports, % total trade.....                                | 9.8         | 4 ●         |
| 7.3 Online creativity.....  | 44.0        | 24          |
| 7.3.1 Generic top-level domains (TLDs)/th pop. 15–69.....                       | 17.1        | 30          |
| 7.3.2 Country-code TLDs/th pop. 15–69.....                                      | 49.6        | 15 ●        |
| 7.3.3 Wikipedia edits/mn pop. 15–69.....  | 6.7         | 22          |
| 7.3.4 Video uploads on YouTube/pop. 15–69.....                                  | 44.8        | 23          |

NOTES: ● indicates a strength; ○ a weakness; \* an index; † a survey question.

Ⓢ indicates that the country's data are older than the base year; see Appendix II for details, including the year of the data, at <http://globalinnovationindex.org>.

Square brackets indicate that the data minimum coverage (DMC) requirements were not met at the sub-pillar or pillar level; see page 181 of this appendix for details.



## Denmark

## Key indicators

|                            |             |
|----------------------------|-------------|
| Population (millions)..... | 5.7         |
| GDP (US\$ billions).....   | 302.6       |
| GDP per capita, PPP\$..... | 45,709.4    |
| Income group.....          | High income |
| Region.....                | Europe      |

|  | Score 0–100<br>or value (hard data) | Rank       |
|--|-------------------------------------|------------|
| <b>Global Innovation Index (out of 127).....</b> | <b>58.7</b>                         | <b>6 ●</b> |
| Innovation Output Sub-Index.....                 | 48.7                                | 12         |
| Innovation Input Sub-Index.....                  | 68.7                                | 6 ●        |
| Innovation Efficiency Ratio.....                 | 0.7                                 | 34         |
| Global Innovation Index 2016 (out of 128).....   | 58.5                                | 8          |

|   |             |            |
|---|-------------|------------|
| <b>1 Institutions.....</b>                            | <b>91.4</b> | <b>6 ●</b> |
| 1.1 Political environment.....                        | 87.6        | 13         |
| 1.1.1 Political stability & safety*.....              | 85.5        | 25         |
| 1.1.2 Government effectiveness*.....                  | 89.7        | 6 ●        |
| 1.2 Regulatory environment.....                       | 96.4        | 4 ●        |
| 1.2.1 Regulatory quality*.....                        | 86.5        | 11         |
| 1.2.2 Rule of law*.....                               | 99.0        | 3 ●        |
| 1.2.3 Cost of redundancy dismissal, salary weeks..... | 8.0         | 1 ●        |
| 1.3 Business environment.....                         | 90.3        | 4 ●        |
| 1.3.1 Ease of starting a business*.....               | 94.1        | 22         |
| 1.3.2 Ease of resolving insolvency*.....              | 84.9        | 8          |
| 1.3.3 Ease of paying taxes*.....                      | 92.1        | 7          |

|  |             |            |
|--|-------------|------------|
| <b>2 Human capital &amp; research.....</b>                   | <b>66.1</b> | <b>3 ●</b> |
| 2.1 Education.....   | 74.1        | 4 ●        |
| 2.1.1 Expenditure on education, % GDP.....                   | 8.6         | 2 ●        |
| 2.1.2 Gov't expenditure/pupil, secondary, % GDP/cap.....     | 28.2        | 15         |
| 2.1.3 School life expectancy, years.....                     | 19.2        | 6 ●        |
| 2.1.4 PISA scales in reading, maths, & science.....          | 504.3       | 16         |
| 2.1.5 Pupil-teacher ratio, secondary <sup>Ⓐ</sup> .....      | 11.3        | 34         |
| 2.2 Tertiary education.....                                  | 50.0        | 19         |
| 2.2.1 Tertiary enrolment, % gross <sup>Ⓐ</sup> .....         | 81.5        | 14         |
| 2.2.2 Graduates in science & engineering, %.....             | 20.4        | 53 ○       |
| 2.2.3 Tertiary inbound mobility, % <sup>Ⓐ</sup> .....        | 9.9         | 18         |
| 2.3 Research & development (R&D).....                        | 74.2        | 7          |
| 2.3.1 Researchers, FTE/mn pop.....                           | 7,483.6     | 2 ●        |
| 2.3.2 Gross expenditure on R&D, % GDP.....                   | 3.0         | 6          |
| 2.3.3 Global R&D companies, avg. expend. top 3, mn \$US..... | 72.3        | 17         |
| 2.3.4 QS university ranking, average score top 3*.....       | 63.8        | 15         |

|  |             |           |
|--|-------------|-----------|
| <b>3 Infrastructure.....</b>                                 | <b>63.2</b> | <b>15</b> |
| 3.1 Information & communication technologies (ICTs).....     | 83.3        | 14        |
| 3.1.1 ICT access*.....                                       | 85.2        | 14        |
| 3.1.2 ICT use*.....  | 89.1        | 1 ●       |
| 3.1.3 Government's online service*.....                      | 77.5        | 28        |
| 3.1.4 E-participation*.....                                  | 81.4        | 22        |
| 3.2 General infrastructure.....                              | 43.1        | 44        |
| 3.2.1 Electricity output, kWh/cap.....                       | 5,076.0     | 40        |
| 3.2.2 Logistics performance*.....                            | 81.0        | 17        |
| 3.2.3 Gross capital formation, % GDP.....                    | 19.6        | 86 ○      |
| 3.3 Ecological sustainability.....                           | 63.2        | 11        |
| 3.3.1 GDP/unit of energy use.....                            | 14.9        | 11        |
| 3.3.2 Environmental performance*.....                        | 89.2        | 4 ●       |
| 3.3.3 ISO 14001 environmental certificates/bn PPP\$ GDP..... | 3.9         | 24        |

|   |             |            |
|---|-------------|------------|
| <b>4 Market sophistication.....</b>                 | <b>70.2</b> | <b>6 ●</b> |
| 4.1 Credit.....                                     | 70.0        | 6 ●        |
| 4.1.1 Ease of getting credit*.....                  | 70.0        | 29         |
| 4.1.2 Domestic credit to private sector, % GDP..... | 174.1       | 5 ●        |
| 4.1.3 Microfinance gross loans, % GDP.....          | n/a         | n/a        |

|   |       |      |
|---|-------|------|
| 4.2 Investment.....                                     | 71.4  | 5 ●  |
| 4.2.1 Ease of protecting minority investors*.....       | 71.7  | 19   |
| 4.2.2 Market capitalization, % GDP.....                 | n/a   | n/a  |
| 4.2.3 Venture capital deals/bn PPP\$ GDP.....           | 0.2   | 6    |
| 4.3 Trade, competition, & market scale.....             | 69.1  | 37   |
| 4.3.1 Applied tariff rate, weighted mean, %.....        | 1.6   | 23   |
| 4.3.2 Intensity of local competition <sup>†</sup> ..... | 74.2  | 30   |
| 4.3.3 Domestic market scale, bn PPP\$.....              | 264.8 | 56 ○ |

|   |             |           |
|---|-------------|-----------|
| <b>5 Business sophistication.....</b>                               | <b>52.5</b> | <b>12</b> |
| 5.1 Knowledge workers.....  | 70.3        | 8         |
| 5.1.1 Knowledge-intensive employment, %.....                        | 45.1        | 12        |
| 5.1.2 Firms offering formal training, % firms.....                  | n/a         | n/a       |
| 5.1.3 GERD performed by business, % of GDP.....                     | 1.9         | 10        |
| 5.1.4 GERD financed by business, %.....                             | 59.4        | 13        |
| 5.1.5 Females employed w/advanced degrees, % total.....             | 21.8        | 18        |
| 5.2 Innovation linkages.....  | 46.1        | 17        |
| 5.2.1 University/industry research collaboration <sup>†</sup> ..... | 64.0        | 14        |
| 5.2.2 State of cluster development <sup>†</sup> .....               | 60.7        | 21        |
| 5.2.3 GERD financed by abroad, %.....                               | 6.5         | 59 ○      |
| 5.2.4 JV-strategic alliance deals/bn PPP\$ GDP.....                 | 0.1         | 15        |
| 5.2.5 Patent families 2+ offices/bn PPP\$ GDP.....                  | 8.0         | 9         |
| 5.3 Knowledge absorption.....                                       | 41.1        | 30        |
| 5.3.1 Intellectual property payments, % total trade.....            | 0.8         | 41        |
| 5.3.2 High-tech imports less re-imports, % total trade.....         | 6.5         | 86 ○      |
| 5.3.3 ICT services imports, % total trade.....                      | 2.4         | 13        |
| 5.3.4 FDI net inflows, % GDP.....                                   | 0.0         | 123 ○     |
| 5.3.5 Research talent, % in business enterprise.....                | 58.0        | 15        |

|   |             |           |
|---|-------------|-----------|
| <b>6 Knowledge &amp; technology outputs.....</b>            | <b>43.9</b> | <b>16</b> |
| 6.1 Knowledge creation.....                                 | 50.3        | 12        |
| 6.1.1 Patents by origin/bn PPP\$ GDP.....                   | 13.1        | 8         |
| 6.1.2 PCT patent applications/bn PPP\$ GDP.....             | 5.1         | 10        |
| 6.1.3 Utility models by origin/bn PPP\$ GDP.....            | 0.5         | 37 ○      |
| 6.1.4 Scientific & technical articles/bn PPP\$ GDP.....     | 66.8        | 2 ●       |
| 6.1.5 Citable documents H index.....                        | 49.4        | 15        |
| 6.2 Knowledge impact.....                                   | 39.8        | 34        |
| 6.2.1 Growth rate of PPP\$ GDP/worker, %.....               | 0.1         | 87 ○      |
| 6.2.2 New businesses/th pop. 15–64.....                     | 4.4         | 28        |
| 6.2.3 Computer software spending, % GDP.....                | 0.6         | 12        |
| 6.2.4 ISO 9001 quality certificates/bn PPP\$ GDP.....       | 7.2         | 50        |
| 6.2.5 High- & medium-high-tech manufactures, %.....         | 0.4         | 17        |
| 6.3 Knowledge diffusion.....                                | 41.7        | 17        |
| 6.3.1 Intellectual property receipts, % total trade.....    | 1.4         | 12        |
| 6.3.2 High-tech exports less re-exports, % total trade..... | 6.8         | 27        |
| 6.3.3 ICT services exports, % total trade.....              | 2.5         | 46        |
| 6.3.4 FDI net outflows, % GDP.....                          | 3.0         | 20        |

|   |             |          |
|---|-------------|----------|
| <b>7 Creative outputs.....</b>  | <b>53.5</b> | <b>9</b> |
| 7.1 Intangible assets.....  | 53.8        | 25       |
| 7.1.1 Trademarks by origin/bn PPP\$ GDP.....                                    | 36.6        | 61 ○     |
| 7.1.2 Industrial designs by origin/bn PPP\$ GDP.....                            | 7.6         | 16       |
| 7.1.3 ICTs & business model creation <sup>†</sup> .....                         | 75.3        | 24       |
| 7.1.4 ICTs & organizational model creation <sup>†</sup> .....                   | 74.1        | 15       |
| 7.2 Creative goods & services.....  | 39.8        | 11       |
| 7.2.1 Cultural & creative services exports, % of total trade <sup>Ⓐ</sup> ..... | 0.7         | 21       |
| 7.2.2 National feature films/mn pop. 15–69.....                                 | 17.7        | 6        |
| 7.2.3 Global ent. & media market/th pop. 15–69.....                             | 76.0        | 4        |
| 7.2.4 Printing & publishing manufactures, %.....                                | 1.0         | 64 ○     |
| 7.2.5 Creative goods exports, % total trade.....                                | 1.8         | 29       |
| 7.3 Online creativity.....  | 66.5        | 6 ●      |
| 7.3.1 Generic top-level domains (TLDs)/th pop. 15–69.....                       | 48.4        | 4        |
| 7.3.2 Country-code TLDs/th pop. 15–69.....                                      | 98.4        | 4 ●      |
| 7.3.3 Wikipedia edits/mn pop. 15–69.....  | 6.6         | 25       |
| 7.3.4 Video uploads on YouTube/pop. 15–69.....                                  | 56.1        | 11       |

NOTES: ● indicates a strength; ○ a weakness; \* an index; † a survey question.

Ⓐ indicates that the country's data are older than the base year; see Appendix II for details, including the year of the data, at <http://globalinnovationindex.org>.

Square brackets indicate that the data minimum coverage (DMC) requirements were not met at the sub-pillar or pillar level; see page 181 of this appendix for details.

## Key indicators

|                             |                                 |
|-----------------------------|---------------------------------|
| Population (millions) ..... | 10.6                            |
| GDP (US\$ billions) .....   | 71.5                            |
| GDP per capita, PPP\$ ..... | 14,983.7                        |
| Income group .....          | Upper-middle income             |
| Region .....                | Latin America and the Caribbean |

|   | Score 0–100<br>or value (hard data) | Rank      |
|---|-------------------------------------|-----------|
| <b>Global Innovation Index (out of 127)</b> ..... | <b>31.2</b>                         | <b>79</b> |
| Innovation Output Sub-Index .....                 | 24.5                                | 72        |
| Innovation Input Sub-Index .....                  | 37.8                                | 88        |
| Innovation Efficiency Ratio .....                 | 0.6                                 | 54 ●      |
| Global Innovation Index 2016 (out of 128) .....   | 30.6                                | 76        |

## 1 Institutions ..... 51.8 90

|  |      |       |
|--|------|-------|
| 1.1 Political environment .....                        | 50.6 | 69    |
| 1.1.1 Political stability & safety* .....              | 68.0 | 53 ●  |
| 1.1.2 Government effectiveness* .....                  | 33.3 | 88    |
| 1.2 Regulatory environment .....                       | 48.8 | 104   |
| 1.2.1 Regulatory quality* .....                        | 41.2 | 73    |
| 1.2.2 Rule of law* .....                               | 26.1 | 89    |
| 1.2.3 Cost of redundancy dismissal, salary weeks ..... | 26.2 | 103   |
| 1.3 Business environment .....                         | 55.9 | 112   |
| 1.3.1 Ease of starting a business* .....               | 83.3 | 89    |
| 1.3.2 Ease of resolving insolvency* .....              | 23.6 | 125 ○ |
| 1.3.3 Ease of paying taxes* .....                      | 60.7 | 93    |

## 2 Human capital & research ..... 17.6 109

|   |       |       |
|---|-------|-------|
| 2.1 Education .....   | 26.6  | 115   |
| 2.1.1 Expenditure on education, % GDP <sup>Ⓢ</sup> .....      | 2.1   | 113 ○ |
| 2.1.2 Gov't expenditure/pupil, secondary, % GDP/cap .....     | 15.0  | 83    |
| 2.1.3 School life expectancy, years .....                     | 13.2  | 70    |
| 2.1.4 PISA scales in reading, maths, & science .....          | 339.0 | 70 ○  |
| 2.1.5 Pupil-teacher ratio, secondary .....                    | 22.1  | 87    |
| 2.2 Tertiary education .....                                  | 26.1  | 91    |
| 2.2.1 Tertiary enrolment, % gross <sup>Ⓢ</sup> .....          | 47.5  | 55    |
| 2.2.2 Graduates in science & engineering, % .....             | 14.4  | 87    |
| 2.2.3 Tertiary inbound mobility, % <sup>Ⓢ</sup> .....         | 2.3   | 65    |
| 2.3 Research & development (R&D) .....                        | 0.0   | 115 ○ |
| 2.3.1 Researchers, FTE/mn pop. ....                           | n/a   | n/a   |
| 2.3.2 Gross expenditure on R&D, % GDP .....                   | n/a   | n/a   |
| 2.3.3 Global R&D companies, avg. expend. top 3, mn \$US ..... | 0.0   | 43 ○  |
| 2.3.4 QS university ranking, average score top 3* .....       | 0.0   | 75 ○  |

## 3 Infrastructure ..... 42.4 78

|   |         |      |
|---|---------|------|
| 3.1 Information & communication technologies (ICTs) .....     | 44.4    | 89   |
| 3.1.1 ICT access* .....                                       | 43.8    | 94   |
| 3.1.2 ICT use* .....  | 34.1    | 78   |
| 3.1.3 Government's online service* .....                      | 50.7    | 83   |
| 3.1.4 E-participation* .....                                  | 49.2    | 89   |
| 3.2 General infrastructure .....                              | 27.0    | 102  |
| 3.2.1 Electricity output, kWh/cap .....                       | 1,784.1 | 80   |
| 3.2.2 Logistics performance* .....                            | 26.1    | 89   |
| 3.2.3 Gross capital formation, % GDP .....                    | 20.1    | 80   |
| 3.3 Ecological sustainability .....                           | 55.7    | 28 ● |
| 3.3.1 GDP/unit of energy use .....                            | 16.9    | 7 ●  |
| 3.3.2 Environmental performance* .....                        | 75.3    | 56   |
| 3.3.3 ISO 14001 environmental certificates/bn PPP\$ GDP ..... | 0.2     | 108  |

## 4 Market sophistication ..... 45.4 70

|  |      |      |
|--|------|------|
| 4.1 Credit .....                                     | 22.6 | 107  |
| 4.1.1 Ease of getting credit* .....                  | 45.0 | 84   |
| 4.1.2 Domestic credit to private sector, % GDP ..... | 27.1 | 102  |
| 4.1.3 Microfinance gross loans, % GDP .....          | 0.7  | 29 ● |

|   |       |      |
|---|-------|------|
| 4.2 Investment .....                                    | 53.3  | [24] |
| 4.2.1 Ease of protecting minority investors* .....      | 53.3  | 80   |
| 4.2.2 Market capitalization, % GDP .....                | n/a   | n/a  |
| 4.2.3 Venture capital deals/bn PPP\$ GDP .....          | n/a   | n/a  |
| 4.3 Trade, competition, & market scale .....            | 60.3  | 67   |
| 4.3.1 Applied tariff rate, weighted mean, % .....       | 6.3   | 100  |
| 4.3.2 Intensity of local competition <sup>†</sup> ..... | 76.6  | 20 ● |
| 4.3.3 Domestic market scale, bn PPP\$ .....             | 160.9 | 66   |

## 5 Business sophistication ..... 31.9 67

|  |      |       |
|--|------|-------|
| 5.1 Knowledge workers .....  | 48.1 | 36 ●  |
| 5.1.1 Knowledge-intensive employment, % .....                          | 17.9 | 79    |
| 5.1.2 Firms offering formal training, % firms <sup>Ⓢ</sup> .....       | 57.0 | 12 ●  |
| 5.1.3 GERD performed by business, % of GDP .....                       | n/a  | n/a   |
| 5.1.4 GERD financed by business, % .....                               | n/a  | n/a   |
| 5.1.5 Females employed w/advanced degrees, % total .....               | 12.7 | 52    |
| 5.2 Innovation linkages .....  | 24.8 | 75    |
| 5.2.1 University/industry research collaboration <sup>†</sup> .....    | 31.8 | 101   |
| 5.2.2 State of cluster development <sup>†</sup> .....                  | 45.9 | 60    |
| 5.2.3 GERD financed by abroad, % .....                                 | n/a  | n/a   |
| 5.2.4 JV-strategic alliance deals/bn PPP\$ GDP .....                   | 0.0  | 109 ○ |
| 5.2.5 Patent families 2+ offices/bn PPP\$ GDP .....                    | 0.0  | 100   |
| 5.3 Knowledge absorption .....   | 22.8 | 109   |
| 5.3.1 Intellectual property payments, % total trade <sup>Ⓢ</sup> ..... | 0.4  | 65    |
| 5.3.2 High-tech imports less re-imports, % total trade .....           | 5.7  | 99    |
| 5.3.3 ICT services imports, % total trade <sup>Ⓢ</sup> .....           | 0.3  | 115   |
| 5.3.4 FDI net inflows, % GDP .....                                     | 3.2  | 52 ●  |
| 5.3.5 Research talent, % in business enterprise .....                  | n/a  | n/a   |

## 6 Knowledge & technology outputs ..... 17.2 91

|  |       |       |
|--|-------|-------|
| 6.1 Knowledge creation .....                                 | 0.9   | 126 ○ |
| 6.1.1 Patents by origin/bn PPP\$ GDP .....                   | 0.1   | 102   |
| 6.1.2 PCT patent applications/bn PPP\$ GDP .....             | 0.1   | 71    |
| 6.1.3 Utility models by origin/bn PPP\$ GDP .....            | 0.1   | 57    |
| 6.1.4 Scientific & technical articles/bn PPP\$ GDP .....     | 0.5   | 126 ○ |
| 6.1.5 Citable documents H index .....                        | 2.1   | 117 ○ |
| 6.2 Knowledge impact .....                                   | 33.2  | 56    |
| 6.2.1 Growth rate of PPP\$ GDP/worker, % .....               | 4.3   | 13 ●  |
| 6.2.2 New businesses/th pop. 15–64 .....                     | 1.2   | 62    |
| 6.2.3 Computer software spending, % GDP .....                | 0.0   | 117 ○ |
| 6.2.4 ISO 9001 quality certificates/bn PPP\$ GDP .....       | 1.3   | 103   |
| 6.2.5 High- & medium-high-tech manufactures, % .....         | n/a   | n/a   |
| 6.3 Knowledge diffusion .....                                | 17.6  | 98    |
| 6.3.1 Intellectual property receipts, % total trade .....    | n/a   | n/a   |
| 6.3.2 High-tech exports less re-exports, % total trade ..... | 1.1   | 68    |
| 6.3.3 ICT services exports, % total trade <sup>Ⓢ</sup> ..... | 1.1   | 81    |
| 6.3.4 FDI net outflows, % GDP .....                          | (0.1) | 117 ○ |

## 7 Creative outputs ..... 31.9 60

|  |      |      |
|--|------|------|
| 7.1 Intangible assets .....  | 41.4 | 68   |
| 7.1.1 Trademarks by origin/bn PPP\$ GDP .....                      | 45.6 | 54   |
| 7.1.2 Industrial designs by origin/bn PPP\$ GDP .....              | 0.3  | 91   |
| 7.1.3 ICTs & business model creation <sup>†</sup> .....            | 65.6 | 44 ● |
| 7.1.4 ICTs & organizational model creation <sup>†</sup> .....      | 55.6 | 53 ● |
| 7.2 Creative goods & services .....                                | 30.2 | [30] |
| 7.2.1 Cultural & creative services exports, % of total trade ..... | n/a  | n/a  |
| 7.2.2 National feature films/mn pop. 15–69 <sup>Ⓢ</sup> .....      | 1.0  | 79   |
| 7.2.3 Global ent. & media market/th pop. 15–69 .....               | n/a  | n/a  |
| 7.2.4 Printing & publishing manufactures, % .....                  | n/a  | n/a  |
| 7.2.5 Creative goods exports, % total trade .....                  | 2.2  | 21 ● |
| 7.3 Online creativity .....  | 14.4 | 81   |
| 7.3.1 Generic top-level domains (TLDs)/th pop. 15–69 .....         | 2.9  | 66   |
| 7.3.2 Country-code TLDs/th pop. 15–69 .....                        | 1.1  | 80   |
| 7.3.3 Wikipedia edits/mn pop. 15–69 <sup>Ⓢ</sup> .....             | 4.1  | 80   |
| 7.3.4 Video uploads on YouTube/pop. 15–69 .....                    | n/a  | n/a  |

NOTES: ● indicates a strength; ○ a weakness; \* an index; † a survey question.

Ⓢ indicates that the country's data are older than the base year; see Appendix II for details, including the year of the data, at <http://globalinnovationindex.org>.

Square brackets indicate that the data minimum coverage (DMC) requirements were not met at the sub-pillar or pillar level; see page 181 of this appendix for details.



## Key indicators

|                            |                                 |
|----------------------------|---------------------------------|
| Population (millions)..... | 16.4                            |
| GDP (US\$ billions).....   | 99.1                            |
| GDP per capita, PPP\$..... | 11,263.6                        |
| Income group.....          | Upper-middle income             |
| Region.....                | Latin America and the Caribbean |

|  | Score 0–100<br>or value (hard data) | Rank      |
|--|-------------------------------------|-----------|
| <b>Global Innovation Index (out of 127).....</b> | <b>29.1</b>                         | <b>92</b> |
| Innovation Output Sub-Index.....                 | 22.2                                | 83        |
| Innovation Input Sub-Index.....                  | 36.1                                | 95        |
| Innovation Efficiency Ratio.....                 | 0.6                                 | 66        |
| Global Innovation Index 2016 (out of 128).....   | 27.1                                | 100       |

**1 Institutions.....43.3 116**

|   |      |       |
|---|------|-------|
| 1.1 Political environment.....                        | 46.2 | 78    |
| 1.1.1 Political stability & safety*.....              | 61.4 | 70    |
| 1.1.2 Government effectiveness*.....                  | 31.0 | 91    |
| 1.2 Regulatory environment.....                       | 32.0 | 122 ○ |
| 1.2.1 Regulatory quality*.....                        | 12.9 | 124 ○ |
| 1.2.2 Rule of law*.....                               | 9.4  | 121 ○ |
| 1.2.3 Cost of redundancy dismissal, salary weeks..... | 31.8 | 120   |
| 1.3 Business environment.....                         | 51.7 | 119   |
| 1.3.1 Ease of starting a business*.....               | 70.6 | 118   |
| 1.3.2 Ease of resolving insolvency*.....              | 25.2 | 124 ○ |
| 1.3.3 Ease of paying taxes*.....                      | 59.3 | 96    |

**2 Human capital & research.....22.8 93**

|  |       |       |
|--|-------|-------|
| 2.1 Education.....   | 39.1  | 89    |
| 2.1.1 Expenditure on education, % GDP.....                   | 4.9   | 56    |
| 2.1.2 Gov't expenditure/pupil, secondary, % GDP/cap.....     | 5.0   | 106 ○ |
| 2.1.3 School life expectancy, years <sup>Ⓐ</sup> .....       | 15.1  | 45 ●  |
| 2.1.4 PISA scales in reading, maths, & science.....          | n/a   | n/a   |
| 2.1.5 Pupil-teacher ratio, secondary.....                    | 22.3  | 88    |
| 2.2 Tertiary education.....                                  | 22.8  | 99    |
| 2.2.1 Tertiary enrolment, % gross <sup>Ⓐ</sup> .....         | 40.5  | 65    |
| 2.2.2 Graduates in science & engineering, %.....             | 14.9  | 86    |
| 2.2.3 Tertiary inbound mobility, % <sup>Ⓐ</sup> .....        | 0.6   | 89    |
| 2.3 Research & development (R&D).....                        | 6.5   | 71    |
| 2.3.1 Researchers, FTE/mn pop. <sup>Ⓐ</sup> .....            | 400.7 | 66    |
| 2.3.2 Gross expenditure on R&D, % GDP <sup>Ⓐ</sup> .....     | 0.4   | 68    |
| 2.3.3 Global R&D companies, avg. expend. top 3, mn \$US..... | 0.0   | 43 ○  |
| 2.3.4 QS university ranking, average score top 3*.....       | 11.1  | 62    |

**3 Infrastructure.....43.4 76**

|  |         |      |
|--|---------|------|
| 3.1 Information & communication technologies (ICTs).....     | 50.7    | 77   |
| 3.1.1 ICT access*.....                                       | 49.0    | 84   |
| 3.1.2 ICT use*.....  | 33.1    | 80   |
| 3.1.3 Government's online service*.....                      | 63.0    | 57   |
| 3.1.4 E-participation*.....                                  | 57.6    | 70   |
| 3.2 General infrastructure.....                              | 33.8    | 78   |
| 3.2.1 Electricity output, kWh/cap.....                       | 1,528.7 | 85   |
| 3.2.2 Logistics performance*.....                            | 33.1    | 74   |
| 3.2.3 Gross capital formation, % GDP.....                    | 24.7    | 46 ● |
| 3.3 Ecological sustainability.....                           | 45.7    | 60   |
| 3.3.1 GDP/unit of energy use.....                            | 11.9    | 28 ● |
| 3.3.2 Environmental performance*.....                        | 66.6    | 88   |
| 3.3.3 ISO 14001 environmental certificates/bn PPP\$ GDP..... | 1.2     | 60   |

**4 Market sophistication.....45.8 68**

|   |      |      |
|---|------|------|
| 4.1 Credit.....                                     | 46.2 | 38 ● |
| 4.1.1 Ease of getting credit*.....                  | 45.0 | 84   |
| 4.1.2 Domestic credit to private sector, % GDP..... | 26.9 | 103  |
| 4.1.3 Microfinance gross loans, % GDP.....          | 4.7  | 8 ●  |

|   |       |     |
|---|-------|-----|
| 4.2 Investment.....   | 31.6  | 103 |
| 4.2.1 Ease of protecting minority investors*.....           | 46.7  | 95  |
| 4.2.2 Market capitalization, % GDP.....                     | n/a   | n/a |
| 4.2.3 Venture capital deals/bn PPP\$ GDP <sup>Ⓐ</sup> ..... | 0.0   | 85  |
| 4.3 Trade, competition, & market scale.....                 | 59.5  | 72  |
| 4.3.1 Applied tariff rate, weighted mean, %.....            | 5.6   | 96  |
| 4.3.2 Intensity of local competition <sup>†</sup> .....     | 66.9  | 73  |
| 4.3.3 Domestic market scale, bn PPP\$.....                  | 182.4 | 59  |

**5 Business sophistication.....25.1 103**

|   |      |       |
|---|------|-------|
| 5.1 Knowledge workers.....  | 35.9 | 73    |
| 5.1.1 Knowledge-intensive employment, %.....                        | 14.7 | 88    |
| 5.1.2 Firms offering formal training, % firms <sup>Ⓐ</sup> .....    | 65.9 | 3 ●   |
| 5.1.3 GERD performed by business, % of GDP <sup>Ⓐ</sup> .....       | 0.2  | 53    |
| 5.1.4 GERD financed by business, % <sup>Ⓐ</sup> .....               | 0.1  | 93 ○  |
| 5.1.5 Females employed w/advanced degrees, % total.....             | 10.6 | 62    |
| 5.2 Innovation linkages.....  | 17.0 | 120   |
| 5.2.1 University/industry research collaboration <sup>†</sup> ..... | 35.1 | 94    |
| 5.2.2 State of cluster development <sup>†</sup> .....               | 37.7 | 92    |
| 5.2.3 GERD financed by abroad, % <sup>Ⓐ</sup> .....                 | 2.5  | 71    |
| 5.2.4 JV-strategic alliance deals/bn PPP\$ GDP.....                 | 0.0  | 111 ○ |
| 5.2.5 Patent families 2+ offices/bn PPP\$ GDP.....                  | 0.0  | 114 ○ |
| 5.3 Knowledge absorption.....                                       | 22.6 | 110   |
| 5.3.1 Intellectual property payments, % total trade.....            | 0.3  | 73    |
| 5.3.2 High-tech imports less re-imports, % total trade.....         | 9.7  | 47 ●  |
| 5.3.3 ICT services imports, % total trade.....                      | 0.0  | 124 ○ |
| 5.3.4 FDI net inflows, % GDP.....                                   | 0.9  | 106   |
| 5.3.5 Research talent, % in business enterprise <sup>Ⓐ</sup> .....  | 15.0 | 61    |

**6 Knowledge & technology outputs.....14.3 109**

|   |       |       |
|---|-------|-------|
| 6.1 Knowledge creation.....                                       | 3.5   | 104   |
| 6.1.1 Patents by origin/bn PPP\$ GDP <sup>Ⓐ</sup> .....           | 0.0   | 121 ○ |
| 6.1.2 PCT patent applications/bn PPP\$ GDP.....                   | 0.0   | 78    |
| 6.1.3 Utility models by origin/bn PPP\$ GDP <sup>Ⓐ</sup> .....    | 0.1   | 50    |
| 6.1.4 Scientific & technical articles/bn PPP\$ GDP.....           | 6.0   | 89    |
| 6.1.5 Citable documents H index.....                              | 7.7   | 79    |
| 6.2 Knowledge impact.....   | 23.1  | 96    |
| 6.2.1 Growth rate of PPP\$ GDP/worker, %.....                     | (1.1) | 99    |
| 6.2.2 New businesses/th pop. 15–64.....                           | n/a   | n/a   |
| 6.2.3 Computer software spending, % GDP.....                      | 0.2   | 63    |
| 6.2.4 ISO 9001 quality certificates/bn PPP\$ GDP.....             | 6.9   | 54 ●  |
| 6.2.5 High- & medium-high-tech manufactures, % <sup>Ⓐ</sup> ..... | 0.1   | 70    |
| 6.3 Knowledge diffusion.....                                      | 16.3  | 107   |
| 6.3.1 Intellectual property receipts, % total trade.....          | n/a   | n/a   |
| 6.3.2 High-tech exports less re-exports, % total trade.....       | 0.5   | 87    |
| 6.3.3 ICT services exports, % total trade.....                    | 0.4   | 106   |
| 6.3.4 FDI net outflows, % GDP.....                                | 0.1   | 97    |

**7 Creative outputs.....30.1 66**

|   |      |      |
|---|------|------|
| 7.1 Intangible assets.....  | 47.4 | 48 ● |
| 7.1.1 Trademarks by origin/bn PPP\$ GDP <sup>Ⓐ</sup> .....        | 63.9 | 31 ● |
| 7.1.2 Industrial designs by origin/bn PPP\$ GDP.....              | n/a  | n/a  |
| 7.1.3 ICTs & business model creation <sup>†</sup> .....           | 57.4 | 76   |
| 7.1.4 ICTs & organizational model creation <sup>†</sup> .....     | 52.2 | 67   |
| 7.2 Creative goods & services.....                                | 12.0 | 82   |
| 7.2.1 Cultural & creative services exports, % of total trade..... | 0.3  | 37 ● |
| 7.2.2 National feature films/mn pop. 15–69.....                   | 2.1  | 60   |
| 7.2.3 Global ent. & media market/th pop. 15–69.....               | n/a  | n/a  |
| 7.2.4 Printing & publishing manufactures, % <sup>Ⓐ</sup> .....    | 1.6  | 33 ● |
| 7.2.5 Creative goods exports, % total trade.....                  | 0.1  | 104  |
| 7.3 Online creativity.....  | 13.7 | 83   |
| 7.3.1 Generic top-level domains (TLDs)/th pop. 15–69.....         | 2.1  | 76   |
| 7.3.2 Country-code TLDs/th pop. 15–69.....                        | 1.1  | 78   |
| 7.3.3 Wikipedia edits/mn pop. 15–69 <sup>Ⓐ</sup> .....            | 3.9  | 86   |
| 7.3.4 Video uploads on YouTube/pop. 15–69.....                    | n/a  | n/a  |

NOTES: ● indicates a strength; ○ a weakness; \* an index; † a survey question.

<sup>Ⓐ</sup> indicates that the country's data are older than the base year; see Appendix II for details, including the year of the data, at <http://globalinnovationindex.org>.

Square brackets indicate that the data minimum coverage (DMC) requirements were not met at the sub-pillar or pillar level; see page 181 of this appendix for details.

## Key indicators

|                            |                                  |
|----------------------------|----------------------------------|
| Population (millions)..... | 93.4                             |
| GDP (US\$ billions).....   | 330.2                            |
| GDP per capita, PPP\$..... | 11,849.6                         |
| Income group.....          | Lower-middle income              |
| Region.....                | Northern Africa and Western Asia |

|  | Score 0–100<br>or value (hard data) | Rank       |
|--|-------------------------------------|------------|
| <b>Global Innovation Index (out of 127).....</b> | <b>26.0</b>                         | <b>105</b> |
| Innovation Output Sub-Index.....                 | 19.3                                | 97         |
| Innovation Input Sub-Index.....                  | 32.7                                | 106        |
| Innovation Efficiency Ratio.....                 | 0.6                                 | 81         |
| Global Innovation Index 2016 (out of 128).....   | 26.0                                | 107        |

|  |             |            |   |
|--|-------------|------------|---|
| <b>1 Institutions.....</b>                                   | <b>40.4</b> | <b>121</b> | ○ |
| 1.1 Political environment.....                               | 26.9        | 119        |   |
| 1.1.1 Political stability & safety*.....                     | 31.3        | 119        |   |
| 1.1.2 Government effectiveness*.....                         | 22.6        | 113        |   |
| 1.2 Regulatory environment.....                              | 33.1        | 120        | ○ |
| 1.2.1 Regulatory quality*.....                               | 21.8        | 111        |   |
| 1.2.2 Rule of law*.....                                      | 24.7        | 92         |   |
| 1.2.3 Cost of redundancy dismissal, salary weeks.....        | 36.8        | 122        | ○ |
| 1.3 Business environment.....                                | 61.3        | 90         |   |
| 1.3.1 Ease of starting a business*.....                      | 92.4        | 33         | ● |
| 1.3.2 Ease of resolving insolvency*.....                     | 39.5        | 97         |   |
| 1.3.3 Ease of paying taxes*.....                             | 52.0        | 111        |   |
| <b>2 Human capital &amp; research.....</b>                   | <b>26.9</b> | <b>82</b>  |   |
| 2.1 Education.....   | 48.6        | 58         |   |
| 2.1.1 Expenditure on education, % GDP <sup>Ⓔ</sup> .....     | 3.8         | 86         |   |
| 2.1.2 Gov't expenditure/pupil, secondary, % GDP/cap.....     | n/a         | n/a        |   |
| 2.1.3 School life expectancy, years.....                     | 13.1        | 71         |   |
| 2.1.4 PISA scales in reading, maths, & science.....          | n/a         | n/a        |   |
| 2.1.5 Pupil-teacher ratio, secondary <sup>Ⓔ</sup> .....      | 14.4        | 60         |   |
| 2.2 Tertiary education.....                                  | 20.2        | 103        |   |
| 2.2.1 Tertiary enrolment, % gross.....                       | 36.2        | 72         |   |
| 2.2.2 Graduates in science & engineering, %.....             | 11.8        | 97         | ○ |
| 2.2.3 Tertiary inbound mobility, % <sup>Ⓔ</sup> .....        | 1.9         | 70         |   |
| 2.3 Research & development (R&D).....                        | 11.9        | 54         |   |
| 2.3.1 Researchers, FTE/mn pop.....                           | 679.8       | 57         |   |
| 2.3.2 Gross expenditure on R&D, % GDP.....                   | 0.7         | 49         |   |
| 2.3.3 Global R&D companies, avg. expend. top 3, mn \$US..... | 0.0         | 43         | ○ |
| 2.3.4 QS university ranking, average score top 3*.....       | 22.9        | 48         | ● |
| <b>3 Infrastructure.....</b>                                 | <b>38.4</b> | <b>93</b>  |   |
| 3.1 Information & communication technologies (ICTs).....     | 43.0        | 91         |   |
| 3.1.1 ICT access*.....                                       | 53.0        | 78         |   |
| 3.1.2 ICT use*.....  | 31.4        | 84         |   |
| 3.1.3 Government's online service*.....                      | 47.1        | 90         |   |
| 3.1.4 E-participation*.....                                  | 40.7        | 97         |   |
| 3.2 General infrastructure.....                              | 27.4        | 100        |   |
| 3.2.1 Electricity output, kWh/cap.....                       | 1,917.2     | 78         |   |
| 3.2.2 Logistics performance*.....                            | 51.9        | 48         | ● |
| 3.2.3 Gross capital formation, % GDP.....                    | 14.5        | 113        |   |
| 3.3 Ecological sustainability.....                           | 44.9        | 63         |   |
| 3.3.1 GDP/unit of energy use.....                            | 11.8        | 29         | ● |
| 3.3.2 Environmental performance*.....                        | 66.5        | 89         |   |
| 3.3.3 ISO 14001 environmental certificates/bn PPP\$ GDP..... | 0.8         | 70         |   |
| <b>4 Market sophistication.....</b>                          | <b>36.7</b> | <b>107</b> |   |
| 4.1 Credit.....  | 20.2        | 111        |   |
| 4.1.1 Ease of getting credit*.....                           | 50.0        | 72         |   |
| 4.1.2 Domestic credit to private sector, % GDP.....          | 26.5        | 104        |   |
| 4.1.3 Microfinance gross loans, % GDP.....                   | 0.0         | 61         |   |

|   |         |     |   |
|---|---------|-----|---|
| 4.2 Investment.....                                     | 26.6    | 121 | ○ |
| 4.2.1 Ease of protecting minority investors*.....       | 48.3    | 92  |   |
| 4.2.2 Market capitalization, % GDP.....                 | 16.7    | 64  |   |
| 4.2.3 Venture capital deals/bn PPP\$ GDP.....           | 0.0     | 72  |   |
| 4.3 Trade, competition, & market scale.....             | 63.4    | 56  |   |
| 4.3.1 Applied tariff rate, weighted mean, %.....        | 7.0     | 103 |   |
| 4.3.2 Intensity of local competition <sup>†</sup> ..... | 53.9    | 117 | ○ |
| 4.3.3 Domestic market scale, bn PPP\$.....              | 1,105.0 | 21  | ● |

**5 Business sophistication.....21.0 120** ○

|  |      |     |   |
|--|------|-----|---|
| 5.1 Knowledge workers.....   | 21.2 | 108 |   |
| 5.1.1 Knowledge-intensive employment, %.....                           | 33.9 | 40  | ● |
| 5.1.2 Firms offering formal training, % firms.....                     | 5.2  | 91  | ○ |
| 5.1.3 GERD performed by business, % of GDP.....                        | 0.0  | 72  |   |
| 5.1.4 GERD financed by business, %.....                                | 6.2  | 76  |   |
| 5.1.5 Females employed w/advanced degrees, % total <sup>Ⓔ</sup> .....  | 5.5  | 76  |   |
| 5.2 Innovation linkages.....   | 19.2 | 113 |   |
| 5.2.1 University/industry research collaboration <sup>†Ⓔ</sup> .....   | 23.8 | 121 | ○ |
| 5.2.2 State of cluster development <sup>†</sup> .....                  | 54.5 | 31  | ● |
| 5.2.3 GERD financed by abroad, % <sup>Ⓔ</sup> .....                    | 0.1  | 98  | ○ |
| 5.2.4 JV-strategic alliance deals/bn PPP\$ GDP.....                    | 0.0  | 103 |   |
| 5.2.5 Patent families 2+ offices/bn PPP\$ GDP.....                     | 0.0  | 83  |   |
| 5.3 Knowledge absorption.....  | 22.5 | 111 |   |
| 5.3.1 Intellectual property payments, % total trade <sup>Ⓔ</sup> ..... | 0.4  | 66  |   |
| 5.3.2 High-tech imports less re-imports, % total trade.....            | 8.6  | 56  |   |
| 5.3.3 ICT services imports, % total trade <sup>Ⓔ</sup> .....           | 0.7  | 86  |   |
| 5.3.4 FDI net inflows, % GDP.....                                      | 1.7  | 88  |   |
| 5.3.5 Research talent, % in business enterprise.....                   | 5.4  | 73  |   |

**6 Knowledge & technology outputs.....17.0 93**

|  |      |     |   |
|--|------|-----|---|
| 6.1 Knowledge creation.....  | 8.0  | 71  |   |
| 6.1.1 Patents by origin/bn PPP\$ GDP <sup>Ⓔ</sup> .....                | 0.8  | 69  |   |
| 6.1.2 PCT patent applications/bn PPP\$ GDP.....                        | 0.0  | 88  |   |
| 6.1.3 Utility models by origin/bn PPP\$ GDP.....                       | n/a  | n/a |   |
| 6.1.4 Scientific & technical articles/bn PPP\$ GDP.....                | 9.7  | 67  |   |
| 6.1.5 Citable documents H index.....                                   | 14.5 | 50  |   |
| 6.2 Knowledge impact.....  | 25.3 | 90  |   |
| 6.2.1 Growth rate of PPP\$ GDP/worker, %.....                          | 0.7  | 69  |   |
| 6.2.2 New businesses/th pop. 15–64 <sup>Ⓔ</sup> .....                  | 0.1  | 99  | ○ |
| 6.2.3 Computer software spending, % GDP.....                           | 0.3  | 46  | ● |
| 6.2.4 ISO 9001 quality certificates/bn PPP\$ GDP.....                  | 2.4  | 87  |   |
| 6.2.5 High- & medium-high-tech manufactures, % <sup>Ⓔ</sup> .....      | 0.2  | 60  |   |
| 6.3 Knowledge diffusion.....   | 17.6 | 97  |   |
| 6.3.1 Intellectual property receipts, % total trade <sup>Ⓔ</sup> ..... | 0.3  | 33  | ● |
| 6.3.2 High-tech exports less re-exports, % total trade.....            | 0.2  | 104 |   |
| 6.3.3 ICT services exports, % total trade <sup>Ⓔ</sup> .....           | 1.7  | 59  |   |
| 6.3.4 FDI net outflows, % GDP.....                                     | 0.1  | 94  |   |

**7 Creative outputs.....21.6 97**

|   |      |     |   |
|---|------|-----|---|
| 7.1 Intangible assets.....  | 30.2 | 103 |   |
| 7.1.1 Trademarks by origin/bn PPP\$ GDP.....                      | 11.7 | 99  |   |
| 7.1.2 Industrial designs by origin/bn PPP\$ GDP.....              | 1.5  | 51  |   |
| 7.1.3 ICTs & business model creation <sup>†</sup> .....           | 50.3 | 97  |   |
| 7.1.4 ICTs & organizational model creation <sup>†</sup> .....     | 45.7 | 88  |   |
| 7.2 Creative goods & services.....                                | 15.2 | 73  |   |
| 7.2.1 Cultural & creative services exports, % of total trade..... | n/a  | n/a |   |
| 7.2.2 National feature films/mn pop. 15–69.....                   | 0.6  | 90  |   |
| 7.2.3 Global ent. & media market/th pop. 15–69.....               | 1.0  | 56  |   |
| 7.2.4 Printing & publishing manufactures, % <sup>Ⓔ</sup> .....    | 0.4  | 93  | ○ |
| 7.2.5 Creative goods exports, % total trade.....                  | 1.9  | 26  | ● |
| 7.3 Online creativity.....  | 11.0 | 97  |   |
| 7.3.1 Generic top-level domains (TLDs)/th pop. 15–69.....         | 1.2  | 90  |   |
| 7.3.2 Country-code TLDs/th pop. 15–69.....                        | 0.0  | 120 | ○ |
| 7.3.3 Wikipedia edits/mn pop. 15–69.....                          | 3.6  | 91  |   |
| 7.3.4 Video uploads on YouTube/pop. 15–69.....                    | 7.9  | 65  |   |

NOTES: ● indicates a strength; ○ a weakness; \* an index; † a survey question.

Ⓔ indicates that the country's data are older than the base year; see Appendix II for details, including the year of the data, at <http://globalinnovationindex.org>.

Square brackets indicate that the data minimum coverage (DMC) requirements were not met at the sub-pillar or pillar level; see page 181 of this appendix for details.

## El Salvador

## Key indicators

|                            |                                 |
|----------------------------|---------------------------------|
| Population (millions)..... | 6.1                             |
| GDP (US\$ billions).....   | 26.6                            |
| GDP per capita, PPP\$..... | 8,302.5                         |
| Income group.....          | Lower-middle income             |
| Region.....                | Latin America and the Caribbean |

|  | Score 0–100<br>or value (hard data) | Rank       |
|--|-------------------------------------|------------|
| <b>Global Innovation Index (out of 127).....</b> | <b>26.7</b>                         | <b>103</b> |
| Innovation Output Sub-Index.....                 | 17.3                                | 105        |
| Innovation Input Sub-Index.....                  | 36.1                                | 96         |
| Innovation Efficiency Ratio.....                 | 0.5                                 | 107        |
| Global Innovation Index 2016 (out of 128).....   | 26.6                                | 104        |

|   |             |           |
|---|-------------|-----------|
| <b>1 Institutions.....</b>                            | <b>53.5</b> | <b>85</b> |
| 1.1 Political environment.....                        | 49.3        | 70        |
| 1.1.1 Political stability & safety*.....              | 62.6        | 64        |
| 1.1.2 Government effectiveness*.....                  | 35.9        | 85        |
| 1.2 Regulatory environment.....                       | 52.6        | 93        |
| 1.2.1 Regulatory quality*.....                        | 47.2        | 64        |
| 1.2.2 Rule of law*.....                               | 22.1        | 96        |
| 1.2.3 Cost of redundancy dismissal, salary weeks..... | 22.9        | 96        |
| 1.3 Business environment.....                         | 58.7        | 102       |
| 1.3.1 Ease of starting a business*.....               | 80.7        | 97        |
| 1.3.2 Ease of resolving insolvency*.....              | 45.8        | 73        |
| 1.3.3 Ease of paying taxes*.....                      | 49.5        | 114       |

|  |             |            |
|--|-------------|------------|
| <b>2 Human capital &amp; research.....</b>                   | <b>20.1</b> | <b>100</b> |
| 2.1 Education.....   | 32.0        | 106        |
| 2.1.1 Expenditure on education, % GDP.....                   | 3.4         | 93         |
| 2.1.2 Gov't expenditure/pupil, secondary, % GDP/cap.....     | 10.4        | 96         |
| 2.1.3 School life expectancy, years.....                     | 13.2        | 69         |
| 2.1.4 PISA scales in reading, maths, & science.....          | n/a         | n/a        |
| 2.1.5 Pupil-teacher ratio, secondary <sup>Ⓐ</sup> .....      | 24.3        | 91         |
| 2.2 Tertiary education.....                                  | 28.0        | 85         |
| 2.2.1 Tertiary enrolment, % gross <sup>Ⓐ</sup> .....         | 28.9        | 81         |
| 2.2.2 Graduates in science & engineering, %.....             | 22.2        | 41 ●       |
| 2.2.3 Tertiary inbound mobility, % <sup>Ⓐ</sup> .....        | 0.4         | 92         |
| 2.3 Research & development (R&D).....                        | 0.5         | 108        |
| 2.3.1 Researchers, FTE/mn pop.....                           | n/a         | n/a        |
| 2.3.2 Gross expenditure on R&D, % GDP <sup>Ⓐ</sup> .....     | 0.1         | 106 ○      |
| 2.3.3 Global R&D companies, avg. expend. top 3, mn \$US..... | 0.0         | 43 ○       |
| 2.3.4 QS university ranking, average score top 3*.....       | 0.0         | 75 ○       |

|  |             |           |
|--|-------------|-----------|
| <b>3 Infrastructure.....</b>                                 | <b>36.2</b> | <b>98</b> |
| 3.1 Information & communication technologies (ICTs).....     | 43.2        | 90        |
| 3.1.1 ICT access*.....                                       | 49.5        | 83        |
| 3.1.2 ICT use*.....  | 18.7        | 101       |
| 3.1.3 Government's online service*.....                      | 48.6        | 87        |
| 3.1.4 E-participation*.....                                  | 55.9        | 74        |
| 3.2 General infrastructure.....                              | 20.7        | 118       |
| 3.2.1 Electricity output, kWh/cap.....                       | 1,018.5     | 92        |
| 3.2.2 Logistics performance*.....                            | 29.7        | 82        |
| 3.2.3 Gross capital formation, % GDP.....                    | 14.2        | 116       |
| 3.3 Ecological sustainability.....                           | 44.8        | 64        |
| 3.3.1 GDP/unit of energy use.....                            | 11.8        | 29 ●      |
| 3.3.2 Environmental performance*.....                        | 68.1        | 85        |
| 3.3.3 ISO 14001 environmental certificates/bn PPP\$ GDP..... | 0.3         | 101       |

|   |             |           |
|---|-------------|-----------|
| <b>4 Market sophistication.....</b>                 | <b>42.2</b> | <b>87</b> |
| 4.1 Credit.....                                     | 35.0        | 65        |
| 4.1.1 Ease of getting credit*.....                  | 65.0        | 40        |
| 4.1.2 Domestic credit to private sector, % GDP..... | 44.9        | 76        |
| 4.1.3 Microfinance gross loans, % GDP.....          | 1.3         | 22 ●      |

|   |      |       |
|---|------|-------|
| 4.2 Investment.....                                     | 32.0 | 101   |
| 4.2.1 Ease of protecting minority investors*.....       | 38.3 | 120 ○ |
| 4.2.2 Market capitalization, % GDP <sup>Ⓐ</sup> .....   | 45.1 | 36    |
| 4.2.3 Venture capital deals/bn PPP\$ GDP.....           | n/a  | n/a   |
| 4.3 Trade, competition, & market scale.....             | 59.6 | 71    |
| 4.3.1 Applied tariff rate, weighted mean, %.....        | 1.8  | 51    |
| 4.3.2 Intensity of local competition <sup>†</sup> ..... | 71.0 | 52    |
| 4.3.3 Domestic market scale, bn PPP\$.....              | 54.8 | 92    |

|   |             |           |
|---|-------------|-----------|
| <b>5 Business sophistication.....</b>                                 | <b>28.2</b> | <b>82</b> |
| 5.1 Knowledge workers.....  | 29.1        | 87        |
| 5.1.1 Knowledge-intensive employment, % <sup>Ⓐ</sup> .....            | 12.1        | 92        |
| 5.1.2 Firms offering formal training, % firms.....                    | 53.8        | 17 ●      |
| 5.1.3 GERD performed by business, % of GDP.....                       | n/a         | n/a       |
| 5.1.4 GERD financed by business, % <sup>Ⓐ</sup> .....                 | 0.7         | 88 ○      |
| 5.1.5 Females employed w/advanced degrees, % total <sup>Ⓐ</sup> ..... | 0.1         | 88 ○      |
| 5.2 Innovation linkages.....  | 26.5        | 70        |
| 5.2.1 University/industry research collaboration <sup>†</sup> .....   | 29.6        | 106       |
| 5.2.2 State of cluster development <sup>†</sup> .....                 | 36.2        | 98        |
| 5.2.3 GERD financed by abroad, % <sup>Ⓐ</sup> .....                   | 16.9        | 26 ●      |
| 5.2.4 JV-strategic alliance deals/bn PPP\$ GDP.....                   | n/a         | n/a       |
| 5.2.5 Patent families 2+ offices/bn PPP\$ GDP.....                    | 0.0         | 104       |
| 5.3 Knowledge absorption.....   | 29.1        | 81        |
| 5.3.1 Intellectual property payments, % total trade.....              | 0.8         | 43 ●      |
| 5.3.2 High-tech imports less re-imports, % total trade.....           | 9.9         | 46 ●      |
| 5.3.3 ICT services imports, % total trade.....                        | 0.4         | 104       |
| 5.3.4 FDI net inflows, % GDP.....                                     | 1.7         | 89        |
| 5.3.5 Research talent, % in business enterprise.....                  | n/a         | n/a       |

|  |            |            |          |
|--|------------|------------|----------|
| <b>6 Knowledge &amp; technology outputs.....</b>               | <b>9.3</b> | <b>121</b> | <b>○</b> |
| 6.1 Knowledge creation.....                                    | 1.4        | 122 ○      |          |
| 6.1.1 Patents by origin/bn PPP\$ GDP.....                      | 0.1        | 103        |          |
| 6.1.2 PCT patent applications/bn PPP\$ GDP.....                | 0.0        | 98 ○       |          |
| 6.1.3 Utility models by origin/bn PPP\$ GDP <sup>Ⓐ</sup> ..... | 0.1        | 49         |          |
| 6.1.4 Scientific & technical articles/bn PPP\$ GDP.....        | 1.1        | 123 ○      |          |
| 6.1.5 Citable documents H index.....                           | 1.4        | 123 ○      |          |
| 6.2 Knowledge impact.....                                      | 4.5        | 119 ○      |          |
| 6.2.1 Growth rate of PPP\$ GDP/worker, %.....                  | n/a        | n/a        |          |
| 6.2.2 New businesses/th pop. 15–64.....                        | 0.5        | 86         |          |
| 6.2.3 Computer software spending, % GDP.....                   | 0.0        | 105        |          |
| 6.2.4 ISO 9001 quality certificates/bn PPP\$ GDP.....          | 4.2        | 68         |          |
| 6.2.5 High- & medium-high-tech manufactures, %.....            | n/a        | n/a        |          |
| 6.3 Knowledge diffusion.....                                   | 22.0       | 64         |          |
| 6.3.1 Intellectual property receipts, % total trade.....       | 0.3        | 30 ●       |          |
| 6.3.2 High-tech exports less re-exports, % total trade.....    | 2.4        | 49 ●       |          |
| 6.3.3 ICT services exports, % total trade.....                 | 2.1        | 51         |          |
| 6.3.4 FDI net outflows, % GDP.....                             | 0.5        | 69         |          |

|   |             |           |
|---|-------------|-----------|
| <b>7 Creative outputs.....</b>  | <b>25.3</b> | <b>89</b> |
| 7.1 Intangible assets.....  | 39.1        | 77        |
| 7.1.1 Trademarks by origin/bn PPP\$ GDP.....                                    | 83.7        | 18 ●      |
| 7.1.2 Industrial designs by origin/bn PPP\$ GDP.....                            | 0.2         | 95        |
| 7.1.3 ICTs & business model creation <sup>†</sup> .....                         | 49.1        | 106       |
| 7.1.4 ICTs & organizational model creation <sup>†</sup> .....                   | 44.5        | 95        |
| 7.2 Creative goods & services.....  | 9.6         | 91        |
| 7.2.1 Cultural & creative services exports, % of total trade <sup>Ⓐ</sup> ..... | 0.0         | 89 ○      |
| 7.2.2 National feature films/mn pop. 15–69 <sup>Ⓐ</sup> .....                   | 0.3         | 97        |
| 7.2.3 Global ent. & media market/th pop. 15–69.....                             | n/a         | n/a       |
| 7.2.4 Printing & publishing manufactures, %.....                                | n/a         | n/a       |
| 7.2.5 Creative goods exports, % total trade.....                                | 0.7         | 52        |
| 7.3 Online creativity.....  | 13.6        | 86        |
| 7.3.1 Generic top-level domains (TLDs)/th pop. 15–69.....                       | 2.6         | 72        |
| 7.3.2 Country-code TLDs/th pop. 15–69.....                                      | 0.6         | 88        |
| 7.3.3 Wikipedia edits/mn pop. 15–69 <sup>Ⓐ</sup> .....                          | 3.9         | 87        |
| 7.3.4 Video uploads on YouTube/pop. 15–69.....                                  | n/a         | n/a       |

NOTES: ● indicates a strength; ○ a weakness; \* an index; † a survey question.

<sup>Ⓐ</sup> indicates that the country's data are older than the base year; see Appendix II for details, including the year of the data, at <http://globalinnovationindex.org>.

Square brackets indicate that the data minimum coverage (DMC) requirements were not met at the sub-pillar or pillar level; see page 181 of this appendix for details.

## Key indicators

|                             |             |
|-----------------------------|-------------|
| Population (millions) ..... | 1.3         |
| GDP (US\$ billions) .....   | 23.5        |
| GDP per capita, PPP\$ ..... | 28,591.8    |
| Income group .....          | High income |
| Region .....                | Europe      |

|  | Score 0–100<br>or value (hard data) | Rank      |
|--|-------------------------------------|-----------|
| <b>Global Innovation Index (out of 127).....</b> | <b>50.9</b>                         | <b>25</b> |
| Innovation Output Sub-Index .....                | 44.9                                | 19        |
| Innovation Input Sub-Index .....                 | 57.0                                | 26        |
| Innovation Efficiency Ratio .....                | 0.8                                 | 19        |
| Global Innovation Index 2016 (out of 128) .....  | 51.7                                | 24        |

|          |  |             |           |
|----------|--|-------------|-----------|
| <b>1</b> | <b>Institutions.....</b>                                 | <b>81.1</b> | <b>20</b> |
| 1.1      | Political environment .....                              | 74.5        | 32        |
| 1.1.1    | Political stability & safety* .....                      | 78.9        | 36        |
| 1.1.2    | Government effectiveness* .....                          | 70.2        | 28        |
| 1.2      | Regulatory environment .....                             | 85.8        | 18        |
| 1.2.1    | Regulatory quality* .....                                | 84.5        | 15        |
| 1.2.2    | Rule of law* .....                                       | 78.2        | 23        |
| 1.2.3    | Cost of redundancy dismissal, salary weeks .....         | 12.9        | 44        |
| 1.3      | Business environment .....                               | 82.9        | 24        |
| 1.3.1    | Ease of starting a business* .....                       | 95.1        | 13        |
| 1.3.2    | Ease of resolving insolvency* .....                      | 65.5        | 39        |
| 1.3.3    | Ease of paying taxes* .....                              | 88.0        | 19        |
| <b>2</b> | <b>Human capital &amp; research.....</b>                 | <b>41.5</b> | <b>38</b> |
| 2.1      | Education .....  | 58.8        | 25        |
| 2.1.1    | Expenditure on education, % GDP .....                    | 4.8         | 58 ○      |
| 2.1.2    | Gov't expenditure/pupil, secondary, % GDP/cap .....      | 23.1        | 40        |
| 2.1.3    | School life expectancy, years .....                      | 16.4        | 26        |
| 2.1.4    | PISA scales in reading, maths, & science .....           | 524.3       | 4 ●       |
| 2.1.5    | Pupil-teacher ratio, secondary <sup>Ⓐ</sup> .....        | 8.1         | 9         |
| 2.2      | Tertiary education .....                                 | 43.1        | 40        |
| 2.2.1    | Tertiary enrolment, % gross .....                        | 69.6        | 26        |
| 2.2.2    | Graduates in science & engineering, % <sup>Ⓐ</sup> ..... | 22.1        | 44        |
| 2.2.3    | Tertiary inbound mobility, % .....                       | 5.2         | 35        |
| 2.3      | Research & development (R&D) .....                       | 22.7        | 42        |
| 2.3.1    | Researchers, FTE/mn pop. .....                           | 3,189.2     | 28        |
| 2.3.2    | Gross expenditure on R&D, % GDP .....                    | 1.5         | 24        |
| 2.3.3    | Global R&D companies, avg. expend. top 3, mn \$US .....  | 0.0         | 43 ○      |
| 2.3.4    | QS university ranking, average score top 3* .....        | 17.9        | 53        |
| <b>3</b> | <b>Infrastructure.....</b>                               | <b>63.9</b> | <b>11</b> |
| 3.1      | Information & communication technologies (ICTs) .....    | 82.3        | 17        |
| 3.1.1    | ICT access* .....  | 80.2        | 24        |
| 3.1.2    | ICT use* .....   | 78.7        | 13        |
| 3.1.3    | Government's online service* .....                       | 89.1        | 13        |
| 3.1.4    | E-participation* .....                                   | 81.4        | 22        |
| 3.2      | General infrastructure .....                             | 45.5        | 38        |
| 3.2.1    | Electricity output, kWh/cap .....                        | 7,891.7     | 22        |
| 3.2.2    | Logistics performance* .....                             | 60.1        | 37        |
| 3.2.3    | Gross capital formation, % GDP .....                     | 24.0        | 49        |
| 3.3      | Ecological sustainability .....                          | 63.9        | 9 ●       |
| 3.3.1    | GDP/unit of energy use .....                             | 6.1         | 92 ○      |
| 3.3.2    | Environmental performance* .....                         | 88.6        | 8 ●       |
| 3.3.3    | ISO 14001 environmental certificates/bn PPP\$ GDP .....  | 14.8        | 1 ●       |
| <b>4</b> | <b>Market sophistication .....</b>                       | <b>55.0</b> | <b>26</b> |
| 4.1      | Credit .....   | 48.8        | 30        |
| 4.1.1    | Ease of getting credit* .....                            | 70.0        | 29        |
| 4.1.2    | Domestic credit to private sector, % GDP .....           | 70.3        | 41        |
| 4.1.3    | Microfinance gross loans, % GDP .....                    | n/a         | n/a       |

|       |   |      |      |
|-------|---|------|------|
| 4.2   | Investment .....                                  | 56.4 | 20   |
| 4.2.1 | Ease of protecting minority investors* .....      | 60.0 | 52   |
| 4.2.2 | Market capitalization, % GDP .....                | n/a  | n/a  |
| 4.2.3 | Venture capital deals/bn PPP\$ GDP .....          | 0.2  | 12   |
| 4.3   | Trade, competition, & market scale .....          | 59.9 | 70 ○ |
| 4.3.1 | Applied tariff rate, weighted mean, % .....       | 1.6  | 23   |
| 4.3.2 | Intensity of local competition <sup>†</sup> ..... | 79.2 | 15   |
| 4.3.3 | Domestic market scale, bn PPP\$ .....             | 38.7 | 98 ○ |

**5 Business sophistication .....** **43.4** **29**

|       |   |      |      |
|-------|---|------|------|
| 5.1   | Knowledge workers .....                                       | 55.1 | 28   |
| 5.1.1 | Knowledge-intensive employment, % .....                       | 44.0 | 17   |
| 5.1.2 | Firms offering formal training, % firms .....                 | 35.2 | 38   |
| 5.1.3 | GERD performed by business, % of GDP .....                    | 0.7  | 27   |
| 5.1.4 | GERD financed by business, % .....                            | 41.0 | 33   |
| 5.1.5 | Females employed w/advanced degrees, % total .....            | 25.8 | 7    |
| 5.2   | Innovation linkages .....                                     | 36.9 | 39   |
| 5.2.1 | University/industry research collaboration <sup>†</sup> ..... | 51.4 | 34   |
| 5.2.2 | State of cluster development <sup>†</sup> .....               | 46.0 | 59   |
| 5.2.3 | GERD financed by abroad, % .....                              | 12.2 | 42   |
| 5.2.4 | JV-strategic alliance deals/bn PPP\$ GDP .....                | 0.2  | 3 ●  |
| 5.2.5 | Patent families 2+ offices/bn PPP\$ GDP .....                 | 1.1  | 27   |
| 5.3   | Knowledge absorption .....                                    | 38.3 | 40   |
| 5.3.1 | Intellectual property payments, % total trade .....           | 0.2  | 79 ○ |
| 5.3.2 | High-tech imports less re-imports, % total trade .....        | 12.2 | 23   |
| 5.3.3 | ICT services imports, % total trade .....                     | 2.2  | 18   |
| 5.3.4 | FDI net inflows, % GDP .....                                  | 2.6  | 69 ○ |
| 5.3.5 | Research talent, % in business enterprise .....               | 27.5 | 47 ○ |

**6 Knowledge & technology outputs .....** **36.1** **27**

|       |  |       |       |
|-------|--|-------|-------|
| 6.1   | Knowledge creation .....                               | 31.3  | 30    |
| 6.1.1 | Patents by origin/bn PPP\$ GDP .....                   | 1.6   | 52    |
| 6.1.2 | PCT patent applications/bn PPP\$ GDP .....             | 0.6   | 33    |
| 6.1.3 | Utility models by origin/bn PPP\$ GDP .....            | 2.0   | 14    |
| 6.1.4 | Scientific & technical articles/bn PPP\$ GDP .....     | 47.6  | 10    |
| 6.1.5 | Citable documents H index .....                        | 14.6  | 49    |
| 6.2   | Knowledge impact .....                                 | 43.4  | 20    |
| 6.2.1 | Growth rate of PPP\$ GDP/worker, % .....               | (1.8) | 101 ○ |
| 6.2.2 | New businesses/th pop. 15–64 .....                     | 16.1  | 4 ●   |
| 6.2.3 | Computer software spending, % GDP .....                | 0.2   | 79 ○  |
| 6.2.4 | ISO 9001 quality certificates/bn PPP\$ GDP .....       | 30.1  | 8 ●   |
| 6.2.5 | High- & medium-high-tech manufactures, % .....         | 0.4   | 30    |
| 6.3   | Knowledge diffusion .....                              | 33.6  | 32    |
| 6.3.1 | Intellectual property receipts, % total trade .....    | 0.1   | 65 ○  |
| 6.3.2 | High-tech exports less re-exports, % total trade ..... | 11.7  | 17    |
| 6.3.3 | ICT services exports, % total trade .....              | 3.2   | 28    |
| 6.3.4 | FDI net outflows, % GDP .....                          | 1.9   | 32    |

**7 Creative outputs .....** **53.6** **8 ●**

|       |   |      |     |
|-------|---|------|-----|
| 7.1   | Intangible assets .....   | 59.9 | 15  |
| 7.1.1 | Trademarks by origin/bn PPP\$ GDP .....                                   | 82.9 | 19  |
| 7.1.2 | Industrial designs by origin/bn PPP\$ GDP .....                           | 4.3  | 29  |
| 7.1.3 | ICTs & business model creation <sup>†</sup> .....                         | 75.9 | 22  |
| 7.1.4 | ICTs & organizational model creation <sup>†</sup> .....                   | 79.9 | 5 ● |
| 7.2   | Creative goods & services .....   | 48.8 | 4 ● |
| 7.2.1 | Cultural & creative services exports, % of total trade <sup>Ⓐ</sup> ..... | 1.5  | 7 ● |
| 7.2.2 | National feature films/mn pop. 15–69 .....                                | 27.2 | 1 ● |
| 7.2.3 | Global ent. & media market/th pop. 15–69 .....                            | n/a  | n/a |
| 7.2.4 | Printing & publishing manufactures, % .....                               | 2.0  | 22  |
| 7.2.5 | Creative goods exports, % total trade .....                               | 1.2  | 38  |
| 7.3   | Online creativity .....   | 45.9 | 21  |
| 7.3.1 | Generic top-level domains (TLDs)/th pop. 15–69 .....                      | 9.2  | 41  |
| 7.3.2 | Country-code TLDs/th pop. 15–69 .....                                     | 40.7 | 17  |
| 7.3.3 | Wikipedia edits/mn pop. 15–69 .....                                       | 7.3  | 5 ● |
| 7.3.4 | Video uploads on YouTube/pop. 15–69 .....                                 | 63.0 | 7   |

NOTES: ● indicates a strength; ○ a weakness; \* an index; † a survey question.

Ⓐ indicates that the country's data are older than the base year; see Appendix II for details, including the year of the data, at <http://globalinnovationindex.org>.

Square brackets indicate that the data minimum coverage (DMC) requirements were not met at the sub-pillar or pillar level; see page 181 of this appendix for details.

## Key indicators

|                            |                    |
|----------------------------|--------------------|
| Population (millions)..... | 101.9              |
| GDP (US\$ billions).....   | 69.2               |
| GDP per capita, PPP\$..... | 1,800.7            |
| Income group.....          | Low income         |
| Region.....                | Sub-Saharan Africa |

|  | Score 0–100<br>or value (hard data) | Rank       |
|--|-------------------------------------|------------|
| <b>Global Innovation Index (out of 127).....</b> | <b>24.2</b>                         | <b>110</b> |
| Innovation Output Sub-Index.....                 | 20.2                                | 91         |
| Innovation Input Sub-Index.....                  | 28.2                                | 122        |
| Innovation Efficiency Ratio.....                 | 0.7                                 | 32 ●       |
| Global Innovation Index 2016 (out of 128).....   | 24.8                                | 110        |

**1 Institutions.....43.9 114**

|   |      |       |
|---|------|-------|
| 1.1 Political environment.....                        | 26.8 | 120   |
| 1.1.1 Political stability & safety*.....              | 27.9 | 120   |
| 1.1.2 Government effectiveness*.....                  | 25.7 | 104   |
| 1.2 Regulatory environment.....                       | 49.7 | 99    |
| 1.2.1 Regulatory quality*.....                        | 16.4 | 121   |
| 1.2.2 Rule of law*.....                               | 26.7 | 88    |
| 1.2.3 Cost of redundancy dismissal, salary weeks..... | 19.1 | 79    |
| 1.3 Business environment.....                         | 55.2 | 114   |
| 1.3.1 Ease of starting a business*.....               | 56.0 | 125 ○ |
| 1.3.2 Ease of resolving insolvency*.....              | 37.6 | 103   |
| 1.3.3 Ease of paying taxes*.....                      | 72.1 | 69    |

**2 Human capital & research.....14.8 115**

|  |      |      |
|--|------|------|
| 2.1 Education.....   | 26.4 | 116  |
| 2.1.1 Expenditure on education, % GDP.....                             | 4.5  | 67   |
| 2.1.2 Gov't expenditure/pupil, secondary, % GDP/cap <sup>Ⓐ</sup> ..... | 25.7 | 27 ● |
| 2.1.3 School life expectancy, years <sup>Ⓐ</sup> .....                 | 8.4  | 110  |
| 2.1.4 PISA scales in reading, maths, & science.....                    | n/a  | n/a  |
| 2.1.5 Pupil-teacher ratio, secondary <sup>Ⓐ</sup> .....                | 40.4 | 109  |
| 2.2 Tertiary education.....  | 14.6 | 110  |
| 2.2.1 Tertiary enrolment, % gross <sup>Ⓐ</sup> .....                   | 8.1  | 110  |
| 2.2.2 Graduates in science & engineering, % <sup>Ⓐ</sup> .....         | 11.2 | 98   |
| 2.2.3 Tertiary inbound mobility, %.....                                | n/a  | n/a  |

**2.3 Research & development (R&D).....3.5 83**

|  |      |      |
|--|------|------|
| 2.3.1 Researchers, FTE/mn pop. <sup>Ⓐ</sup> .....            | 45.1 | 91   |
| 2.3.2 Gross expenditure on R&D, % GDP <sup>Ⓐ</sup> .....     | 0.6  | 56   |
| 2.3.3 Global R&D companies, avg. expend. top 3, mn \$US..... | 0.0  | 43 ○ |
| 2.3.4 QS university ranking, average score top 3*.....       | 0.0  | 75 ○ |

**3 Infrastructure.....33.0 107**

|  |      |       |
|--|------|-------|
| 3.1 Information & communication technologies (ICTs).....     | 32.8 | 104   |
| 3.1.1 ICT access*.....                                       | 21.1 | 124 ○ |
| 3.1.2 ICT use*.....  | 8.2  | 118   |
| 3.1.3 Government's online service*.....                      | 52.9 | 79    |
| 3.1.4 E-participation*.....                                  | 49.2 | 89    |
| 3.2 General infrastructure.....                              | 44.6 | 39 ●  |
| 3.2.1 Electricity output, kWh/cap.....                       | 99.2 | 116   |
| 3.2.2 Logistics performance*.....                            | 14.5 | 116   |
| 3.2.3 Gross capital formation, % GDP.....                    | 39.7 | 6 ●   |
| 3.3 Ecological sustainability.....                           | 21.6 | 124   |
| 3.3.1 GDP/unit of energy use.....                            | 2.8  | 114   |
| 3.3.2 Environmental performance*.....                        | 45.8 | 115   |
| 3.3.3 ISO 14001 environmental certificates/bn PPP\$ GDP..... | 0.0  | 126 ○ |

**4 Market sophistication.....24.8 127 ○**

|   |      |       |
|---|------|-------|
| 4.1 Credit.....   | 7.2  | 126 ○ |
| 4.1.1 Ease of getting credit*.....                                | 15.0 | 121   |
| 4.1.2 Domestic credit to private sector, % GDP <sup>Ⓐ</sup> ..... | 17.7 | 113   |
| 4.1.3 Microfinance gross loans, % GDP.....                        | 0.0  | 66    |

|   |       |       |
|---|-------|-------|
| 4.2 Investment.....                                     | 22.3  | 125 ○ |
| 4.2.1 Ease of protecting minority investors*.....       | 31.7  | 126 ○ |
| 4.2.2 Market capitalization, % GDP.....                 | n/a   | n/a   |
| 4.2.3 Venture capital deals/bn PPP\$ GDP.....           | 0.0   | 66    |
| 4.3 Trade, competition, & market scale.....             | 45.1  | 114   |
| 4.3.1 Applied tariff rate, weighted mean, %.....        | 12.1  | 123   |
| 4.3.2 Intensity of local competition <sup>†</sup> ..... | 48.1  | 122 ○ |
| 4.3.3 Domestic market scale, bn PPP\$.....              | 174.7 | 61 ●  |

**5 Business sophistication.....24.2 108**

|  |      |      |
|--|------|------|
| 5.1 Knowledge workers.....   | 10.8 | 121  |
| 5.1.1 Knowledge-intensive employment, % <sup>Ⓐ</sup> .....             | 3.8  | 104  |
| 5.1.2 Firms offering formal training, % firms.....                     | 20.8 | 74   |
| 5.1.3 GERD performed by business, % of GDP <sup>Ⓐ</sup> .....          | 0.0  | 82   |
| 5.1.4 GERD financed by business, % <sup>Ⓐ</sup> .....                  | 0.7  | 87   |
| 5.1.5 Females employed w/advanced degrees, % total <sup>Ⓐ</sup> .....  | 6.0  | 74   |
| 5.2 Innovation linkages.....   | 23.3 | 82   |
| 5.2.1 University/industry research collaboration <sup>†</sup> .....    | 47.2 | 38 ● |
| 5.2.2 State of cluster development <sup>†</sup> .....                  | 42.3 | 77   |
| 5.2.3 GERD financed by abroad, % <sup>Ⓐ</sup> .....                    | 2.1  | 75   |
| 5.2.4 JV-strategic alliance deals/bn PPP\$ GDP.....                    | 0.0  | 101  |
| 5.2.5 Patent families 2+ offices/bn PPP\$ GDP.....                     | n/a  | n/a  |
| 5.3 Knowledge absorption.....  | 38.5 | 38 ● |
| 5.3.1 Intellectual property payments, % total trade <sup>Ⓐ</sup> ..... | 0.0  | 111  |
| 5.3.2 High-tech imports less re-imports, % total trade.....            | 22.2 | 4 ●  |
| 5.3.3 ICT services imports, % total trade <sup>Ⓐ</sup> .....           | 1.6  | 34 ● |
| 5.3.4 FDI net inflows, % GDP.....                                      | 3.1  | 54 ● |
| 5.3.5 Research talent, % in business enterprise <sup>Ⓐ</sup> .....     | 0.5  | 81   |

**6 Knowledge & technology outputs.....15.3 105**

|  |      |       |
|--|------|-------|
| 6.1 Knowledge creation.....  | 8.0  | [72]  |
| 6.1.1 Patents by origin/bn PPP\$ GDP.....                              | n/a  | n/a   |
| 6.1.2 PCT patent applications/bn PPP\$ GDP.....                        | n/a  | n/a   |
| 6.1.3 Utility models by origin/bn PPP\$ GDP.....                       | n/a  | n/a   |
| 6.1.4 Scientific & technical articles/bn PPP\$ GDP.....                | 7.1  | 77    |
| 6.1.5 Citable documents H index.....                                   | 6.7  | 83    |
| 6.2 Knowledge impact.....  | 32.7 | 59 ●  |
| 6.2.1 Growth rate of PPP\$ GDP/worker, %.....                          | 5.6  | 3 ●   |
| 6.2.2 New businesses/th pop. 15–64 <sup>Ⓐ</sup> .....                  | 0.0  | 104 ○ |
| 6.2.3 Computer software spending, % GDP.....                           | 0.0  | 125 ○ |
| 6.2.4 ISO 9001 quality certificates/bn PPP\$ GDP.....                  | 0.6  | 116   |
| 6.2.5 High- & medium-high-tech manufactures, %.....                    | 0.1  | 71    |
| 6.3 Knowledge diffusion.....   | 5.3  | 127 ○ |
| 6.3.1 Intellectual property receipts, % total trade <sup>Ⓐ</sup> ..... | 0.0  | 93    |
| 6.3.2 High-tech exports less re-exports, % total trade.....            | 0.1  | 108   |
| 6.3.3 ICT services exports, % total trade <sup>Ⓐ</sup> .....           | 1.7  | 63 ●  |
| 6.3.4 FDI net outflows, % GDP.....                                     | n/a  | n/a   |

**7 Creative outputs.....25.0 90**

|   |      |       |
|---|------|-------|
| 7.1 Intangible assets.....  | 44.3 | 57 ●  |
| 7.1.1 Trademarks by origin/bn PPP\$ GDP.....                      | n/a  | n/a   |
| 7.1.2 Industrial designs by origin/bn PPP\$ GDP.....              | n/a  | n/a   |
| 7.1.3 ICTs & business model creation <sup>†</sup> .....           | 44.4 | 117   |
| 7.1.4 ICTs & organizational model creation <sup>†</sup> .....     | 44.2 | 96    |
| 7.2 Creative goods & services.....                                | 10.6 | 87    |
| 7.2.1 Cultural & creative services exports, % of total trade..... | 0.0  | 86    |
| 7.2.2 National feature films/mn pop. 15–69.....                   | n/a  | n/a   |
| 7.2.3 Global ent. & media market/th pop. 15–69.....               | n/a  | n/a   |
| 7.2.4 Printing & publishing manufactures, %.....                  | 1.8  | 26 ●  |
| 7.2.5 Creative goods exports, % total trade.....                  | 0.0  | 111   |
| 7.3 Online creativity.....  | 0.9  | 123   |
| 7.3.1 Generic top-level domains (TLDs)/th pop. 15–69.....         | 0.0  | 127 ○ |
| 7.3.2 Country-code TLDs/th pop. 15–69.....                        | 0.0  | 124   |
| 7.3.3 Wikipedia edits/mn pop. 15–69 <sup>Ⓐ</sup> .....            | 0.3  | 123   |
| 7.3.4 Video uploads on YouTube/pop. 15–69.....                    | n/a  | n/a   |

NOTES: ● indicates a strength; ○ a weakness; \* an index; † a survey question.

<sup>Ⓐ</sup> indicates that the country's data are older than the base year; see Appendix II for details, including the year of the data, at <http://globalinnovationindex.org>.

Square brackets indicate that the data minimum coverage (DMC) requirements were not met at the sub-pillar or pillar level; see page 181 of this appendix for details.



## Key indicators

|                            |             |
|----------------------------|-------------|
| Population (millions)..... | 5.5         |
| GDP (US\$ billions).....   | 239.2       |
| GDP per capita, PPP\$..... | 41,120.0    |
| Income group.....          | High income |
| Region.....                | Europe      |

|  | Score 0–100<br>or value (hard data) | Rank     |
|--|-------------------------------------|----------|
| <b>Global Innovation Index (out of 127).....</b> | <b>58.5</b>                         | <b>8</b> |
| Innovation Output Sub-Index.....                 | 48.1                                | 13       |
| Innovation Input Sub-Index.....                  | 68.9                                | 4 ●      |
| Innovation Efficiency Ratio.....                 | 0.7                                 | 37       |
| Global Innovation Index 2016 (out of 128).....   | 59.9                                | 5        |

**1 Institutions.....92.2 4 ●**

|   |       |     |
|---|-------|-----|
| 1.1 Political environment.....                        | 89.0  | 8   |
| 1.1.1 Political stability & safety*.....              | 89.0  | 11  |
| 1.1.2 Government effectiveness*.....                  | 89.0  | 8   |
| 1.2 Regulatory environment.....                       | 95.1  | 5 ● |
| 1.2.1 Regulatory quality*.....                        | 88.9  | 5 ● |
| 1.2.2 Rule of law*.....                               | 100.0 | 1 ● |
| 1.2.3 Cost of redundancy dismissal, salary weeks..... | 10.1  | 33  |
| 1.3 Business environment.....                         | 92.4  | 1 ● |
| 1.3.1 Ease of starting a business*.....               | 93.1  | 25  |
| 1.3.2 Ease of resolving insolvency*.....              | 93.9  | 1 ● |
| 1.3.3 Ease of paying taxes*.....                      | 90.2  | 13  |

**2 Human capital & research.....66.4 1 ●**

|  |         |      |
|--|---------|------|
| 2.1 Education.....   | 73.0    | 5 ●  |
| 2.1.1 Expenditure on education, % GDP.....                             | 7.2     | 13   |
| 2.1.2 Gov't expenditure/pupil, secondary, % GDP/cap <sup>Ⓞ</sup> ..... | 34.7    | 11   |
| 2.1.3 School life expectancy, years.....                               | 19.3    | 4 ●  |
| 2.1.4 PISA scales in reading, maths, & science.....                    | 522.7   | 6    |
| 2.1.5 Pupil-teacher ratio, secondary <sup>Ⓞ</sup> .....                | 12.8    | 48 ○ |
| 2.2 Tertiary education.....  | 56.5    | 11   |
| 2.2.1 Tertiary enrolment, % gross.....                                 | 87.3    | 7    |
| 2.2.2 Graduates in science & engineering, %.....                       | 27.9    | 16   |
| 2.2.3 Tertiary inbound mobility, %.....                                | 7.7     | 24   |
| 2.3 Research & development (R&D).....                                  | 69.7    | 9    |
| 2.3.1 Researchers, FTE/mn pop.....                                     | 6,816.8 | 5    |
| 2.3.2 Gross expenditure on R&D, % GDP.....                             | 2.9     | 8    |
| 2.3.3 Global R&D companies, avg. expend. top 3, mn \$US.....           | 73.5    | 15   |
| 2.3.4 QS university ranking, average score top 3*.....                 | 54.8    | 17   |

**3 Infrastructure.....64.4 8**

|  |          |      |
|--|----------|------|
| 3.1 Information & communication technologies (ICTs).....     | 86.1     | 9    |
| 3.1.1 ICT access*.....                                       | 76.9     | 33   |
| 3.1.2 ICT use*.....  | 81.8     | 7    |
| 3.1.3 Government's online service*.....                      | 94.2     | 5    |
| 3.1.4 E-participation*.....                                  | 91.5     | 8    |
| 3.2 General infrastructure.....                              | 53.1     | 15   |
| 3.2.1 Electricity output, kWh/cap.....                       | 12,494.7 | 9    |
| 3.2.2 Logistics performance*.....                            | 85.9     | 15   |
| 3.2.3 Gross capital formation, % GDP.....                    | 21.4     | 72 ○ |
| 3.3 Ecological sustainability.....                           | 53.9     | 34   |
| 3.3.1 GDP/unit of energy use.....                            | 6.3      | 89 ○ |
| 3.3.2 Environmental performance*.....                        | 90.7     | 1 ●  |
| 3.3.3 ISO 14001 environmental certificates/bn PPP\$ GDP..... | 6.5      | 17   |

**4 Market sophistication.....61.6 13**

|   |      |     |
|---|------|-----|
| 4.1 Credit.....                                     | 51.4 | 26  |
| 4.1.1 Ease of getting credit*.....                  | 65.0 | 40  |
| 4.1.2 Domestic credit to private sector, % GDP..... | 95.5 | 30  |
| 4.1.3 Microfinance gross loans, % GDP.....          | n/a  | n/a |

|   |       |      |
|---|-------|------|
| 4.2 Investment.....                                     | 67.8  | 9    |
| 4.2.1 Ease of protecting minority investors*.....       | 56.7  | 67 ○ |
| 4.2.2 Market capitalization, % GDP.....                 | n/a   | n/a  |
| 4.2.3 Venture capital deals/bn PPP\$ GDP.....           | 0.3   | 5    |
| 4.3 Trade, competition, & market scale.....             | 65.6  | 51   |
| 4.3.1 Applied tariff rate, weighted mean, %.....        | 1.6   | 23   |
| 4.3.2 Intensity of local competition <sup>†</sup> ..... | 63.0  | 89 ○ |
| 4.3.3 Domestic market scale, bn PPP\$.....              | 230.0 | 58 ○ |

**5 Business sophistication.....60.1 6**

|   |      |      |
|---|------|------|
| 5.1 Knowledge workers.....  | 72.6 | 5 ●  |
| 5.1.1 Knowledge-intensive employment, %.....                        | 46.0 | 10   |
| 5.1.2 Firms offering formal training, % firms.....                  | n/a  | n/a  |
| 5.1.3 GERD performed by business, % of GDP.....                     | 2.0  | 8    |
| 5.1.4 GERD financed by business, %.....                             | 54.8 | 15   |
| 5.1.5 Females employed w/advanced degrees, % total.....             | 26.6 | 6    |
| 5.2 Innovation linkages.....  | 56.8 | 5 ●  |
| 5.2.1 University/industry research collaboration <sup>†</sup> ..... | 78.6 | 2 ●  |
| 5.2.2 State of cluster development <sup>†</sup> .....               | 64.9 | 17   |
| 5.2.3 GERD financed by abroad, %.....                               | 14.5 | 32   |
| 5.2.4 JV-strategic alliance deals/bn PPP\$ GDP.....                 | 0.1  | 11   |
| 5.2.5 Patent families 2+ offices/bn PPP\$ GDP.....                  | 9.4  | 1 ●  |
| 5.3 Knowledge absorption.....                                       | 50.9 | 11   |
| 5.3.1 Intellectual property payments, % total trade.....            | 1.0  | 33   |
| 5.3.2 High-tech imports less re-imports, % total trade.....         | 8.2  | 62 ○ |
| 5.3.3 ICT services imports, % total trade.....                      | 3.6  | 5 ●  |
| 5.3.4 FDI net inflows, % GDP.....                                   | 3.9  | 38   |
| 5.3.5 Research talent, % in business enterprise.....                | 56.8 | 16   |

**6 Knowledge & technology outputs.....48.8 10**

|   |       |       |
|---|-------|-------|
| 6.1 Knowledge creation.....                                 | 61.2  | 8     |
| 6.1.1 Patents by origin/bn PPP\$ GDP.....                   | 14.6  | 7     |
| 6.1.2 PCT patent applications/bn PPP\$ GDP.....             | 6.6   | 6     |
| 6.1.3 Utility models by origin/bn PPP\$ GDP.....            | 1.8   | 17    |
| 6.1.4 Scientific & technical articles/bn PPP\$ GDP.....     | 55.0  | 5 ●   |
| 6.1.5 Citable documents H index.....                        | 42.1  | 18    |
| 6.2 Knowledge impact.....                                   | 40.3  | 32    |
| 6.2.1 Growth rate of PPP\$ GDP/worker, %.....               | 0.9   | 60 ○  |
| 6.2.2 New businesses/th pop. 15–64.....                     | 3.4   | 34    |
| 6.2.3 Computer software spending, % GDP.....                | 0.5   | 19    |
| 6.2.4 ISO 9001 quality certificates/bn PPP\$ GDP.....       | 11.5  | 33    |
| 6.2.5 High- & medium-high-tech manufactures, %.....         | 0.4   | 22    |
| 6.3 Knowledge diffusion.....                                | 44.9  | 14    |
| 6.3.1 Intellectual property receipts, % total trade.....    | 2.9   | 6     |
| 6.3.2 High-tech exports less re-exports, % total trade..... | 5.0   | 34    |
| 6.3.3 ICT services exports, % total trade.....              | 9.9   | 5 ●   |
| 6.3.4 FDI net outflows, % GDP.....                          | (1.0) | 120 ○ |

**7 Creative outputs.....47.3 18**

|   |      |      |
|---|------|------|
| 7.1 Intangible assets.....  | 57.7 | 20   |
| 7.1.1 Trademarks by origin/bn PPP\$ GDP.....                                    | 51.5 | 44   |
| 7.1.2 Industrial designs by origin/bn PPP\$ GDP.....                            | 5.3  | 23   |
| 7.1.3 ICTs & business model creation <sup>†</sup> .....                         | 83.1 | 4 ●  |
| 7.1.4 ICTs & organizational model creation <sup>†</sup> .....                   | 78.5 | 7    |
| 7.2 Creative goods & services.....  | 27.1 | 40   |
| 7.2.1 Cultural & creative services exports, % of total trade <sup>Ⓞ</sup> ..... | 0.3  | 39   |
| 7.2.2 National feature films/mn pop. 15–69.....                                 | 11.6 | 12   |
| 7.2.3 Global ent. & media market/th pop. 15–69.....                             | 62.6 | 9    |
| 7.2.4 Printing & publishing manufactures, %.....                                | 1.2  | 50 ○ |
| 7.2.5 Creative goods exports, % total trade.....                                | 0.6  | 53   |
| 7.3 Online creativity.....  | 46.7 | 19   |
| 7.3.1 Generic top-level domains (TLDs)/th pop. 15–69.....                       | 29.3 | 21   |
| 7.3.2 Country-code TLDs/th pop. 15–69.....                                      | 31.6 | 19   |
| 7.3.3 Wikipedia edits/mn pop. 15–69.....  | 7.3  | 6    |
| 7.3.4 Video uploads on YouTube/pop. 15–69.....                                  | 56.1 | 11   |

NOTES: ● indicates a strength; ○ a weakness; \* an index; † a survey question.

Ⓞ indicates that the country's data are older than the base year; see Appendix II for details, including the year of the data, at <http://globalinnovationindex.org>.

Square brackets indicate that the data minimum coverage (DMC) requirements were not met at the sub-pillar or pillar level; see page 181 of this appendix for details.

## France

## Key indicators

|                             |             |
|-----------------------------|-------------|
| Population (millions) ..... | 64.7        |
| GDP (US\$ billions) .....   | 2,488.3     |
| GDP per capita, PPP\$ ..... | 41,180.7    |
| Income group .....          | High income |
| Region .....                | Europe      |

|   | Score 0–100<br>or value (hard data) | Rank      |
|---|-------------------------------------|-----------|
| <b>Global Innovation Index (out of 127)</b> ..... | <b>54.2</b>                         | <b>15</b> |
| Innovation Output Sub-Index .....                 | 44.9                                | 18        |
| Innovation Input Sub-Index .....                  | 63.4                                | 15        |
| Innovation Efficiency Ratio .....                 | 0.7                                 | 35        |
| Global Innovation Index 2016 (out of 128) .....   | 54.0                                | 18        |

**1 Institutions .....** **80.7** **24**

|  |      |    |
|--|------|----|
| 1.1 Political environment .....                        | 74.8 | 31 |
| 1.1.1 Political stability & safety* .....              | 70.5 | 48 |
| 1.1.2 Government effectiveness* .....                  | 79.2 | 21 |
| 1.2 Regulatory environment .....                       | 84.2 | 21 |
| 1.2.1 Regulatory quality* .....                        | 71.7 | 27 |
| 1.2.2 Rule of law* .....                               | 80.5 | 21 |
| 1.2.3 Cost of redundancy dismissal, salary weeks ..... | 11.8 | 42 |
| 1.3 Business environment .....                         | 82.9 | 25 |
| 1.3.1 Ease of starting a business* .....               | 93.3 | 24 |
| 1.3.2 Ease of resolving insolvency* .....              | 76.6 | 22 |
| 1.3.3 Ease of paying taxes* .....                      | 78.7 | 54 |

**2 Human capital & research .....** **58.1** **12**

|   |       |      |
|---|-------|------|
| 2.1 Education .....                                       | 58.6  | 27   |
| 2.1.1 Expenditure on education, % GDP .....               | 5.5   | 32   |
| 2.1.2 Gov't expenditure/pupil, secondary, % GDP/cap ..... | 26.8  | 20   |
| 2.1.3 School life expectancy, years .....                 | 16.3  | 27   |
| 2.1.4 PISA scales in reading, maths, & science .....      | 495.7 | 24   |
| 2.1.5 Pupil-teacher ratio, secondary <sup>Ⓔ</sup> .....   | 12.9  | 50 ○ |
| 2.2 Tertiary education .....                              | 50.6  | 18   |
| 2.2.1 Tertiary enrolment, % gross <sup>Ⓔ</sup> .....      | 64.4  | 36   |
| 2.2.2 Graduates in science & engineering, % .....         | 24.5  | 32   |
| 2.2.3 Tertiary inbound mobility, % <sup>Ⓔ</sup> .....     | 9.8   | 20   |

**2.3 Research & development (R&D) .....** **65.1** **12**

|   |         |      |
|---|---------|------|
| 2.3.1 Researchers, FTE/mn pop. <sup>Ⓔ</sup> .....             | 4,168.8 | 21   |
| 2.3.2 Gross expenditure on R&D, % GDP .....                   | 2.2     | 12   |
| 2.3.3 Global R&D companies, avg. expend. top 3, mn \$US ..... | 87.1    | 8 ●  |
| 2.3.4 QS university ranking, average score top 3* .....       | 71.4    | 10 ● |

**3 Infrastructure .....** **63.4** **12**

|   |         |      |
|---|---------|------|
| 3.1 Information & communication technologies (ICTs) .....     | 86.8    | 8 ●  |
| 3.1.1 ICT access* .....                                       | 87.0    | 11   |
| 3.1.2 ICT use* .....  | 76.1    | 16   |
| 3.1.3 Government's online service* .....                      | 94.2    | 5 ●  |
| 3.1.4 E-participation* .....                                  | 89.8    | 12   |
| 3.2 General infrastructure .....                              | 50.3    | 25   |
| 3.2.1 Electricity output, kWh/cap .....                       | 8,470.6 | 17   |
| 3.2.2 Logistics performance* .....                            | 85.0    | 16   |
| 3.2.3 Gross capital formation, % GDP .....                    | 22.4    | 62 ○ |
| 3.3 Ecological sustainability .....                           | 53.1    | 35   |
| 3.3.1 GDP/unit of energy use .....                            | 9.9     | 51 ○ |
| 3.3.2 Environmental performance* .....                        | 88.2    | 10 ● |
| 3.3.3 ISO 14001 environmental certificates/bn PPP\$ GDP ..... | 2.6     | 43   |

**4 Market sophistication .....** **64.3** **11 ●**

|  |      |      |
|--|------|------|
| 4.1 Credit .....                                     | 44.0 | 42   |
| 4.1.1 Ease of getting credit* .....                  | 50.0 | 72 ○ |
| 4.1.2 Domestic credit to private sector, % GDP ..... | 95.8 | 29   |
| 4.1.3 Microfinance gross loans, % GDP .....          | n/a  | n/a  |

|   |         |      |
|---|---------|------|
| 4.2 Investment .....                                    | 66.7    | 10 ● |
| 4.2.1 Ease of protecting minority investors* .....      | 65.0    | 31   |
| 4.2.2 Market capitalization, % GDP .....                | 86.3    | 16   |
| 4.2.3 Venture capital deals/bn PPP\$ GDP .....          | 0.3     | 1 ●  |
| 4.3 Trade, competition, & market scale .....            | 82.3    | 6 ●  |
| 4.3.1 Applied tariff rate, weighted mean, % .....       | 1.6     | 23   |
| 4.3.2 Intensity of local competition <sup>†</sup> ..... | 79.4    | 13   |
| 4.3.3 Domestic market scale, bn PPP\$ .....             | 2,736.7 | 10 ● |

**5 Business sophistication .....** **50.6** **18**

|   |      |       |
|---|------|-------|
| 5.1 Knowledge workers .....   | 65.9 | 13    |
| 5.1.1 Knowledge-intensive employment, % .....                       | 44.6 | 14    |
| 5.1.2 Firms offering formal training, % firms .....                 | n/a  | n/a   |
| 5.1.3 GERD performed by business, % of GDP .....                    | 1.5  | 14    |
| 5.1.4 GERD financed by business, % <sup>Ⓔ</sup> .....               | 55.7 | 14    |
| 5.1.5 Females employed w/advanced degrees, % total .....            | 21.1 | 20    |
| 5.2 Innovation linkages .....                                       | 36.2 | 41    |
| 5.2.1 University/industry research collaboration <sup>†</sup> ..... | 54.8 | 31    |
| 5.2.2 State of cluster development <sup>†</sup> .....               | 59.3 | 25    |
| 5.2.3 GERD financed by abroad, % <sup>Ⓔ</sup> .....                 | 7.8  | 51 ○  |
| 5.2.4 JV-strategic alliance deals/bn PPP\$ GDP .....                | 0.0  | 39    |
| 5.2.5 Patent families 2+ offices/bn PPP\$ GDP .....                 | 3.9  | 16    |
| 5.3 Knowledge absorption .....                                      | 49.7 | 14    |
| 5.3.1 Intellectual property payments, % total trade .....           | 1.8  | 13    |
| 5.3.2 High-tech imports less re-imports, % total trade .....        | 11.4 | 31    |
| 5.3.3 ICT services imports, % total trade .....                     | 2.2  | 17    |
| 5.3.4 FDI net inflows, % GDP .....                                  | 0.8  | 108 ○ |
| 5.3.5 Research talent, % in business enterprise <sup>Ⓔ</sup> .....  | 60.5 | 11    |

**6 Knowledge & technology outputs .....** **38.5** **20**

|  |      |      |
|--|------|------|
| 6.1 Knowledge creation .....                                 | 34.6 | 24   |
| 6.1.1 Patents by origin/bn PPP\$ GDP .....                   | 9.4  | 14   |
| 6.1.2 PCT patent applications/bn PPP\$ GDP .....             | 3.0  | 15   |
| 6.1.3 Utility models by origin/bn PPP\$ GDP .....            | 0.1  | 55 ○ |
| 6.1.4 Scientific & technical articles/bn PPP\$ GDP .....     | 25.3 | 30   |
| 6.1.5 Citable documents H index .....                        | 79.3 | 4 ●  |
| 6.2 Knowledge impact .....                                   | 39.3 | 36   |
| 6.2.1 Growth rate of PPP\$ GDP/worker, % .....               | 0.8  | 63 ○ |
| 6.2.2 New businesses/th pop. 15–64 .....                     | 2.3  | 46 ○ |
| 6.2.3 Computer software spending, % GDP .....                | 0.6  | 13   |
| 6.2.4 ISO 9001 quality certificates/bn PPP\$ GDP .....       | 10.4 | 36   |
| 6.2.5 High- & medium-high-tech manufactures, % .....         | 0.4  | 23   |
| 6.3 Knowledge diffusion .....                                | 41.6 | 18   |
| 6.3.1 Intellectual property receipts, % total trade .....    | 1.9  | 11   |
| 6.3.2 High-tech exports less re-exports, % total trade ..... | 14.4 | 11 ● |
| 6.3.3 ICT services exports, % total trade .....              | 2.2  | 49   |
| 6.3.4 FDI net outflows, % GDP .....                          | 1.2  | 43   |

**7 Creative outputs .....** **51.4** **12**

|   |       |      |
|---|-------|------|
| 7.1 Intangible assets .....   | 64.0  | 7 ●  |
| 7.1.1 Trademarks by origin/bn PPP\$ GDP .....                                   | 109.0 | 10 ● |
| 7.1.2 Industrial designs by origin/bn PPP\$ GDP .....                           | 7.5   | 17   |
| 7.1.3 ICTs & business model creation <sup>†</sup> .....                         | 76.7  | 17   |
| 7.1.4 ICTs & organizational model creation <sup>†</sup> .....                   | 71.4  | 20   |
| 7.2 Creative goods & services .....   | 34.5  | 19   |
| 7.2.1 Cultural & creative services exports, % of total trade <sup>Ⓔ</sup> ..... | 1.2   | 10   |
| 7.2.2 National feature films/mn pop. 15–69 .....                                | 6.8   | 25   |
| 7.2.3 Global ent. & media market/th pop. 15–69 .....                            | 53.1  | 15   |
| 7.2.4 Printing & publishing manufactures, % .....                               | 1.2   | 55 ○ |
| 7.2.5 Creative goods exports, % total trade .....                               | 1.7   | 30   |
| 7.3 Online creativity .....   | 43.0  | 26   |
| 7.3.1 Generic top-level domains (TLDs)/th pop. 15–69 .....                      | 41.3  | 18   |
| 7.3.2 Country-code TLDs/th pop. 15–69 .....                                     | 20.2  | 27   |
| 7.3.3 Wikipedia edits/mn pop. 15–69 .....                                       | 7.0   | 10 ● |
| 7.3.4 Video uploads on YouTube/pop. 15–69 .....                                 | 43.3  | 26   |

NOTES: ● indicates a strength; ○ a weakness; \* an index; † a survey question.

Ⓔ indicates that the country's data are older than the base year; see Appendix II for details, including the year of the data, at <http://globalinnovationindex.org>.

Square brackets indicate that the data minimum coverage (DMC) requirements were not met at the sub-pillar or pillar level; see page 181 of this appendix for details.



## Key indicators

|                            |                                  |
|----------------------------|----------------------------------|
| Population (millions)..... | 4.0                              |
| GDP (US\$ billions).....   | 14.5                             |
| GDP per capita, PPP\$..... | 9,630.0                          |
| Income group.....          | Upper-middle income              |
| Region.....                | Northern Africa and Western Asia |

|  | Score 0–100<br>or value (hard data) | Rank      |
|--|-------------------------------------|-----------|
| <b>Global Innovation Index (out of 127).....</b> | <b>34.4</b>                         | <b>68</b> |
| Innovation Output Sub-Index.....                 | 26.6                                | 62        |
| Innovation Input Sub-Index.....                  | 42.2                                | 69        |
| Innovation Efficiency Ratio.....                 | 0.6                                 | 60        |
| Global Innovation Index 2016 (out of 128).....   | 33.9                                | 64        |

**1 Institutions.....68.6 47**

|   |      |      |
|---|------|------|
| 1.1 Political environment.....                        | 53.3 | 61   |
| 1.1.1 Political stability & safety*.....              | 54.2 | 82   |
| 1.1.2 Government effectiveness*.....                  | 52.5 | 48   |
| 1.2 Regulatory environment.....                       | 77.8 | 30   |
| 1.2.1 Regulatory quality*.....                        | 65.8 | 35   |
| 1.2.2 Rule of law*.....                               | 48.1 | 48   |
| 1.2.3 Cost of redundancy dismissal, salary weeks..... | 8.6  | 20 ● |
| 1.3 Business environment.....                         | 74.5 | 53   |
| 1.3.1 Ease of starting a business*.....               | 96.1 | 8 ●  |
| 1.3.2 Ease of resolving insolvency*.....              | 40.0 | 94   |
| 1.3.3 Ease of paying taxes*.....                      | 87.4 | 20 ● |

**2 Human capital & research.....23.6 89**

|  |       |       |
|--|-------|-------|
| 2.1 Education.....   | 39.1  | 88    |
| 2.1.1 Expenditure on education, % GDP <sup>Ⓔ</sup> .....               | 2.0   | 114 ○ |
| 2.1.2 Gov't expenditure/pupil, secondary, % GDP/cap <sup>Ⓔ</sup> ..... | 14.2  | 85    |
| 2.1.3 School life expectancy, years.....                               | 15.4  | 37    |
| 2.1.4 PISA scales in reading, maths, & science.....                    | 405.4 | 61    |
| 2.1.5 Pupil-teacher ratio, secondary.....                              | 7.2   | 4 ●   |
| 2.2 Tertiary education.....  | 29.5  | 83    |
| 2.2.1 Tertiary enrolment, % gross.....                                 | 43.4  | 61    |
| 2.2.2 Graduates in science & engineering, %.....                       | 16.7  | 75    |
| 2.2.3 Tertiary inbound mobility, %.....                                | 3.7   | 51    |
| 2.3 Research & development (R&D).....                                  | 2.2   | 91    |
| 2.3.1 Researchers, FTE/mn pop. <sup>Ⓔ</sup> .....                      | 585.4 | 61    |
| 2.3.2 Gross expenditure on R&D, % GDP <sup>Ⓔ</sup> .....               | 0.1   | 104 ○ |
| 2.3.3 Global R&D companies, avg. expend. top 3, mn \$US.....           | 0.0   | 43 ○  |
| 2.3.4 QS university ranking, average score top 3*.....                 | 0.0   | 75 ○  |

**3 Infrastructure.....43.8 74**

|  |         |       |
|--|---------|-------|
| 3.1 Information & communication technologies (ICTs).....     | 55.7    | 69    |
| 3.1.1 ICT access*.....                                       | 62.9    | 67    |
| 3.1.2 ICT use*.....  | 40.0    | 68    |
| 3.1.3 Government's online service*.....                      | 63.8    | 55    |
| 3.1.4 E-participation*.....                                  | 55.9    | 74    |
| 3.2 General infrastructure.....                              | 39.3    | 53    |
| 3.2.1 Electricity output, kWh/cap.....                       | 2,304.7 | 74    |
| 3.2.2 Logistics performance*.....                            | 13.4    | 118 ○ |
| 3.2.3 Gross capital formation, % GDP.....                    | 33.4    | 10 ●  |
| 3.3 Ecological sustainability.....                           | 36.6    | 93    |
| 3.3.1 GDP/unit of energy use.....                            | 7.2     | 83    |
| 3.3.2 Environmental performance*.....                        | 65.0    | 94    |
| 3.3.3 ISO 14001 environmental certificates/bn PPP\$ GDP..... | 0.3     | 95    |

**4 Market sophistication.....49.2 53**

|   |      |     |
|---|------|-----|
| 4.1 Credit.....                                     | 48.3 | 31  |
| 4.1.1 Ease of getting credit*.....                  | 85.0 | 7 ● |
| 4.1.2 Domestic credit to private sector, % GDP..... | 49.8 | 72  |
| 4.1.3 Microfinance gross loans, % GDP.....          | 2.3  | 15  |

|   |      |      |
|---|------|------|
| 4.2 Investment.....                                     | 41.0 | 60   |
| 4.2.1 Ease of protecting minority investors*.....       | 76.7 | 7 ●  |
| 4.2.2 Market capitalization, % GDP <sup>Ⓔ</sup> .....   | 6.0  | 80 ○ |
| 4.2.3 Venture capital deals/bn PPP\$ GDP.....           | 0.0  | 44   |
| 4.3 Trade, competition, & market scale.....             | 58.2 | 78   |
| 4.3.1 Applied tariff rate, weighted mean, %.....        | 0.3  | 4 ●  |
| 4.3.2 Intensity of local competition <sup>†</sup> ..... | 66.1 | 75   |
| 4.3.3 Domestic market scale, bn PPP\$.....              | 37.4 | 101  |

**5 Business sophistication.....25.6 101**

|   |      |       |
|---|------|-------|
| 5.1 Knowledge workers.....  | 28.2 | 90    |
| 5.1.1 Knowledge-intensive employment, % <sup>Ⓔ</sup> .....          | 22.3 | 65    |
| 5.1.2 Firms offering formal training, % firms.....                  | 10.5 | 89 ○  |
| 5.1.3 GERD performed by business, % of GDP.....                     | n/a  | n/a   |
| 5.1.4 GERD financed by business, %.....                             | n/a  | n/a   |
| 5.1.5 Females employed w/advanced degrees, % total.....             | 15.4 | 39    |
| 5.2 Innovation linkages.....  | 20.9 | 98    |
| 5.2.1 University/industry research collaboration <sup>†</sup> ..... | 28.7 | 107 ○ |
| 5.2.2 State of cluster development <sup>†</sup> .....               | 32.9 | 111 ○ |
| 5.2.3 GERD financed by abroad, % <sup>Ⓔ</sup> .....                 | 14.3 | 34    |
| 5.2.4 JV-strategic alliance deals/bn PPP\$ GDP.....                 | 0.0  | 81    |
| 5.2.5 Patent families 2+ offices/bn PPP\$ GDP.....                  | 0.0  | 92    |
| 5.3 Knowledge absorption.....                                       | 27.6 | 88    |
| 5.3.1 Intellectual property payments, % total trade.....            | 0.1  | 101 ○ |
| 5.3.2 High-tech imports less re-imports, % total trade.....         | 6.5  | 88    |
| 5.3.3 ICT services imports, % total trade.....                      | 0.5  | 97    |
| 5.3.4 FDI net inflows, % GDP.....                                   | 9.3  | 12 ●  |
| 5.3.5 Research talent, % in business enterprise.....                | n/a  | n/a   |

**6 Knowledge & technology outputs.....23.9 54**

|   |      |    |
|---|------|----|
| 6.1 Knowledge creation.....                                       | 20.9 | 44 |
| 6.1.1 Patents by origin/bn PPP\$ GDP.....                         | 2.8  | 36 |
| 6.1.2 PCT patent applications/bn PPP\$ GDP.....                   | 0.3  | 44 |
| 6.1.3 Utility models by origin/bn PPP\$ GDP.....                  | 1.7  | 18 |
| 6.1.4 Scientific & technical articles/bn PPP\$ GDP.....           | 16.0 | 47 |
| 6.1.5 Citable documents H index.....                              | 7.9  | 75 |
| 6.2 Knowledge impact.....   | 30.7 | 66 |
| 6.2.1 Growth rate of PPP\$ GDP/worker, %.....                     | 2.4  | 32 |
| 6.2.2 New businesses/th pop. 15–64.....                           | 5.7  | 22 |
| 6.2.3 Computer software spending, % GDP.....                      | 0.1  | 91 |
| 6.2.4 ISO 9001 quality certificates/bn PPP\$ GDP.....             | 2.4  | 86 |
| 6.2.5 High- & medium-high-tech manufactures, % <sup>Ⓔ</sup> ..... | 0.1  | 76 |
| 6.3 Knowledge diffusion.....                                      | 20.2 | 77 |
| 6.3.1 Intellectual property receipts, % total trade.....          | 0.0  | 88 |
| 6.3.2 High-tech exports less re-exports, % total trade.....       | 0.5  | 83 |
| 6.3.3 ICT services exports, % total trade.....                    | 0.6  | 96 |
| 6.3.4 FDI net outflows, % GDP.....                                | 1.8  | 36 |

**7 Creative outputs.....29.3 69**

|   |      |       |
|---|------|-------|
| 7.1 Intangible assets.....  | 37.6 | 85    |
| 7.1.1 Trademarks by origin/bn PPP\$ GDP.....                      | 53.7 | 41    |
| 7.1.2 Industrial designs by origin/bn PPP\$ GDP.....              | 4.9  | 27    |
| 7.1.3 ICTs & business model creation <sup>†</sup> .....           | 50.0 | 99    |
| 7.1.4 ICTs & organizational model creation <sup>†</sup> .....     | 41.3 | 107 ○ |
| 7.2 Creative goods & services.....                                | 21.0 | 54    |
| 7.2.1 Cultural & creative services exports, % of total trade..... | 0.1  | 59    |
| 7.2.2 National feature films/mn pop. 15–69.....                   | 5.5  | 35    |
| 7.2.3 Global ent. & media market/th pop. 15–69.....               | n/a  | n/a   |
| 7.2.4 Printing & publishing manufactures, % <sup>Ⓔ</sup> .....    | 3.1  | 7 ●   |
| 7.2.5 Creative goods exports, % total trade.....                  | 0.1  | 91    |
| 7.3 Online creativity.....  | 20.9 | 60    |
| 7.3.1 Generic top-level domains (TLDs)/th pop. 15–69.....         | 1.8  | 83    |
| 7.3.2 Country-code TLDs/th pop. 15–69.....                        | 2.1  | 63    |
| 7.3.3 Wikipedia edits/mn pop. 15–69.....                          | 6.1  | 40    |
| 7.3.4 Video uploads on YouTube/pop. 15–69.....                    | n/a  | n/a   |

NOTES: ● indicates a strength; ○ a weakness; \* an index; † a survey question.

Ⓔ indicates that the country's data are older than the base year; see Appendix II for details, including the year of the data, at <http://globalinnovationindex.org>.

Square brackets indicate that the data minimum coverage (DMC) requirements were not met at the sub-pillar or pillar level; see page 181 of this appendix for details.

## Germany

## Key indicators

|                             |             |
|-----------------------------|-------------|
| Population (millions) ..... | 80.7        |
| GDP (US\$ billions) .....   | 3,494.9     |
| GDP per capita, PPP\$ ..... | 46,893.2    |
| Income group .....          | High income |
| Region .....                | Europe      |

|  | Score 0–100<br>or value (hard data) | Rank     |
|--|-------------------------------------|----------|
| <b>Global Innovation Index (out of 127).....</b> | <b>58.4</b>                         | <b>9</b> |
| Innovation Output Sub-Index .....                | 53.5                                | 7        |
| Innovation Input Sub-Index .....                 | 63.3                                | 17       |
| Innovation Efficiency Ratio .....                | 0.8                                 | 7        |
| Global Innovation Index 2016 (out of 128) .....  | 57.9                                | 10       |

|  |             |           |
|--|-------------|-----------|
| <b>1 Institutions.....</b>                             | <b>83.5</b> | <b>18</b> |
| 1.1 Political environment .....                        | 84.0        | 15        |
| 1.1.1 Political stability & safety* .....              | 81.2        | 30        |
| 1.1.2 Government effectiveness* .....                  | 86.8        | 12        |
| 1.2 Regulatory environment .....                       | 80.6        | 25        |
| 1.2.1 Regulatory quality* .....                        | 84.7        | 14        |
| 1.2.2 Rule of law* .....                               | 91.5        | 16        |
| 1.2.3 Cost of redundancy dismissal, salary weeks ..... | 21.6        | 88 ○      |
| 1.3 Business environment .....                         | 85.9        | 19        |
| 1.3.1 Ease of starting a business* .....               | 83.4        | 88 ○      |
| 1.3.2 Ease of resolving insolvency* .....              | 92.3        | 3 ●       |
| 1.3.3 Ease of paying taxes* .....                      | 82.1        | 41        |

|   |             |           |
|---|-------------|-----------|
| <b>2 Human capital &amp; research.....</b>                    | <b>60.1</b> | <b>10</b> |
| 2.1 Education .....   | 58.5        | 29        |
| 2.1.1 Expenditure on education, % GDP .....                   | 4.9         | 53        |
| 2.1.2 Gov't expenditure/pupil, secondary, % GDP/cap .....     | 23.7        | 35        |
| 2.1.3 School life expectancy, years .....                     | 17.3        | 15        |
| 2.1.4 PISA scales in reading, maths, & science .....          | 508.1       | 11        |
| 2.1.5 Pupil-teacher ratio, secondary .....                    | 12.1        | 42        |
| 2.2 Tertiary education .....                                  | 49.8        | 20        |
| 2.2.1 Tertiary enrolment, % gross .....                       | 68.3        | 31        |
| 2.2.2 Graduates in science & engineering, % .....             | n/a         | n/a       |
| 2.2.3 Tertiary inbound mobility, % .....                      | 7.7         | 23        |
| 2.3 Research & development (R&D) .....                        | 72.1        | 8         |
| 2.3.1 Researchers, FTE/mn pop. .....                          | 4,431.1     | 19        |
| 2.3.2 Gross expenditure on R&D, % GDP .....                   | 2.9         | 9         |
| 2.3.3 Global R&D companies, avg. expend. top 3, mn \$US ..... | 97.1        | 2 ●       |
| 2.3.4 QS university ranking, average score top 3* .....       | 70.8        | 11        |

|   |             |           |
|---|-------------|-----------|
| <b>3 Infrastructure.....</b>                                  | <b>61.5</b> | <b>20</b> |
| 3.1 Information & communication technologies (ICTs) .....     | 81.5        | 18        |
| 3.1.1 ICT access* .....                                       | 90.9        | 5 ●       |
| 3.1.2 ICT use* .....  | 74.9        | 19        |
| 3.1.3 Government's online service* .....                      | 84.1        | 21        |
| 3.1.4 E-participation* .....                                  | 76.3        | 27        |
| 3.2 General infrastructure .....                              | 50.1        | 26        |
| 3.2.1 Electricity output, kWh/cap .....                       | 7,915.4     | 21        |
| 3.2.2 Logistics performance* .....                            | 100.0       | 1 ●       |
| 3.2.3 Gross capital formation, % GDP .....                    | 19.3        | 91 ○      |
| 3.3 Ecological sustainability .....                           | 53.0        | 36        |
| 3.3.1 GDP/unit of energy use .....                            | 11.2        | 32        |
| 3.3.2 Environmental performance* .....                        | 84.3        | 30        |
| 3.3.3 ISO 14001 environmental certificates/bn PPP\$ GDP ..... | 2.1         | 48        |

|  |             |           |
|--|-------------|-----------|
| <b>4 Market sophistication .....</b>                 | <b>60.0</b> | <b>16</b> |
| 4.1 Credit .....                                     | 50.3        | 28        |
| 4.1.1 Ease of getting credit* .....                  | 70.0        | 29        |
| 4.1.2 Domestic credit to private sector, % GDP ..... | 78.0        | 38        |
| 4.1.3 Microfinance gross loans, % GDP .....          | n/a         | n/a       |

|   |         |     |
|---|---------|-----|
| 4.2 Investment .....                                    | 44.9    | 41  |
| 4.2.1 Ease of protecting minority investors* .....      | 60.0    | 52  |
| 4.2.2 Market capitalization, % GDP .....                | 51.0    | 31  |
| 4.2.3 Venture capital deals/bn PPP\$ GDP .....          | 0.1     | 16  |
| 4.3 Trade, competition, & market scale .....            | 84.7    | 4 ● |
| 4.3.1 Applied tariff rate, weighted mean, % .....       | 1.6     | 23  |
| 4.3.2 Intensity of local competition <sup>†</sup> ..... | 81.7    | 9   |
| 4.3.3 Domestic market scale, bn PPP\$ .....             | 3,979.1 | 5 ● |

|   |             |           |
|---|-------------|-----------|
| <b>5 Business sophistication .....</b>                              | <b>51.4</b> | <b>15</b> |
| 5.1 Knowledge workers .....   | 66.0        | 12        |
| 5.1.1 Knowledge-intensive employment, % .....                       | 44.2        | 16        |
| 5.1.2 Firms offering formal training, % firms .....                 | n/a         | n/a       |
| 5.1.3 GERD performed by business, % of GDP .....                    | 2.0         | 9         |
| 5.1.4 GERD financed by business, % <sup>Ⓔ</sup> .....               | 65.8        | 7         |
| 5.1.5 Females employed w/advanced degrees, % total .....            | 12.7        | 51 ○      |
| 5.2 Innovation linkages .....                                       | 45.2        | 20        |
| 5.2.1 University/industry research collaboration <sup>†</sup> ..... | 72.5        | 8         |
| 5.2.2 State of cluster development <sup>†</sup> .....               | 72.7        | 3 ●       |
| 5.2.3 GERD financed by abroad, % <sup>Ⓔ</sup> .....                 | 5.0         | 65 ○      |
| 5.2.4 JV-strategic alliance deals/bn PPP\$ GDP .....                | 0.0         | 46        |
| 5.2.5 Patent families 2+ offices/bn PPP\$ GDP .....                 | 6.7         | 10        |
| 5.3 Knowledge absorption .....                                      | 43.1        | 27        |
| 5.3.1 Intellectual property payments, % total trade .....           | 0.5         | 60 ○      |
| 5.3.2 High-tech imports less re-imports, % total trade .....        | 11.6        | 26        |
| 5.3.3 ICT services imports, % total trade .....                     | 1.7         | 30        |
| 5.3.4 FDI net inflows, % GDP .....                                  | 1.1         | 102 ○     |
| 5.3.5 Research talent, % in business enterprise .....               | 56.5        | 17        |

|  |             |          |
|--|-------------|----------|
| <b>6 Knowledge &amp; technology outputs .....</b>            | <b>51.1</b> | <b>8</b> |
| 6.1 Knowledge creation .....                                 | 67.3        | 4 ●      |
| 6.1.1 Patents by origin/bn PPP\$ GDP .....                   | 18.7        | 1 ●      |
| 6.1.2 PCT patent applications/bn PPP\$ GDP .....             | 4.6         | 11       |
| 6.1.3 Utility models by origin/bn PPP\$ GDP .....            | 2.7         | 9        |
| 6.1.4 Scientific & technical articles/bn PPP\$ GDP .....     | 25.7        | 29       |
| 6.1.5 Citable documents H index .....                        | 87.1        | 3 ●      |
| 6.2 Knowledge impact .....                                   | 43.1        | 21       |
| 6.2.1 Growth rate of PPP\$ GDP/worker, % .....               | 0.9         | 61 ○     |
| 6.2.2 New businesses/th pop. 15–64 <sup>Ⓔ</sup> .....        | 1.3         | 60 ○     |
| 6.2.3 Computer software spending, % GDP .....                | 0.5         | 20       |
| 6.2.4 ISO 9001 quality certificates/bn PPP\$ GDP .....       | 13.7        | 27       |
| 6.2.5 High- & medium-high-tech manufactures, % .....         | 0.5         | 6        |
| 6.3 Knowledge diffusion .....                                | 42.7        | 15       |
| 6.3.1 Intellectual property receipts, % total trade .....    | 0.9         | 16       |
| 6.3.2 High-tech exports less re-exports, % total trade ..... | 13.9        | 13       |
| 6.3.3 ICT services exports, % total trade .....              | 2.0         | 52       |
| 6.3.4 FDI net outflows, % GDP .....                          | 2.9         | 22       |

|   |             |          |
|---|-------------|----------|
| <b>7 Creative outputs .....</b>   | <b>55.9</b> | <b>7</b> |
| 7.1 Intangible assets .....   | 65.7        | 4 ●      |
| 7.1.1 Trademarks by origin/bn PPP\$ GDP .....                                   | 66.9        | 28       |
| 7.1.2 Industrial designs by origin/bn PPP\$ GDP .....                           | 16.5        | 6 ●      |
| 7.1.3 ICTs & business model creation <sup>†</sup> .....                         | 77.3        | 15       |
| 7.1.4 ICTs & organizational model creation <sup>†</sup> .....                   | 74.0        | 17       |
| 7.2 Creative goods & services .....   | 31.7        | 28       |
| 7.2.1 Cultural & creative services exports, % of total trade <sup>Ⓔ</sup> ..... | 0.7         | 22       |
| 7.2.2 National feature films/mn pop. 15–69 .....                                | 3.9         | 49       |
| 7.2.3 Global ent. & media market/th pop. 15–69 .....                            | 57.8        | 11       |
| 7.2.4 Printing & publishing manufactures, % .....                               | 1.1         | 59 ○     |
| 7.2.5 Creative goods exports, % total trade .....                               | 2.2         | 22       |
| 7.3 Online creativity .....   | 60.4        | 8        |
| 7.3.1 Generic top-level domains (TLDs)/th pop. 15–69 .....                      | 55.3        | 13       |
| 7.3.2 Country-code TLDs/th pop. 15–69 .....                                     | 83.8        | 5 ●      |
| 7.3.3 Wikipedia edits/mn pop. 15–69 .....                                       | 6.8         | 15       |
| 7.3.4 Video uploads on YouTube/pop. 15–69 .....                                 | 36.8        | 36       |

NOTES: ● indicates a strength; ○ a weakness; \* an index; † a survey question.

Ⓔ indicates that the country's data are older than the base year; see Appendix II for details, including the year of the data, at <http://globalinnovationindex.org>.

Square brackets indicate that the data minimum coverage (DMC) requirements were not met at the sub-pillar or pillar level; see page 181 of this appendix for details.

## Key indicators

|                             |             |
|-----------------------------|-------------|
| Population (millions) ..... | 10.9        |
| GDP (US\$ billions) .....   | 195.9       |
| GDP per capita, PPP\$ ..... | 26,448.7    |
| Income group .....          | High income |
| Region .....                | Europe      |

|   | Score 0–100<br>or value (hard data) | Rank      |
|---|-------------------------------------|-----------|
| <b>Global Innovation Index (out of 127)</b> ..... | <b>38.8</b>                         | <b>44</b> |
| Innovation Output Sub-Index .....                 | 28.0                                | 59        |
| Innovation Input Sub-Index .....                  | 49.7                                | 38        |
| Innovation Efficiency Ratio .....                 | 0.6                                 | 87        |
| Global Innovation Index 2016 (out of 128) .....   | 39.8                                | 40        |

**1 Institutions.....65.2 59**

|  |      |    |
|--|------|----|
| 1.1 Political environment .....                        | 53.4 | 60 |
| 1.1.1 Political stability & safety* .....              | 58.3 | 76 |
| 1.1.2 Government effectiveness* .....                  | 48.6 | 54 |
| 1.2 Regulatory environment .....                       | 66.9 | 53 |
| 1.2.1 Regulatory quality* .....                        | 52.3 | 55 |
| 1.2.2 Rule of law* .....                               | 46.5 | 51 |
| 1.2.3 Cost of redundancy dismissal, salary weeks ..... | 15.9 | 66 |
| 1.3 Business environment .....                         | 75.2 | 49 |
| 1.3.1 Ease of starting a business* .....               | 90.7 | 47 |
| 1.3.2 Ease of resolving insolvency* .....              | 56.7 | 49 |
| 1.3.3 Ease of paying taxes* .....                      | 78.2 | 55 |

**2 Human capital & research.....56.4 16 ●**

|  |         |      |
|--|---------|------|
| 2.1 Education .....  | 79.2    | 2 ●  |
| 2.1.1 Expenditure on education, % GDP .....                    | n/a     | n/a  |
| 2.1.2 Gov't expenditure/pupil, secondary, % GDP/cap .....      | n/a     | n/a  |
| 2.1.3 School life expectancy, years .....                      | 17.8    | 12 ● |
| 2.1.4 PISA scales in reading, maths, & science .....           | 458.5   | 42   |
| 2.1.5 Pupil-teacher ratio, secondary <sup>Ⓢ</sup> .....        | 8.3     | 11 ● |
| 2.2 Tertiary education .....                                   | 58.7    | 9 ●  |
| 2.2.1 Tertiary enrolment, % gross <sup>Ⓢ</sup> .....           | 113.9   | 1 ●  |
| 2.2.2 Graduates in science & engineering, % <sup>Ⓢ</sup> ..... | 28.7    | 11 ● |
| 2.2.3 Tertiary inbound mobility, % <sup>Ⓢ</sup> .....          | 4.2     | 45   |
| 2.3 Research & development (R&D) .....                         | 31.2    | 36   |
| 2.3.1 Researchers, FTE/mn pop. .....                           | 3,201.3 | 27   |
| 2.3.2 Gross expenditure on R&D, % GDP .....                    | 1.0     | 39   |
| 2.3.3 Global R&D companies, avg. expend. top 3, mn \$US .....  | 39.5    | 38   |
| 2.3.4 QS university ranking, average score top 3* .....        | 24.8    | 46   |

**3 Infrastructure.....48.2 58**

|   |         |       |
|---|---------|-------|
| 3.1 Information & communication technologies (ICTs) .....     | 63.0    | 51    |
| 3.1.1 ICT access* .....                                       | 78.5    | 31    |
| 3.1.2 ICT use* .....  | 54.6    | 50    |
| 3.1.3 Government's online service* .....                      | 58.0    | 71    |
| 3.1.4 E-participation* .....                                  | 61.0    | 63    |
| 3.2 General infrastructure .....                              | 25.5    | 109 ○ |
| 3.2.1 Electricity output, kWh/cap .....                       | 4,374.4 | 48    |
| 3.2.2 Logistics performance* .....                            | 54.4    | 46    |
| 3.2.3 Gross capital formation, % GDP .....                    | 10.3    | 122 ○ |
| 3.3 Ecological sustainability .....                           | 56.0    | 26    |
| 3.3.1 GDP/unit of energy use .....                            | 11.2    | 32    |
| 3.3.2 Environmental performance* .....                        | 85.8    | 21 ●  |
| 3.3.3 ISO 14001 environmental certificates/bn PPP\$ GDP ..... | 3.9     | 25 ●  |

**4 Market sophistication.....50.2 48**

|  |       |      |
|--|-------|------|
| 4.1 Credit .....                                     | 47.5  | 34   |
| 4.1.1 Ease of getting credit* .....                  | 50.0  | 72   |
| 4.1.2 Domestic credit to private sector, % GDP ..... | 113.2 | 21 ● |
| 4.1.3 Microfinance gross loans, % GDP .....          | n/a   | n/a  |

|   |       |    |
|---|-------|----|
| 4.2 Investment .....  | 35.0  | 84 |
| 4.2.1 Ease of protecting minority investors* .....          | 63.3  | 41 |
| 4.2.2 Market capitalization, % GDP .....                    | 21.6  | 60 |
| 4.2.3 Venture capital deals/bn PPP\$ GDP <sup>Ⓢ</sup> ..... | 0.0   | 58 |
| 4.3 Trade, competition, & market scale .....                | 68.0  | 43 |
| 4.3.1 Applied tariff rate, weighted mean, % .....           | 1.6   | 23 |
| 4.3.2 Intensity of local competition <sup>†</sup> .....     | 67.6  | 70 |
| 4.3.3 Domestic market scale, bn PPP\$ .....                 | 290.5 | 53 |

**5 Business sophistication.....28.8 80**

|   |      |       |
|---|------|-------|
| 5.1 Knowledge workers .....   | 40.6 | 55    |
| 5.1.1 Knowledge-intensive employment, % .....                       | 29.9 | 47    |
| 5.1.2 Firms offering formal training, % firms .....                 | n/a  | n/a   |
| 5.1.3 GERD performed by business, % of GDP .....                    | 0.3  | 45    |
| 5.1.4 GERD financed by business, % .....                            | 31.8 | 47    |
| 5.1.5 Females employed w/advanced degrees, % total .....            | 16.9 | 31    |
| 5.2 Innovation linkages .....                                       | 21.5 | 91    |
| 5.2.1 University/industry research collaboration <sup>†</sup> ..... | 27.6 | 112 ○ |
| 5.2.2 State of cluster development <sup>†</sup> .....               | 33.6 | 107 ○ |
| 5.2.3 GERD financed by abroad, % .....                              | 12.8 | 38    |
| 5.2.4 JV-strategic alliance deals/bn PPP\$ GDP .....                | 0.0  | 51    |
| 5.2.5 Patent families 2+ offices/bn PPP\$ GDP .....                 | 0.4  | 41    |
| 5.3 Knowledge absorption .....                                      | 24.2 | 104 ○ |
| 5.3.1 Intellectual property payments, % total trade .....           | 0.5  | 62    |
| 5.3.2 High-tech imports less re-imports, % total trade .....        | 6.7  | 83    |
| 5.3.3 ICT services imports, % total trade .....                     | 1.1  | 64    |
| 5.3.4 FDI net inflows, % GDP .....                                  | 1.0  | 104 ○ |
| 5.3.5 Research talent, % in business enterprise .....               | 14.3 | 62 ○  |

**6 Knowledge & technology outputs.....20.4 74**

|  |       |       |
|--|-------|-------|
| 6.1 Knowledge creation .....                                 | 15.8  | 51    |
| 6.1.1 Patents by origin/bn PPP\$ GDP .....                   | 2.2   | 44    |
| 6.1.2 PCT patent applications/bn PPP\$ GDP .....             | 0.4   | 43    |
| 6.1.3 Utility models by origin/bn PPP\$ GDP .....            | 0.0   | 59 ○  |
| 6.1.4 Scientific & technical articles/bn PPP\$ GDP .....     | 33.4  | 22 ●  |
| 6.1.5 Citable documents H index .....                        | 30.4  | 29    |
| 6.2 Knowledge impact .....                                   | 25.8  | 87    |
| 6.2.1 Growth rate of PPP\$ GDP/worker, % .....               | (2.1) | 102 ○ |
| 6.2.2 New businesses/th pop. 15–64 <sup>Ⓢ</sup> .....        | 0.8   | 78 ○  |
| 6.2.3 Computer software spending, % GDP .....                | 0.6   | 17 ●  |
| 6.2.4 ISO 9001 quality certificates/bn PPP\$ GDP .....       | 21.6  | 18 ●  |
| 6.2.5 High- & medium-high-tech manufactures, % .....         | 0.1   | 75 ○  |
| 6.3 Knowledge diffusion .....                                | 19.6  | 82    |
| 6.3.1 Intellectual property receipts, % total trade .....    | 0.1   | 57    |
| 6.3.2 High-tech exports less re-exports, % total trade ..... | 2.3   | 51    |
| 6.3.3 ICT services exports, % total trade .....              | 1.5   | 66    |
| 6.3.4 FDI net outflows, % GDP .....                          | 0.7   | 63    |

**7 Creative outputs.....35.5 51**

|   |      |      |
|---|------|------|
| 7.1 Intangible assets .....   | 44.1 | 58   |
| 7.1.1 Trademarks by origin/bn PPP\$ GDP .....                                   | n/a  | n/a  |
| 7.1.2 Industrial designs by origin/bn PPP\$ GDP .....                           | 4.2  | 30   |
| 7.1.3 ICTs & business model creation <sup>†</sup> .....                         | 54.2 | 87   |
| 7.1.4 ICTs & organizational model creation <sup>†</sup> .....                   | 44.7 | 94 ○ |
| 7.2 Creative goods & services .....   | 22.0 | 53   |
| 7.2.1 Cultural & creative services exports, % of total trade <sup>Ⓢ</sup> ..... | 0.6  | 24   |
| 7.2.2 National feature films/mn pop. 15–69 .....                                | 5.5  | 36   |
| 7.2.3 Global ent. & media market/th pop. 15–69 .....                            | 18.6 | 27   |
| 7.2.4 Printing & publishing manufactures, % .....                               | 0.9  | 69   |
| 7.2.5 Creative goods exports, % total trade .....                               | 1.2  | 36   |
| 7.3 Online creativity .....   | 32.0 | 36   |
| 7.3.1 Generic top-level domains (TLDs)/th pop. 15–69 .....                      | 12.4 | 35   |
| 7.3.2 Country-code TLDs/th pop. 15–69 .....                                     | 16.3 | 33   |
| 7.3.3 Wikipedia edits/mn pop. 15–69 .....                                       | 6.2  | 35   |
| 7.3.4 Video uploads on YouTube/pop. 15–69 .....                                 | 39.7 | 29   |

NOTES: ● indicates a strength; ○ a weakness; \* an index; † a survey question.

Ⓢ indicates that the country's data are older than the base year; see Appendix II for details, including the year of the data, at <http://globalinnovationindex.org>.

Square brackets indicate that the data minimum coverage (DMC) requirements were not met at the sub-pillar or pillar level; see page 181 of this appendix for details.

## Guatemala

## Key indicators

|                       |                                 |
|-----------------------|---------------------------------|
| Population (millions) | 16.7                            |
| GDP (US\$ billions)   | 68.4                            |
| GDP per capita, PPP\$ | 7,737.6                         |
| Income group          | Lower-middle income             |
| Region                | Latin America and the Caribbean |

|   | Score 0–100<br>or value (hard data) | Rank      |
|---|-------------------------------------|-----------|
| <b>Global Innovation Index (out of 127)</b> | <b>27.9</b>                         | <b>98</b> |
| Innovation Output Sub-Index                 | 19.9                                | 92        |
| Innovation Input Sub-Index                  | 35.9                                | 97        |
| Innovation Efficiency Ratio                 | 0.6                                 | 91        |
| Global Innovation Index 2016 (out of 128)   | 27.3                                | 97        |

**1 Institutions** ..... 46.5 107

|  |      |     |
|--|------|-----|
| 1.1 Political environment                        | 36.0 | 105 |
| 1.1.1 Political stability & safety*              | 48.1 | 95  |
| 1.1.2 Government effectiveness*                  | 23.8 | 110 |
| 1.2 Regulatory environment                       | 43.1 | 111 |
| 1.2.1 Regulatory quality*                        | 36.9 | 81  |
| 1.2.2 Rule of law*                               | 10.6 | 118 |
| 1.2.3 Cost of redundancy dismissal, salary weeks | 27.0 | 104 |
| 1.3 Business environment                         | 60.5 | 97  |
| 1.3.1 Ease of starting a business*               | 82.3 | 91  |
| 1.3.2 Ease of resolving insolvency*              | 27.5 | 119 |
| 1.3.3 Ease of paying taxes*                      | 71.6 | 71  |

**2 Human capital & research** ..... 18.1 107

|  |      |       |
|--|------|-------|
| 2.1 Education  | 28.5 | 112   |
| 2.1.1 Expenditure on education, % GDP                    | 3.0  | 99    |
| 2.1.2 Gov't expenditure/pupil, secondary, % GDP/cap      | 5.6  | 105 ○ |
| 2.1.3 School life expectancy, years <sup>Ⓐ</sup>         | 10.7 | 97    |
| 2.1.4 PISA scales in reading, maths, & science           | n/a  | n/a   |
| 2.1.5 Pupil-teacher ratio, secondary <sup>Ⓐ</sup>        | 12.7 | 47    |
| 2.2 Tertiary education                                   | 25.6 | 92    |
| 2.2.1 Tertiary enrolment, % gross <sup>Ⓐ</sup>           | 18.3 | 94    |
| 2.2.2 Graduates in science & engineering, % <sup>Ⓐ</sup> | 16.8 | 74    |
| 2.2.3 Tertiary inbound mobility, %                       | n/a  | n/a   |
| 2.3 Research & development (R&D)                         | 0.2  | 112   |
| 2.3.1 Researchers, FTE/mn pop. <sup>Ⓐ</sup>              | 26.7 | 99 ○  |
| 2.3.2 Gross expenditure on R&D, % GDP <sup>Ⓐ</sup>       | 0.0  | 109 ○ |
| 2.3.3 Global R&D companies, avg. expend. top 3, mn \$US  | 0.0  | 43 ○  |
| 2.3.4 QS university ranking, average score top 3*        | 0.0  | 75 ○  |

**3 Infrastructure** ..... 34.6 103

|   |       |       |
|---|-------|-------|
| 3.1 Information & communication technologies (ICTs)     | 47.0  | 86    |
| 3.1.1 ICT access*                                       | 44.7  | 93    |
| 3.1.2 ICT use*  | 14.0  | 105   |
| 3.1.3 Government's online service*                      | 66.7  | 51    |
| 3.1.4 E-participation*                                  | 62.7  | 59    |
| 3.2 General infrastructure                              | 16.7  | 123 ○ |
| 3.2.1 Electricity output, kWh/cap                       | 669.5 | 100   |
| 3.2.2 Logistics performance*                            | 19.1  | 105   |
| 3.2.3 Gross capital formation, % GDP                    | 13.4  | 119 ○ |
| 3.3 Ecological sustainability                           | 40.2  | 81    |
| 3.3.1 GDP/unit of energy use                            | 8.5   | 63    |
| 3.3.2 Environmental performance*                        | 69.6  | 79    |
| 3.3.3 ISO 14001 environmental certificates/bn PPP\$ GDP | 0.2   | 111   |

**4 Market sophistication** ..... 43.8 77

|  |      |      |
|--|------|------|
| 4.1 Credit                                     | 32.1 | 73   |
| 4.1.1 Ease of getting credit*                  | 80.0 | 15 ● |
| 4.1.2 Domestic credit to private sector, % GDP | 34.4 | 94   |
| 4.1.3 Microfinance gross loans, % GDP          | 0.2  | 52   |

|  |      |       |
|--|------|-------|
| 4.2 Investment                               | 33.3 | [94]  |
| 4.2.1 Ease of protecting minority investors* | 33.3 | 124 ○ |
| 4.2.2 Market capitalization, % GDP           | n/a  | n/a   |
| 4.2.3 Venture capital deals/bn PPP\$ GDP     | n/a  | n/a   |

|   |       |      |
|---|-------|------|
| 4.3 Trade, competition, & market scale            | 66.1  | 50   |
| 4.3.1 Applied tariff rate, weighted mean, %       | 1.4   | 21 ● |
| 4.3.2 Intensity of local competition <sup>†</sup> | 75.3  | 25 ● |
| 4.3.3 Domestic market scale, bn PPP\$             | 132.3 | 70   |

**5 Business sophistication** ..... 36.2 47 ●

|   |      |      |
|---|------|------|
| 5.1 Knowledge workers   | 28.3 | 89   |
| 5.1.1 Knowledge-intensive employment, %                         | 9.6  | 97   |
| 5.1.2 Firms offering formal training, % firms <sup>Ⓐ</sup>      | 51.9 | 19 ● |
| 5.1.3 GERD performed by business, % of GDP <sup>Ⓐ</sup>         | 0.0  | 90 ○ |
| 5.1.4 GERD financed by business, %                              | n/a  | n/a  |
| 5.1.5 Females employed w/advanced degrees, % total <sup>Ⓐ</sup> | 3.5  | 80   |
| 5.2 Innovation linkages   | 50.2 | 8 ●  |
| 5.2.1 University/industry research collaboration <sup>†</sup>   | 41.8 | 57   |
| 5.2.2 State of cluster development <sup>†</sup>                 | 47.4 | 51   |
| 5.2.3 GERD financed by abroad, % <sup>Ⓐ</sup>                   | 49.0 | 5 ●  |
| 5.2.4 JV-strategic alliance deals/bn PPP\$ GDP                  | n/a  | n/a  |
| 5.2.5 Patent families 2+ offices/bn PPP\$ GDP <sup>Ⓐ</sup>      | 0.0  | 112  |
| 5.3 Knowledge absorption  | 30.2 | 80   |
| 5.3.1 Intellectual property payments, % total trade             | 1.2  | 23 ● |
| 5.3.2 High-tech imports less re-imports, % total trade          | 9.4  | 49 ● |
| 5.3.3 ICT services imports, % total trade                       | 0.4  | 107  |
| 5.3.4 FDI net inflows, % GDP                                    | 2.1  | 81   |
| 5.3.5 Research talent, % in business enterprise                 | n/a  | n/a  |

**6 Knowledge & technology outputs** ..... 13.9 111

|  |      |       |
|--|------|-------|
| 6.1 Knowledge creation                                 | 1.4  | 123 ○ |
| 6.1.1 Patents by origin/bn PPP\$ GDP                   | 0.1  | 115   |
| 6.1.2 PCT patent applications/bn PPP\$ GDP             | 0.0  | 101 ○ |
| 6.1.3 Utility models by origin/bn PPP\$ GDP            | 0.1  | 54    |
| 6.1.4 Scientific & technical articles/bn PPP\$ GDP     | 1.3  | 121 ○ |
| 6.1.5 Citable documents H index                        | 3.7  | 106   |
| 6.2 Knowledge impact                                   | 21.1 | 103   |
| 6.2.1 Growth rate of PPP\$ GDP/worker, %               | 1.0  | 56    |
| 6.2.2 New businesses/th pop. 15–64 <sup>Ⓐ</sup>        | 0.5  | 86    |
| 6.2.3 Computer software spending, % GDP                | 0.0  | 121 ○ |
| 6.2.4 ISO 9001 quality certificates/bn PPP\$ GDP       | 1.8  | 96    |
| 6.2.5 High- & medium-high-tech manufactures, %         | n/a  | n/a   |
| 6.3 Knowledge diffusion                                | 19.2 | 84    |
| 6.3.1 Intellectual property receipts, % total trade    | 0.1  | 55    |
| 6.3.2 High-tech exports less re-exports, % total trade | 1.5  | 61    |
| 6.3.3 ICT services exports, % total trade              | 2.9  | 33 ●  |
| 6.3.4 FDI net outflows, % GDP                          | 0.0  | 106   |

**7 Creative outputs** ..... 26.0 84

|  |      |      |
|--|------|------|
| 7.1 Intangible assets  | 41.3 | 69   |
| 7.1.1 Trademarks by origin/bn PPP\$ GDP <sup>Ⓐ</sup>         | 39.3 | 60   |
| 7.1.2 Industrial designs by origin/bn PPP\$ GDP              | 0.2  | 101  |
| 7.1.3 ICTs & business model creation <sup>†</sup>            | 65.2 | 47 ● |
| 7.1.4 ICTs & organizational model creation <sup>†</sup>      | 59.2 | 40 ● |
| 7.2 Creative goods & services                                | 7.8  | 96   |
| 7.2.1 Cultural & creative services exports, % of total trade | 0.0  | 76   |
| 7.2.2 National feature films/mn pop. 15–69 <sup>Ⓐ</sup>      | 1.2  | 75   |
| 7.2.3 Global ent. & media market/th pop. 15–69               | n/a  | n/a  |
| 7.2.4 Printing & publishing manufactures, %                  | n/a  | n/a  |
| 7.2.5 Creative goods exports, % total trade                  | 0.4  | 61   |
| 7.3 Online creativity  | 13.5 | 87   |
| 7.3.1 Generic top-level domains (TLDs)/th pop. 15–69         | 4.3  | 60   |
| 7.3.2 Country-code TLDs/th pop. 15–69                        | 0.5  | 90   |
| 7.3.3 Wikipedia edits/mn pop. 15–69 <sup>Ⓐ</sup>             | 3.7  | 90   |
| 7.3.4 Video uploads on YouTube/pop. 15–69                    | n/a  | n/a  |

NOTES: ● indicates a strength; ○ a weakness; \* an index; † a survey question.

<sup>Ⓐ</sup> indicates that the country's data are older than the base year; see Appendix II for details, including the year of the data, at <http://globalinnovationindex.org>.

Square brackets indicate that the data minimum coverage (DMC) requirements were not met at the sub-pillar or pillar level; see page 181 of this appendix for details.

## Key indicators

|                            |                    |
|----------------------------|--------------------|
| Population (millions)..... | 12.9               |
| GDP (US\$ billions).....   | 6.8                |
| GDP per capita, PPP\$..... | 1,213.6            |
| Income group.....          | Low income         |
| Region.....                | Sub-Saharan Africa |

|  | Score 0–100<br>or value (hard data) | Rank         |
|--|-------------------------------------|--------------|
| <b>Global Innovation Index (out of 127).....</b> | <b>17.4</b>                         | <b>126</b> ○ |
| Innovation Output Sub-Index.....                 | 10.0                                | 124          |
| Innovation Input Sub-Index.....                  | 24.9                                | 126 ○        |
| Innovation Efficiency Ratio.....                 | 0.4                                 | 118          |
| Global Innovation Index 2016 (out of 128).....   | 17.2                                | 127          |

|   |             |            |
|---|-------------|------------|
| <b>1 Institutions.....</b>                            | <b>45.0</b> | <b>112</b> |
| 1.1 Political environment.....                        | 33.0        | 111        |
| 1.1.1 Political stability & safety*.....              | 53.0        | 84 ●       |
| 1.1.2 Government effectiveness*.....                  | 13.0        | 122        |
| 1.2 Regulatory environment.....                       | 54.3        | 87 ●       |
| 1.2.1 Regulatory quality*.....                        | 20.0        | 115        |
| 1.2.2 Rule of law*.....                               | 5.2         | 125 ○      |
| 1.2.3 Cost of redundancy dismissal, salary weeks..... | 10.1        | 32 ●       |
| 1.3 Business environment.....                         | 47.8        | 124        |
| 1.3.1 Ease of starting a business*.....               | 80.2        | 100        |
| 1.3.2 Ease of resolving insolvency*.....              | 38.8        | 100        |
| 1.3.3 Ease of paying taxes*.....                      | 24.3        | 126 ○      |

|  |            |              |
|--|------------|--------------|
| <b>2 Human capital &amp; research.....</b>                   | <b>8.9</b> | <b>126</b> ○ |
| 2.1 Education.....   | 20.0       | 124          |
| 2.1.1 Expenditure on education, % GDP.....                   | 3.2        | 96           |
| 2.1.2 Gov't expenditure/pupil, secondary, % GDP/cap.....     | 12.0       | 91           |
| 2.1.3 School life expectancy, years.....                     | 8.8        | 108          |
| 2.1.4 PISA scales in reading, maths, & science.....          | n/a        | n/a          |
| 2.1.5 Pupil-teacher ratio, secondary <sup>Ⓢ</sup> .....      | 33.1       | 105          |
| 2.2 Tertiary education.....                                  | 6.8        | 118          |
| 2.2.1 Tertiary enrolment, % gross <sup>Ⓢ</sup> .....         | 10.8       | 101          |
| 2.2.2 Graduates in science & engineering, %.....             | n/a        | n/a          |
| 2.2.3 Tertiary inbound mobility, % <sup>Ⓢ</sup> .....        | 0.9        | 83           |
| 2.3 Research & development (R&D).....                        | 0.0        | 115 ○        |
| 2.3.1 Researchers, FTE/mn pop.....                           | n/a        | n/a          |
| 2.3.2 Gross expenditure on R&D, % GDP.....                   | n/a        | n/a          |
| 2.3.3 Global R&D companies, avg. expend. top 3, mn \$US..... | 0.0        | 43 ○         |
| 2.3.4 QS university ranking, average score top 3*.....       | 0.0        | 75 ○         |

|  |             |            |
|--|-------------|------------|
| <b>3 Infrastructure.....</b>                                 | <b>24.8</b> | <b>121</b> |
| 3.1 Information & communication technologies (ICTs).....     | 12.3        | 126 ○      |
| 3.1.1 ICT access*.....                                       | 25.7        | 120        |
| 3.1.2 ICT use*.....  | 6.2         | 119        |
| 3.1.3 Government's online service*.....                      | 8.7         | 123        |
| 3.1.4 E-participation*.....                                  | 8.5         | 123 ○      |
| 3.2 General infrastructure.....                              | 25.0        | 110        |
| 3.2.1 Electricity output, kWh/cap.....                       | n/a         | n/a        |
| 3.2.2 Logistics performance*.....                            | 13.7        | 117        |
| 3.2.3 Gross capital formation, % GDP.....                    | 16.9        | 104        |
| 3.3 Ecological sustainability.....                           | 37.1        | 91 ●       |
| 3.3.1 GDP/unit of energy use.....                            | n/a         | n/a        |
| 3.3.2 Environmental performance*.....                        | 55.4        | 107        |
| 3.3.3 ISO 14001 environmental certificates/bn PPP\$ GDP..... | 0.1         | 118        |

|  |             |              |
|--|-------------|--------------|
| <b>4 Market sophistication.....</b>                      | <b>26.3</b> | <b>126</b> ○ |
| 4.1 Credit.....  | 13.0        | 123          |
| 4.1.1 Ease of getting credit*.....                       | 30.0        | 108          |
| 4.1.2 Domestic credit to private sector, % GDP.....      | 14.4        | 119          |
| 4.1.3 Microfinance gross loans, % GDP <sup>Ⓢ</sup> ..... | 0.2         | 46 ●         |

|  |      |      |
|--|------|------|
| 4.2 Investment.....  | 33.6 | 91 ● |
| 4.2.1 Ease of protecting minority investors*.....              | 40.0 | 111  |
| 4.2.2 Market capitalization, % GDP.....                        | n/a  | n/a  |
| 4.2.3 Venture capital deals/bn PPP\$ GDP <sup>Ⓢ</sup> .....    | 0.1  | 24 ● |
| 4.3 Trade, competition, & market scale.....                    | 32.2 | 123  |
| 4.3.1 Applied tariff rate, weighted mean, % <sup>Ⓢ</sup> ..... | 11.9 | 122  |
| 4.3.2 Intensity of local competition <sup>†Ⓢ</sup> .....       | 53.3 | 119  |
| 4.3.3 Domestic market scale, bn PPP\$.....                     | 16.1 | 124  |

**5 Business sophistication..... 19.3 124**

|   |      |       |
|---|------|-------|
| 5.1 Knowledge workers.....  | 11.7 | [120] |
| 5.1.1 Knowledge-intensive employment, % <sup>Ⓢ</sup> .....                | 0.7  | 108 ○ |
| 5.1.2 Firms offering formal training, % firms <sup>Ⓢ</sup> .....          | 21.1 | 73    |
| 5.1.3 GERD performed by business, % of GDP.....                           | n/a  | n/a   |
| 5.1.4 GERD financed by business, %.....                                   | n/a  | n/a   |
| 5.1.5 Females employed w/advanced degrees, % total.....                   | n/a  | n/a   |
| 5.2 Innovation linkages.....  | 22.0 | 86 ●  |
| 5.2.1 University/industry research collaboration <sup>†</sup> .....       | 19.7 | 122 ○ |
| 5.2.2 State of cluster development <sup>†Ⓢ</sup> .....                    | 33.7 | 106   |
| 5.2.3 GERD financed by abroad, %.....                                     | n/a  | n/a   |
| 5.2.4 JV-strategic alliance deals/bn PPP\$ GDP.....                       | n/a  | n/a   |
| 5.2.5 Patent families 2+ offices/bn PPP\$ GDP <sup>Ⓢ</sup> .....          | 0.1  | 70 ●  |
| 5.3 Knowledge absorption.....   | 24.3 | 101   |
| 5.3.1 Intellectual property payments, % total trade <sup>Ⓢ</sup> .....    | 0.1  | 107   |
| 5.3.2 High-tech imports less re-imports, % total trade <sup>Ⓢ</sup> ..... | 4.5  | 111   |
| 5.3.3 ICT services imports, % total trade <sup>Ⓢ</sup> .....              | 1.5  | 44 ●  |
| 5.3.4 FDI net inflows, % GDP.....   | 1.5  | 97 ●  |
| 5.3.5 Research talent, % in business enterprise.....                      | n/a  | n/a   |

**6 Knowledge & technology outputs..... 6.5 127 ○**

|   |      |       |
|---|------|-------|
| 6.1 Knowledge creation.....   | 0.7  | 127 ○ |
| 6.1.1 Patents by origin/bn PPP\$ GDP.....                                 | 0.1  | 113   |
| 6.1.2 PCT patent applications/bn PPP\$ GDP.....                           | n/a  | n/a   |
| 6.1.3 Utility models by origin/bn PPP\$ GDP.....                          | n/a  | n/a   |
| 6.1.4 Scientific & technical articles/bn PPP\$ GDP.....                   | 0.7  | 125 ○ |
| 6.1.5 Citable documents H index.....                                      | 1.6  | 121   |
| 6.2 Knowledge impact.....   | 1.7  | 126 ○ |
| 6.2.1 Growth rate of PPP\$ GDP/worker, %.....                             | n/a  | n/a   |
| 6.2.2 New businesses/th pop. 15–64.....                                   | 0.1  | 98    |
| 6.2.3 Computer software spending, % GDP.....                              | 0.0  | 107   |
| 6.2.4 ISO 9001 quality certificates/bn PPP\$ GDP.....                     | 0.6  | 117   |
| 6.2.5 High- & medium-high-tech manufactures, %.....                       | n/a  | n/a   |
| 6.3 Knowledge diffusion.....  | 17.0 | 101   |
| 6.3.1 Intellectual property receipts, % total trade <sup>Ⓢ</sup> .....    | 0.0  | 90    |
| 6.3.2 High-tech exports less re-exports, % total trade <sup>Ⓢ</sup> ..... | 0.1  | 106   |
| 6.3.3 ICT services exports, % total trade <sup>Ⓢ</sup> .....              | 2.7  | 40 ●  |
| 6.3.4 FDI net outflows, % GDP.....  | 0.0  | 105   |

**7 Creative outputs..... 13.5 122**

|   |      |       |
|---|------|-------|
| 7.1 Intangible assets.....  | 23.9 | 122   |
| 7.1.1 Trademarks by origin/bn PPP\$ GDP.....                                    | 13.8 | 94    |
| 7.1.2 Industrial designs by origin/bn PPP\$ GDP.....                            | 4.6  | 28 ●  |
| 7.1.3 ICTs & business model creation <sup>†Ⓢ</sup> .....                        | 35.9 | 121 ○ |
| 7.1.4 ICTs & organizational model creation <sup>†Ⓢ</sup> .....                  | 28.6 | 121 ○ |
| 7.2 Creative goods & services.....  | 6.1  | 103   |
| 7.2.1 Cultural & creative services exports, % of total trade <sup>Ⓢ</sup> ..... | 0.4  | 30 ●  |
| 7.2.2 National feature films/mn pop. 15–69 <sup>Ⓢ</sup> .....                   | 0.8  | 84    |
| 7.2.3 Global ent. & media market/th pop. 15–69.....                             | n/a  | n/a   |
| 7.2.4 Printing & publishing manufactures, %.....                                | n/a  | n/a   |
| 7.2.5 Creative goods exports, % total trade <sup>Ⓢ</sup> .....                  | 0.0  | 114   |
| 7.3 Online creativity.....  | 0.0  | 127 ○ |
| 7.3.1 Generic top-level domains (TLDs)/th pop. 15–69.....                       | 0.0  | 124   |
| 7.3.2 Country-code TLDs/th pop. 15–69.....                                      | 0.1  | 115   |
| 7.3.3 Wikipedia edits/mn pop. 15–69 <sup>Ⓢ</sup> .....                          | 0.0  | 126 ○ |
| 7.3.4 Video uploads on YouTube/pop. 15–69.....                                  | n/a  | n/a   |

NOTES: ● indicates a strength; ○ a weakness; \* an index; † a survey question.

Ⓢ indicates that the country's data are older than the base year; see Appendix II for details, including the year of the data, at <http://globalinnovationindex.org>.

Square brackets indicate that the data minimum coverage (DMC) requirements were not met at the sub-pillar or pillar level; see page 181 of this appendix for details.



## Honduras

## Key indicators

|                            |                                 |
|----------------------------|---------------------------------|
| Population (millions)..... | 8.2                             |
| GDP (US\$ billions).....   | 20.9                            |
| GDP per capita, PPP\$..... | 4,868.6                         |
| Income group.....          | Lower-middle income             |
| Region.....                | Latin America and the Caribbean |

|  | Score 0–100<br>or value (hard data) | Rank       |
|--|-------------------------------------|------------|
| <b>Global Innovation Index (out of 127).....</b> | <b>26.4</b>                         | <b>104</b> |
| Innovation Output Sub-Index.....                 | 18.0                                | 103        |
| Innovation Input Sub-Index.....                  | 34.8                                | 103        |
| Innovation Efficiency Ratio.....                 | 0.5                                 | 101        |
| Global Innovation Index 2016 (out of 128).....   | 26.9                                | 101        |

**1 Institutions..... 43.2 117** ○

|   |      |     |
|---|------|-----|
| 1.1 Political environment.....                        | 36.3 | 104 |
| 1.1.1 Political stability & safety*.....              | 51.5 | 88  |
| 1.1.2 Government effectiveness*.....                  | 21.1 | 115 |
| 1.2 Regulatory environment.....                       | 38.8 | 116 |
| 1.2.1 Regulatory quality*.....                        | 32.0 | 95  |
| 1.2.2 Rule of law*.....                               | 11.6 | 115 |
| 1.2.3 Cost of redundancy dismissal, salary weeks..... | 30.3 | 117 |
| 1.3 Business environment.....                         | 54.6 | 117 |
| 1.3.1 Ease of starting a business*.....               | 77.0 | 109 |
| 1.3.2 Ease of resolving insolvency*.....              | 31.7 | 112 |
| 1.3.3 Ease of paying taxes*.....                      | 55.0 | 105 |

**2 Human capital & research..... 19.7 102**

|  |      |     |
|--|------|-----|
| 2.1 Education.....   | 43.1 | 79  |
| 2.1.1 Expenditure on education, % GDP.....                   | 5.9  | 23  |
| 2.1.2 Gov't expenditure/pupil, secondary, % GDP/cap.....     | 18.1 | 62  |
| 2.1.3 School life expectancy, years.....                     | 11.2 | 92  |
| 2.1.4 PISA scales in reading, maths, & science.....          | n/a  | n/a |
| 2.1.5 Pupil-teacher ratio, secondary.....                    | 16.1 | 70  |
| 2.2 Tertiary education.....                                  | 15.9 | 107 |
| 2.2.1 Tertiary enrolment, % gross <sup>Ⓐ</sup> .....         | 21.2 | 90  |
| 2.2.2 Graduates in science & engineering, %.....             | 12.4 | 94  |
| 2.2.3 Tertiary inbound mobility, % <sup>Ⓐ</sup> .....        | 0.7  | 85  |
| 2.3 Research & development (R&D).....                        | 0.0  | 115 |
| 2.3.1 Researchers, FTE/mn pop.....                           | n/a  | n/a |
| 2.3.2 Gross expenditure on R&D, % GDP.....                   | n/a  | n/a |
| 2.3.3 Global R&D companies, avg. expend. top 3, mn \$US..... | 0.0  | 43  |
| 2.3.4 QS university ranking, average score top 3*.....       | 0.0  | 75  |

**3 Infrastructure..... 33.8 104**

|  |         |     |
|--|---------|-----|
| 3.1 Information & communication technologies (ICTs).....     | 31.4    | 107 |
| 3.1.1 ICT access*.....                                       | 41.7    | 100 |
| 3.1.2 ICT use*.....  | 13.8    | 106 |
| 3.1.3 Government's online service*.....                      | 31.2    | 108 |
| 3.1.4 E-participation*.....                                  | 39.0    | 98  |
| 3.2 General infrastructure.....                              | 31.0    | 88  |
| 3.2.1 Electricity output, kWh/cap.....                       | 1,009.8 | 93  |
| 3.2.2 Logistics performance*.....                            | 18.5    | 106 |
| 3.2.3 Gross capital formation, % GDP.....                    | 26.0    | 38  |
| 3.3 Ecological sustainability.....                           | 38.9    | 86  |
| 3.3.1 GDP/unit of energy use.....                            | 6.8     | 86  |
| 3.3.2 Environmental performance*.....                        | 69.6    | 79  |
| 3.3.3 ISO 14001 environmental certificates/bn PPP\$ GDP..... | 1.2     | 59  |

**4 Market sophistication..... 45.9 66**

|   |      |    |
|---|------|----|
| 4.1 Credit.....                                     | 38.9 | 52 |
| 4.1.1 Ease of getting credit*.....                  | 85.0 | 7  |
| 4.1.2 Domestic credit to private sector, % GDP..... | 55.4 | 59 |
| 4.1.3 Microfinance gross loans, % GDP.....          | 0.6  | 32 |

|   |      |      |
|---|------|------|
| 4.2 Investment.....                                     | 43.3 | [47] |
| 4.2.1 Ease of protecting minority investors*.....       | 43.3 | 101  |
| 4.2.2 Market capitalization, % GDP.....                 | n/a  | n/a  |
| 4.2.3 Venture capital deals/bn PPP\$ GDP.....           | n/a  | n/a  |
| 4.3 Trade, competition, & market scale.....             | 55.4 | 93   |
| 4.3.1 Applied tariff rate, weighted mean, %.....        | 2.8  | 64   |
| 4.3.2 Intensity of local competition <sup>†</sup> ..... | 65.9 | 76   |
| 4.3.3 Domestic market scale, bn PPP\$.....              | 43.2 | 95   |

**5 Business sophistication..... 31.3 70**

|   |      |      |
|---|------|------|
| 5.1 Knowledge workers.....  | 31.4 | [82] |
| 5.1.1 Knowledge-intensive employment, %.....                              | 12.0 | 93   |
| 5.1.2 Firms offering formal training, % firms <sup>Ⓐ</sup> .....          | 35.8 | 37   |
| 5.1.3 GERD performed by business, % of GDP.....                           | n/a  | n/a  |
| 5.1.4 GERD financed by business, %.....                                   | n/a  | n/a  |
| 5.1.5 Females employed w/advanced degrees, % total.....                   | n/a  | n/a  |
| 5.2 Innovation linkages.....  | 31.7 | 53   |
| 5.2.1 University/industry research collaboration <sup>†</sup> .....       | 35.4 | 92   |
| 5.2.2 State of cluster development <sup>†</sup> .....                     | 45.5 | 63   |
| 5.2.3 GERD financed by abroad, %.....                                     | n/a  | n/a  |
| 5.2.4 JV-strategic alliance deals/bn PPP\$ GDP.....                       | n/a  | n/a  |
| 5.2.5 Patent families 2+ offices/bn PPP\$ GDP <sup>Ⓐ</sup> .....          | 0.0  | 95   |
| 5.3 Knowledge absorption.....   | 30.7 | 77   |
| 5.3.1 Intellectual property payments, % total trade.....                  | 0.5  | 58   |
| 5.3.2 High-tech imports less re-imports, % total trade <sup>Ⓐ</sup> ..... | 7.5  | 71   |
| 5.3.3 ICT services imports, % total trade.....                            | 0.8  | 76   |
| 5.3.4 FDI net inflows, % GDP.....   | 6.3  | 21   |
| 5.3.5 Research talent, % in business enterprise.....                      | n/a  | n/a  |

**6 Knowledge & technology outputs..... 12.4 117** ○

|   |      |       |
|---|------|-------|
| 6.1 Knowledge creation.....   | 1.0  | 125   |
| 6.1.1 Patents by origin/bn PPP\$ GDP.....                                 | 0.1  | 107   |
| 6.1.2 PCT patent applications/bn PPP\$ GDP.....                           | 0.0  | 95    |
| 6.1.3 Utility models by origin/bn PPP\$ GDP.....                          | 0.1  | 56    |
| 6.1.4 Scientific & technical articles/bn PPP\$ GDP.....                   | 1.2  | 122   |
| 6.1.5 Citable documents H index.....                                      | 2.1  | 117   |
| 6.2 Knowledge impact.....   | 15.6 | [112] |
| 6.2.1 Growth rate of PPP\$ GDP/worker, %.....                             | n/a  | n/a   |
| 6.2.2 New businesses/th pop. 15–64.....                                   | n/a  | n/a   |
| 6.2.3 Computer software spending, % GDP.....                              | 0.3  | 55    |
| 6.2.4 ISO 9001 quality certificates/bn PPP\$ GDP.....                     | 4.2  | 67    |
| 6.2.5 High- & medium-high-tech manufactures, %.....                       | n/a  | n/a   |
| 6.3 Knowledge diffusion.....  | 20.5 | 72    |
| 6.3.1 Intellectual property receipts, % total trade.....                  | 0.0  | 85    |
| 6.3.2 High-tech exports less re-exports, % total trade <sup>Ⓐ</sup> ..... | 0.5  | 80    |
| 6.3.3 ICT services exports, % total trade.....                            | 2.9  | 34    |
| 6.3.4 FDI net outflows, % GDP.....  | 0.8  | 60    |

**7 Creative outputs..... 23.5 93**

|   |       |     |
|---|-------|-----|
| 7.1 Intangible assets.....  | 40.0  | 74  |
| 7.1.1 Trademarks by origin/bn PPP\$ GDP.....                                    | 49.7  | 51  |
| 7.1.2 Industrial designs by origin/bn PPP\$ GDP.....                            | 0.2   | 98  |
| 7.1.3 ICTs & business model creation <sup>†</sup> .....                         | 59.4  | 67  |
| 7.1.4 ICTs & organizational model creation <sup>†</sup> .....                   | 54.9  | 56  |
| 7.2 Creative goods & services.....  | 2.5   | 118 |
| 7.2.1 Cultural & creative services exports, % of total trade <sup>Ⓐ</sup> ..... | (0.0) | 92  |
| 7.2.2 National feature films/mn pop. 15–69.....                                 | 1.0   | 80  |
| 7.2.3 Global ent. & media market/th pop. 15–69.....                             | n/a   | n/a |
| 7.2.4 Printing & publishing manufactures, %.....                                | n/a   | n/a |
| 7.2.5 Creative goods exports, % total trade <sup>Ⓐ</sup> .....                  | 0.1   | 94  |
| 7.3 Online creativity.....  | 11.6  | 94  |
| 7.3.1 Generic top-level domains (TLDs)/th pop. 15–69.....                       | 0.6   | 100 |
| 7.3.2 Country-code TLDs/th pop. 15–69.....                                      | 0.4   | 91  |
| 7.3.3 Wikipedia edits/mn pop. 15–69 <sup>Ⓐ</sup> .....                          | 3.5   | 95  |
| 7.3.4 Video uploads on YouTube/pop. 15–69.....                                  | n/a   | n/a |

NOTES: ● indicates a strength; ○ a weakness; \* an index; † a survey question.

Ⓐ indicates that the country's data are older than the base year; see Appendix II for details, including the year of the data, at <http://globalinnovationindex.org>.

Square brackets indicate that the data minimum coverage (DMC) requirements were not met at the sub-pillar or pillar level; see page 181 of this appendix for details.



## Key indicators

|                            |   |
|----------------------------|---|
| Population (millions)..... | 7.3                                     |
| GDP (US\$ billions).....   | 316.1                                   |
| GDP per capita, PPP\$..... | 56,700.8                                |
| Income group.....          | High income                             |
| Region.....                | South East Asia, East Asia, and Oceania |

|  | Score 0–100<br>or value (hard data) | Rank      |
|--|-------------------------------------|-----------|
| <b>Global Innovation Index (out of 127).....</b> | <b>53.9</b>                         | <b>16</b> |
| Innovation Output Sub-Index.....                 | 40.8                                | 25        |
| Innovation Input Sub-Index.....                  | 67.0                                | 8         |
| Innovation Efficiency Ratio.....                 | 0.6                                 | 73 ○      |
| Global Innovation Index 2016 (out of 128).....   | 55.7                                | 14        |

## 1 Institutions.....92.7 3 ●

|   |      |     |
|---|------|-----|
| 1.1 Political environment.....                        | 89.8 | 7   |
| 1.1.1 Political stability & safety*.....              | 87.9 | 13  |
| 1.1.2 Government effectiveness*.....                  | 91.7 | 3 ● |
| 1.2 Regulatory environment.....                       | 97.7 | 2 ● |
| 1.2.1 Regulatory quality*.....                        | 97.8 | 2 ● |
| 1.2.2 Rule of law*.....                               | 92.9 | 12  |
| 1.2.3 Cost of redundancy dismissal, salary weeks..... | 8.0  | 1 ● |
| 1.3 Business environment.....                         | 90.7 | 2 ● |
| 1.3.1 Ease of starting a business*.....               | 98.2 | 3 ● |
| 1.3.2 Ease of resolving insolvency*.....              | 75.1 | 26  |
| 1.3.3 Ease of paying taxes*.....                      | 98.7 | 3 ● |

## 2 Human capital & research.....47.7 28

|  |         |      |
|--|---------|------|
| 2.1 Education.....   | 44.9    | 73 ○ |
| 2.1.1 Expenditure on education, % GDP.....                   | 3.3     | 95 ○ |
| 2.1.2 Gov't expenditure/pupil, secondary, % GDP/cap.....     | 20.4    | 51   |
| 2.1.3 School life expectancy, years.....                     | n/a     | n/a  |
| 2.1.4 PISA scales in reading, maths, & science.....          | 532.6   | 2 ●  |
| 2.1.5 Pupil-teacher ratio, secondary.....                    | 13.0    | 51   |
| 2.2 Tertiary education.....                                  | 63.7    | 4    |
| 2.2.1 Tertiary enrolment, % gross.....                       | 68.5    | 30   |
| 2.2.2 Graduates in science & engineering, %.....             | 34.7    | 5    |
| 2.2.3 Tertiary inbound mobility, %.....                      | 10.7    | 16   |
| 2.3 Research & development (R&D).....                        | 34.6    | 33   |
| 2.3.1 Researchers, FTE/mn pop.Ⓔ.....                         | 3,297.6 | 26   |
| 2.3.2 Gross expenditure on R&D, % GDPⒺ.....                  | 0.7     | 47   |
| 2.3.3 Global R&D companies, avg. expend. top 3, mn \$US..... | 0.0     | 43 ○ |
| 2.3.4 QS university ranking, average score top 3*.....       | 81.8    | 6    |

## 3 Infrastructure.....68.4 4

|  |         |     |
|--|---------|-----|
| 3.1 Information & communication technologies (ICTs).....     | 85.5    | 10  |
| 3.1.1 ICT access*.....                                       | 91.6    | 4   |
| 3.1.2 ICT use*.....  | 79.4    | 12  |
| 3.1.3 Government's online service*.....                      | n/a     | n/a |
| 3.1.4 E-participation*.....                                  | n/a     | n/a |
| 3.2 General infrastructure.....                              | 49.2    | 29  |
| 3.2.1 Electricity output, kWh/cap.....                       | 5,511.3 | 36  |
| 3.2.2 Logistics performance*.....                            | 92.7    | 9   |
| 3.2.3 Gross capital formation, % GDP.....                    | 22.1    | 64  |
| 3.3 Ecological sustainability.....                           | 70.5    | 1 ● |
| 3.3.1 GDP/unit of energy use.....                            | 26.3    | 1 ● |
| 3.3.2 Environmental performance*.....                        | n/a     | n/a |
| 3.3.3 ISO 14001 environmental certificates/bn PPP\$ GDP..... | 1.7     | 53  |

## 4 Market sophistication.....74.8 2 ●

|   |       |     |
|---|-------|-----|
| 4.1 Credit.....                                     | 79.4  | 3 ● |
| 4.1.1 Ease of getting credit*.....                  | 75.0  | 19  |
| 4.1.2 Domestic credit to private sector, % GDP..... | 208.0 | 2 ● |
| 4.1.3 Microfinance gross loans, % GDP.....          | n/a   | n/a |

|   |         |     |
|---|---------|-----|
| 4.2 Investment.....                               | 68.1    | 8   |
| 4.2.1 Ease of protecting minority investors*..... | 80.0    | 3 ● |
| 4.2.2 Market capitalization, % GDP.....           | 1,029.9 | 1 ● |
| 4.2.3 Venture capital deals/bn PPP\$ GDP.....     | 0.0     | 34  |
| 4.3 Trade, competition, & market scale.....       | 76.8    | 17  |
| 4.3.1 Applied tariff rate, weighted mean, %.....  | 0.0     | 1 ● |
| 4.3.2 Intensity of local competition†.....        | 86.0    | 2 ● |
| 4.3.3 Domestic market scale, bn PPP\$.....        | 427.4   | 42  |

## 5 Business sophistication.....51.1 16

|   |      |       |
|---|------|-------|
| 5.1 Knowledge workers.....                                  | 48.6 | 35    |
| 5.1.1 Knowledge-intensive employment, %.....                | 38.6 | 27    |
| 5.1.2 Firms offering formal training, % firms.....          | n/a  | n/a   |
| 5.1.3 GERD performed by business, % of GDPⒺ.....            | 0.3  | 44    |
| 5.1.4 GERD financed by business, %Ⓔ.....                    | 46.4 | 25    |
| 5.1.5 Females employed w/advanced degrees, % total.....     | 13.4 | 46    |
| 5.2 Innovation linkages.....                                | 47.3 | 13    |
| 5.2.1 University/industry research collaboration†Ⓔ.....     | 59.8 | 21    |
| 5.2.2 State of cluster development†.....                    | 67.3 | 14    |
| 5.2.3 GERD financed by abroad, %Ⓔ.....                      | 7.0  | 56 ○  |
| 5.2.4 JV-strategic alliance deals/bn PPP\$ GDP.....         | 0.3  | 1 ●   |
| 5.2.5 Patent families 2+ offices/bn PPP\$ GDP.....          | 1.3  | 26    |
| 5.3 Knowledge absorption.....                               | 57.4 | 3 ●   |
| 5.3.1 Intellectual property payments, % total tradeⒺ.....   | 0.3  | 74 ○  |
| 5.3.2 High-tech imports less re-imports, % total trade..... | 46.1 | 1     |
| 5.3.3 ICT services imports, % total tradeⒺ.....             | 0.3  | 111 ○ |
| 5.3.4 FDI net inflows, % GDP.....                           | 43.6 | 1 ●   |
| 5.3.5 Research talent, % in business enterpriseⒺ.....       | 40.9 | 32    |

## 6 Knowledge & technology outputs.....36.2 25

|   |      |      |
|---|------|------|
| 6.1 Knowledge creation.....                             | 20.9 | 43   |
| 6.1.1 Patents by origin/bn PPP\$ GDP.....               | 0.6  | 73 ○ |
| 6.1.2 PCT patent applications/bn PPP\$ GDP.....         | n/a  | n/a  |
| 6.1.3 Utility models by origin/bn PPP\$ GDP.....        | 1.1  | 24   |
| 6.1.4 Scientific & technical articles/bn PPP\$ GDP..... | n/a  | n/a  |
| 6.1.5 Citable documents H index.....                    | 33.9 | 25   |
| 6.2 Knowledge impact.....                               | 46.0 | 15   |
| 6.2.1 Growth rate of PPP\$ GDP/worker, %.....           | 1.0  | 55   |
| 6.2.2 New businesses/th pop. 15–64.....                 | 31.3 | 1 ●  |
| 6.2.3 Computer software spending, % GDP.....            | 0.4  | 28   |
| 6.2.4 ISO 9001 quality certificates/bn PPP\$ GDP.....   | 6.1  | 56   |
| 6.2.5 High- & medium-high-tech manufactures, %.....     | 0.2  | 53   |

|   |      |       |
|---|------|-------|
| 6.3 Knowledge diffusion.....                                | 41.8 | 16    |
| 6.3.1 Intellectual property receipts, % total tradeⒺ.....   | 0.1  | 54    |
| 6.3.2 High-tech exports less re-exports, % total trade..... | 0.1  | 113 ○ |
| 6.3.3 ICT services exports, % total tradeⒺ.....             | 0.5  | 101 ○ |
| 6.3.4 FDI net outflows, % GDP.....                          | 32.8 | 1 ●   |

## 7 Creative outputs.....45.4 25

|  |      |      |
|--|------|------|
| 7.1 Intangible assets.....   | 53.1 | 28   |
| 7.1.1 Trademarks by origin/bn PPP\$ GDP.....                       | 69.5 | 26   |
| 7.1.2 Industrial designs by origin/bn PPP\$ GDP.....               | 3.2  | 35   |
| 7.1.3 ICTs & business model creation†.....                         | 70.7 | 31   |
| 7.1.4 ICTs & organizational model creation†.....                   | 71.2 | 21   |
| 7.2 Creative goods & services.....                                 | 22.7 | 50   |
| 7.2.1 Cultural & creative services exports, % of total tradeⒺ..... | 0.2  | 49 ○ |
| 7.2.2 National feature films/mn pop. 15–69.....                    | 10.4 | 14   |
| 7.2.3 Global ent. & media market/th pop. 15–69.....                | 56.2 | 13   |
| 7.2.4 Printing & publishing manufactures, %.....                   | n/a  | n/a  |
| 7.2.5 Creative goods exports, % total trade.....                   | 0.2  | 79 ○ |

|   |      |    |
|---|------|----|
| 7.3 Online creativity.....                                | 52.7 | 15 |
| 7.3.1 Generic top-level domains (TLDs)/th pop. 15–69..... | 70.8 | 7  |
| 7.3.2 Country-code TLDs/th pop. 15–69.....                | 17.5 | 30 |
| 7.3.3 Wikipedia edits/mn pop. 15–69.....                  | 7.0  | 9  |
| 7.3.4 Video uploads on YouTube/pop. 15–69.....            | 54.6 | 14 |

NOTES: ● indicates a strength; ○ a weakness; \* an index; † a survey question.

Ⓔ indicates that the country's data are older than the base year; see Appendix II for details, including the year of the data, at <http://globalinnovationindex.org>.

Square brackets indicate that the data minimum coverage (DMC) requirements were not met at the sub-pillar or pillar level; see page 181 of this appendix for details.

## Hungary

## Key indicators

|                            |             |
|----------------------------|-------------|
| Population (millions)..... | 9.8         |
| GDP (US\$ billions).....   | 117.1       |
| GDP per capita, PPP\$..... | 26,222.0    |
| Income group.....          | High income |
| Region.....                | Europe      |

|  | Score 0–100<br>or value (hard data) | Rank      |
|--|-------------------------------------|-----------|
| <b>Global Innovation Index (out of 127).....</b> | <b>41.7</b>                         | <b>39</b> |
| Innovation Output Sub-Index.....                 | 35.1                                | 37        |
| Innovation Input Sub-Index.....                  | 48.4                                | 41        |
| Innovation Efficiency Ratio.....                 | 0.7                                 | 30        |
| Global Innovation Index 2016 (out of 128).....   | 44.7                                | 33        |

**1 Institutions..... 70.7 40**

|   |      |    |
|---|------|----|
| 1.1 Political environment.....                        | 68.2 | 40 |
| 1.1.1 Political stability & safety*.....              | 81.6 | 29 |
| 1.1.2 Government effectiveness*.....                  | 54.8 | 45 |
| 1.2 Regulatory environment.....                       | 72.9 | 38 |
| 1.2.1 Regulatory quality*.....                        | 61.8 | 41 |
| 1.2.2 Rule of law*.....                               | 51.2 | 47 |
| 1.2.3 Cost of redundancy dismissal, salary weeks..... | 13.4 | 52 |
| 1.3 Business environment.....                         | 71.0 | 63 |
| 1.3.1 Ease of starting a business*.....               | 87.3 | 62 |
| 1.3.2 Ease of resolving insolvency*.....              | 51.3 | 58 |
| 1.3.3 Ease of paying taxes*.....                      | 74.5 | 62 |

**2 Human capital & research..... 39.5 42**

|  |         |    |
|--|---------|----|
| 2.1 Education.....   | 49.2    | 57 |
| 2.1.1 Expenditure on education, % GDP.....                     | 4.2     | 73 |
| 2.1.2 Gov't expenditure/pupil, secondary, % GDP/cap.....       | 16.2    | 72 |
| 2.1.3 School life expectancy, years.....                       | 15.4    | 38 |
| 2.1.4 PISA scales in reading, maths, & science.....            | 474.4   | 36 |
| 2.1.5 Pupil-teacher ratio, secondary.....                      | 10.3    | 27 |
| 2.2 Tertiary education.....                                    | 35.7    | 64 |
| 2.2.1 Tertiary enrolment, % gross.....                         | 50.9    | 52 |
| 2.2.2 Graduates in science & engineering, % <sup>Ⓢ</sup> ..... | 16.8    | 72 |
| 2.2.3 Tertiary inbound mobility, %.....                        | 7.1     | 28 |
| 2.3 Research & development (R&D).....                          | 33.7    | 34 |
| 2.3.1 Researchers, FTE/mn pop.....                             | 2,568.8 | 33 |
| 2.3.2 Gross expenditure on R&D, % GDP.....                     | 1.4     | 25 |
| 2.3.3 Global R&D companies, avg. expend. top 3, mn \$US.....   | 51.0    | 30 |
| 2.3.4 QS university ranking, average score top 3*.....         | 20.8    | 49 |

**3 Infrastructure..... 52.3 46**

|  |         |      |
|--|---------|------|
| 3.1 Information & communication technologies (ICTs).....     | 60.3    | 60   |
| 3.1.1 ICT access*.....                                       | 76.2    | 35   |
| 3.1.2 ICT use*.....  | 52.8    | 55   |
| 3.1.3 Government's online service*.....                      | 63.0    | 57   |
| 3.1.4 E-participation*.....                                  | 49.2    | 89 ○ |
| 3.2 General infrastructure.....                              | 38.4    | 57   |
| 3.2.1 Electricity output, kWh/cap.....                       | 3,062.0 | 62   |
| 3.2.2 Logistics performance*.....                            | 63.2    | 30   |
| 3.2.3 Gross capital formation, % GDP.....                    | 21.0    | 75   |
| 3.3 Ecological sustainability.....                           | 58.2    | 22   |
| 3.3.1 GDP/unit of energy use.....                            | 9.8     | 53   |
| 3.3.2 Environmental performance*.....                        | 84.6    | 28   |
| 3.3.3 ISO 14001 environmental certificates/bn PPP\$ GDP..... | 7.5     | 14 ● |

**4 Market sophistication..... 41.5 91**

|  |      |      |
|--|------|------|
| 4.1 Credit.....  | 29.5 | 80   |
| 4.1.1 Ease of getting credit*.....                       | 75.0 | 19   |
| 4.1.2 Domestic credit to private sector, % GDP.....      | 36.1 | 89   |
| 4.1.3 Microfinance gross loans, % GDP <sup>Ⓢ</sup> ..... | 0.0  | 79 ○ |

|   |       |       |
|---|-------|-------|
| 4.2 Investment.....                                     | 31.1  | 105 ○ |
| 4.2.1 Ease of protecting minority investors*.....       | 55.0  | 75    |
| 4.2.2 Market capitalization, % GDP.....                 | 14.5  | 68 ○  |
| 4.2.3 Venture capital deals/bn PPP\$ GDP.....           | 0.0   | 45    |
| 4.3 Trade, competition, & market scale.....             | 63.8  | 53    |
| 4.3.1 Applied tariff rate, weighted mean, %.....        | 1.6   | 23    |
| 4.3.2 Intensity of local competition <sup>†</sup> ..... | 52.7  | 120 ○ |
| 4.3.3 Domestic market scale, bn PPP\$.....              | 267.6 | 55    |

**5 Business sophistication..... 37.8 40**

|   |      |      |
|---|------|------|
| 5.1 Knowledge workers.....  | 41.5 | 53   |
| 5.1.1 Knowledge-intensive employment, %.....                        | 34.9 | 39   |
| 5.1.2 Firms offering formal training, % firms.....                  | 15.8 | 85 ○ |
| 5.1.3 GERD performed by business, % of GDP.....                     | 1.0  | 23   |
| 5.1.4 GERD financed by business, %.....                             | 49.7 | 20   |
| 5.1.5 Females employed w/advanced degrees, % total.....             | 15.2 | 41   |
| 5.2 Innovation linkages.....  | 24.7 | 76   |
| 5.2.1 University/industry research collaboration <sup>†</sup> ..... | 32.0 | 99 ○ |
| 5.2.2 State of cluster development <sup>†</sup> .....               | 39.3 | 87   |
| 5.2.3 GERD financed by abroad, %.....                               | 15.0 | 31   |
| 5.2.4 JV-strategic alliance deals/bn PPP\$ GDP.....                 | 0.0  | 63   |
| 5.2.5 Patent families 2+ offices/bn PPP\$ GDP.....                  | 0.5  | 38   |
| 5.3 Knowledge absorption.....                                       | 47.2 | 18 ● |
| 5.3.1 Intellectual property payments, % total trade.....            | 1.3  | 22   |
| 5.3.2 High-tech imports less re-imports, % total trade.....         | 13.8 | 16 ● |
| 5.3.3 ICT services imports, % total trade.....                      | 1.3  | 51   |
| 5.3.4 FDI net inflows, % GDP.....                                   | 1.4  | 99 ○ |
| 5.3.5 Research talent, % in business enterprise.....                | 59.4 | 12 ● |

**6 Knowledge & technology outputs..... 32.3 33**

|   |       |       |
|---|-------|-------|
| 6.1 Knowledge creation.....                                 | 20.4  | 46    |
| 6.1.1 Patents by origin/bn PPP\$ GDP.....                   | 2.6   | 40    |
| 6.1.2 PCT patent applications/bn PPP\$ GDP.....             | 0.7   | 30    |
| 6.1.3 Utility models by origin/bn PPP\$ GDP.....            | 0.8   | 28    |
| 6.1.4 Scientific & technical articles/bn PPP\$ GDP.....     | 25.3  | 31    |
| 6.1.5 Citable documents H index.....                        | 28.0  | 31    |
| 6.2 Knowledge impact.....                                   | 43.0  | 22    |
| 6.2.1 Growth rate of PPP\$ GDP/worker, %.....               | 0.1   | 84 ○  |
| 6.2.2 New businesses/th pop. 15–64.....                     | 3.7   | 33    |
| 6.2.3 Computer software spending, % GDP.....                | 0.3   | 42    |
| 6.2.4 ISO 9001 quality certificates/bn PPP\$ GDP.....       | 22.4  | 16 ●  |
| 6.2.5 High- & medium-high-tech manufactures, %.....         | 0.6   | 3 ●   |
| 6.3 Knowledge diffusion.....                                | 33.6  | 33    |
| 6.3.1 Intellectual property receipts, % total trade.....    | 1.4   | 13 ●  |
| 6.3.2 High-tech exports less re-exports, % total trade..... | 13.9  | 14 ●  |
| 6.3.3 ICT services exports, % total trade.....              | 1.7   | 58    |
| 6.3.4 FDI net outflows, % GDP.....                          | (0.0) | 114 ○ |

**7 Creative outputs..... 37.9 42**

|   |      |      |
|---|------|------|
| 7.1 Intangible assets.....  | 41.4 | 67   |
| 7.1.1 Trademarks by origin/bn PPP\$ GDP.....                                    | 35.8 | 63   |
| 7.1.2 Industrial designs by origin/bn PPP\$ GDP.....                            | 3.3  | 34   |
| 7.1.3 ICTs & business model creation <sup>†</sup> .....                         | 63.8 | 49   |
| 7.1.4 ICTs & organizational model creation <sup>†</sup> .....                   | 54.5 | 59   |
| 7.2 Creative goods & services.....  | 32.9 | 25   |
| 7.2.1 Cultural & creative services exports, % of total trade <sup>Ⓢ</sup> ..... | 0.6  | 25   |
| 7.2.2 National feature films/mn pop. 15–69.....                                 | 5.7  | 34   |
| 7.2.3 Global ent. & media market/th pop. 15–69.....                             | 12.6 | 30   |
| 7.2.4 Printing & publishing manufactures, %.....                                | 0.8  | 73 ○ |
| 7.2.5 Creative goods exports, % total trade.....                                | 5.9  | 8 ●  |
| 7.3 Online creativity.....  | 35.9 | 31   |
| 7.3.1 Generic top-level domains (TLDs)/th pop. 15–69.....                       | 10.3 | 39   |
| 7.3.2 Country-code TLDs/th pop. 15–69.....                                      | 29.1 | 20 ● |
| 7.3.3 Wikipedia edits/mn pop. 15–69.....  | 6.8  | 16 ● |
| 7.3.4 Video uploads on YouTube/pop. 15–69.....                                  | 38.9 | 33   |

NOTES: ● indicates a strength; ○ a weakness; \* an index; † a survey question.

Ⓢ indicates that the country's data are older than the base year; see Appendix II for details, including the year of the data, at <http://globalinnovationindex.org>.

Square brackets indicate that the data minimum coverage (DMC) requirements were not met at the sub-pillar or pillar level; see page 181 of this appendix for details.

## Key indicators

|                            |             |
|----------------------------|-------------|
| Population (millions)..... | 0.3         |
| GDP (US\$ billions).....   | 19.4        |
| GDP per capita, PPP\$..... | 46,097.0    |
| Income group.....          | High income |
| Region.....                | Europe      |

|  | Score 0–100<br>or value (hard data) | Rank      |
|--|-------------------------------------|-----------|
| <b>Global Innovation Index (out of 127).....</b> | <b>55.8</b>                         | <b>13</b> |
| Innovation Output Sub-Index.....                 | 51.4                                | 10        |
| Innovation Input Sub-Index.....                  | 60.1                                | 21        |
| Innovation Efficiency Ratio.....                 | 0.9                                 | 5 ●       |
| Global Innovation Index 2016 (out of 128).....   | 56.0                                | 13        |

**1 Institutions.....86.6 16**

|   |      |     |
|---|------|-----|
| 1.1 Political environment.....                        | 87.6 | 12  |
| 1.1.1 Political stability & safety*.....              | 94.6 | 4 ● |
| 1.1.2 Government effectiveness*.....                  | 80.7 | 18  |
| 1.2 Regulatory environment.....                       | 85.8 | 19  |
| 1.2.1 Regulatory quality*.....                        | 74.6 | 23  |
| 1.2.2 Rule of law*.....                               | 88.4 | 17  |
| 1.2.3 Cost of redundancy dismissal, salary weeks..... | 13.0 | 46  |
| 1.3 Business environment.....                         | 86.4 | 18  |
| 1.3.1 Ease of starting a business*.....               | 92.6 | 31  |
| 1.3.2 Ease of resolving insolvency*.....              | 81.7 | 13  |
| 1.3.3 Ease of paying taxes*.....                      | 84.9 | 27  |

**2 Human capital & research.....49.0 26**

|  |         |      |
|--|---------|------|
| 2.1 Education.....   | 64.7    | 11   |
| 2.1.1 Expenditure on education, % GDP.....                     | 7.8     | 6    |
| 2.1.2 Gov't expenditure/pupil, secondary, % GDP/cap.....       | 18.3    | 59   |
| 2.1.3 School life expectancy, years <sup>Ⓐ</sup> .....         | 19.6    | 3 ●  |
| 2.1.4 PISA scales in reading, maths, & science.....            | 480.9   | 33   |
| 2.1.5 Pupil-teacher ratio, secondary.....                      | n/a     | n/a  |
| 2.2 Tertiary education.....                                    | 40.4    | 46   |
| 2.2.1 Tertiary enrolment, % gross <sup>Ⓐ</sup> .....           | 81.3    | 15   |
| 2.2.2 Graduates in science & engineering, % <sup>Ⓐ</sup> ..... | 15.6    | 81 ○ |
| 2.2.3 Tertiary inbound mobility, % <sup>Ⓐ</sup> .....          | 6.5     | 30   |
| 2.3 Research & development (R&D).....                          | 41.8    | 24   |
| 2.3.1 Researchers, FTE/mn pop.....                             | 5,902.5 | 8    |
| 2.3.2 Gross expenditure on R&D, % GDP.....                     | 2.2     | 13   |
| 2.3.3 Global R&D companies, avg. expend. top 3, mn \$US.....   | 44.2    | 34   |
| 2.3.4 QS university ranking, average score top 3*.....         | 0.0     | 75 ○ |

**3 Infrastructure.....59.9 25**

|  |          |       |
|--|----------|-------|
| 3.1 Information & communication technologies (ICTs).....     | 76.8     | 26    |
| 3.1.1 ICT access*.....                                       | 94.2     | 2 ●   |
| 3.1.2 ICT use*.....  | 84.4     | 5 ●   |
| 3.1.3 Government's online service*.....                      | 62.3     | 60    |
| 3.1.4 E-participation*.....                                  | 66.1     | 49    |
| 3.2 General infrastructure.....                              | 59.2     | 9     |
| 3.2.1 Electricity output, kWh/cap.....                       | 56,966.7 | 1 ●   |
| 3.2.2 Logistics performance*.....                            | 59.3     | 38    |
| 3.2.3 Gross capital formation, % GDP.....                    | 20.5     | 77 ○  |
| 3.3 Ecological sustainability.....                           | 43.8     | 66    |
| 3.3.1 GDP/unit of energy use.....                            | 2.4      | 116 ○ |
| 3.3.2 Environmental performance*.....                        | 90.5     | 2 ●   |
| 3.3.3 ISO 14001 environmental certificates/bn PPP\$ GDP..... | 3.7      | 27    |

**4 Market sophistication.....55.2 24**

|   |      |     |
|---|------|-----|
| 4.1 Credit.....                                     | 48.2 | 32  |
| 4.1.1 Ease of getting credit*.....                  | 60.0 | 55  |
| 4.1.2 Domestic credit to private sector, % GDP..... | 92.1 | 32  |
| 4.1.3 Microfinance gross loans, % GDP.....          | n/a  | n/a |

|   |      |       |
|---|------|-------|
| 4.2 Investment.....                                     | 66.3 | 12    |
| 4.2.1 Ease of protecting minority investors*.....       | 70.0 | 22    |
| 4.2.2 Market capitalization, % GDP.....                 | n/a  | n/a   |
| 4.2.3 Venture capital deals/bn PPP\$ GDP.....           | 0.2  | 9     |
| 4.3 Trade, competition, & market scale.....             | 51.0 | 102 ○ |
| 4.3.1 Applied tariff rate, weighted mean, %.....        | 0.8  | 9     |
| 4.3.2 Intensity of local competition <sup>†</sup> ..... | 64.0 | 82 ○  |
| 4.3.3 Domestic market scale, bn PPP\$.....              | 16.1 | 123 ○ |

**5 Business sophistication.....49.8 20**

|   |      |      |
|---|------|------|
| 5.1 Knowledge workers.....  | 63.3 | 16   |
| 5.1.1 Knowledge-intensive employment, %.....                        | 47.8 | 7    |
| 5.1.2 Firms offering formal training, % firms.....                  | n/a  | n/a  |
| 5.1.3 GERD performed by business, % of GDP.....                     | 1.4  | 15   |
| 5.1.4 GERD financed by business, %.....                             | 33.3 | 45   |
| 5.1.5 Females employed w/advanced degrees, % total.....             | 22.7 | 15   |
| 5.2 Innovation linkages.....  | 45.6 | 18   |
| 5.2.1 University/industry research collaboration <sup>†</sup> ..... | 63.1 | 16   |
| 5.2.2 State of cluster development <sup>†</sup> .....               | 51.5 | 41   |
| 5.2.3 GERD financed by abroad, %.....                               | 26.4 | 16   |
| 5.2.4 JV-strategic alliance deals/bn PPP\$ GDP.....                 | 0.0  | 48   |
| 5.2.5 Patent families 2+ offices/bn PPP\$ GDP.....                  | 5.1  | 12   |
| 5.3 Knowledge absorption.....                                       | 40.4 | 32   |
| 5.3.1 Intellectual property payments, % total trade.....            | 1.2  | 26   |
| 5.3.2 High-tech imports less re-imports, % total trade.....         | 6.8  | 80 ○ |
| 5.3.3 ICT services imports, % total trade.....                      | 2.1  | 21   |
| 5.3.4 FDI net inflows, % GDP.....                                   | 4.6  | 31   |
| 5.3.5 Research talent, % in business enterprise.....                | 41.8 | 31   |

**6 Knowledge & technology outputs.....39.9 18**

|   |      |      |
|---|------|------|
| 6.1 Knowledge creation.....                                 | 48.5 | 13   |
| 6.1.1 Patents by origin/bn PPP\$ GDP.....                   | 5.6  | 22   |
| 6.1.2 PCT patent applications/bn PPP\$ GDP.....             | 3.5  | 12   |
| 6.1.3 Utility models by origin/bn PPP\$ GDP.....            | n/a  | n/a  |
| 6.1.4 Scientific & technical articles/bn PPP\$ GDP.....     | 71.1 | 1 ●  |
| 6.1.5 Citable documents H index.....                        | 17.7 | 39   |
| 6.2 Knowledge impact.....                                   | 31.1 | 64   |
| 6.2.1 Growth rate of PPP\$ GDP/worker, %.....               | 0.2  | 81 ○ |
| 6.2.2 New businesses/th pop. 15–64.....                     | 9.5  | 12   |
| 6.2.3 Computer software spending, % GDP.....                | 0.3  | 32   |
| 6.2.4 ISO 9001 quality certificates/bn PPP\$ GDP.....       | 4.9  | 62   |
| 6.2.5 High- & medium-high-tech manufactures, %.....         | 0.1  | 90 ○ |
| 6.3 Knowledge diffusion.....                                | 40.1 | 21   |
| 6.3.1 Intellectual property receipts, % total trade.....    | 2.8  | 7    |
| 6.3.2 High-tech exports less re-exports, % total trade..... | 1.3  | 65   |
| 6.3.3 ICT services exports, % total trade.....              | 2.8  | 38   |
| 6.3.4 FDI net outflows, % GDP.....                          | 2.0  | 31   |

**7 Creative outputs.....62.9 2 ●**

|   |       |      |
|---|-------|------|
| 7.1 Intangible assets.....  | 58.3  | 19   |
| 7.1.1 Trademarks by origin/bn PPP\$ GDP.....                      | 87.7  | 17   |
| 7.1.2 Industrial designs by origin/bn PPP\$ GDP.....              | 1.1   | 59   |
| 7.1.3 ICTs & business model creation <sup>†</sup> .....           | 78.6  | 14   |
| 7.1.4 ICTs & organizational model creation <sup>†</sup> .....     | 77.8  | 8    |
| 7.2 Creative goods & services.....                                | 53.7  | 1 ●  |
| 7.2.1 Cultural & creative services exports, % of total trade..... | 0.3   | 36   |
| 7.2.2 National feature films/mn pop. 15–69.....                   | 55.9  | 1 ●  |
| 7.2.3 Global ent. & media market/th pop. 15–69.....               | n/a   | n/a  |
| 7.2.4 Printing & publishing manufactures, %.....                  | 6.4   | 1 ●  |
| 7.2.5 Creative goods exports, % total trade.....                  | 0.1   | 95 ○ |
| 7.3 Online creativity.....  | 81.4  | 1 ●  |
| 7.3.1 Generic top-level domains (TLDs)/th pop. 15–69.....         | 100.0 | 1 ●  |
| 7.3.2 Country-code TLDs/th pop. 15–69.....                        | 77.0  | 6    |
| 7.3.3 Wikipedia edits/mn pop. 15–69 <sup>Ⓐ</sup> .....            | 7.0   | 11   |
| 7.3.4 Video uploads on YouTube/pop. 15–69.....                    | n/a   | n/a  |

NOTES: ● indicates a strength; ○ a weakness; \* an index; † a survey question.

Ⓐ indicates that the country's data are older than the base year; see Appendix II for details, including the year of the data, at <http://globalinnovationindex.org>.

Square brackets indicate that the data minimum coverage (DMC) requirements were not met at the sub-pillar or pillar level; see page 181 of this appendix for details.

## India

## Key indicators

|                       |                           |
|-----------------------|---------------------------|
| Population (millions) | 1,326.8                   |
| GDP (US\$ billions)   | 2,251.0                   |
| GDP per capita, PPP\$ | 6,161.6                   |
| Income group          | Lower-middle income       |
| Region                | Central and Southern Asia |

|   | Score 0–100<br>or value (hard data) | Rank      |
|---|-------------------------------------|-----------|
| <b>Global Innovation Index (out of 127)</b> | <b>35.5</b>                         | <b>60</b> |
| Innovation Output Sub-Index                 | 28.1                                | 58        |
| Innovation Input Sub-Index                  | 42.8                                | 66        |
| Innovation Efficiency Ratio                 | 0.7                                 | 53        |
| Global Innovation Index 2016 (out of 128)   | 33.6                                | 66        |

|          |   |             |           |
|----------|---|-------------|-----------|
| <b>1</b> | <b>Institutions</b>                                   | <b>51.4</b> | <b>92</b> |
| 1.1      | Political environment                                 | 43.1        | 87        |
| 1.1.1    | Political stability & safety*                         | 41.5        | 106       |
| 1.1.2    | Government effectiveness*                             | 44.7        | 66        |
| 1.2      | Regulatory environment                                | 59.8        | 73        |
| 1.2.1    | Regulatory quality*                                   | 32.1        | 93        |
| 1.2.2    | Rule of law*  | 37.8        | 61        |
| 1.2.3    | Cost of redundancy dismissal, salary weeks            | 15.8        | 64        |
| 1.3      | Business environment                                  | 51.2        | 121 ○     |
| 1.3.1    | Ease of starting a business*                          | 74.3        | 114 ○     |
| 1.3.2    | Ease of resolving insolvency*                         | 32.8        | 111 ○     |
| 1.3.3    | Ease of paying taxes*                                 | 46.6        | 118 ○     |
| <b>2</b> | <b>Human capital &amp; research</b>                   | <b>32.3</b> | <b>64</b> |
| 2.1      | Education   | 26.7        | 114 ○     |
| 2.1.1    | Expenditure on education, % GDP                       | 3.8         | 84        |
| 2.1.2    | Gov't expenditure/pupil, secondary, % GDP/cap         | 16.8        | 67        |
| 2.1.3    | School life expectancy, years                         | 11.9        | 89        |
| 2.1.4    | PISA scales in reading, maths, & science <sup>Ⓢ</sup> | 336.0       | 71 ○      |
| 2.1.5    | Pupil-teacher ratio, secondary <sup>Ⓢ</sup>           | 31.8        | 104 ○     |
| 2.2      | Tertiary education                                    | 34.3        | 68        |
| 2.2.1    | Tertiary enrolment, % gross <sup>Ⓢ</sup>              | 25.5        | 88        |
| 2.2.2    | Graduates in science & engineering, %                 | 29.1        | 10 ●      |
| 2.2.3    | Tertiary inbound mobility, % <sup>Ⓢ</sup>             | 0.1         | 102 ○     |
| 2.3      | Research & development (R&D)                          | 35.9        | 32        |
| 2.3.1    | Researchers, FTE/mn pop. <sup>Ⓢ</sup>                 | 156.6       | 81        |
| 2.3.2    | Gross expenditure on R&D, % GDP <sup>Ⓢ</sup>          | 0.8         | 43        |
| 2.3.3    | Global R&D companies, avg. expend. top 3, mn \$US     | 74.0        | 14 ●      |
| 2.3.4    | QS university ranking, average score top 3*           | 49.0        | 21 ●      |
| <b>3</b> | <b>Infrastructure</b>                                 | <b>44.1</b> | <b>73</b> |
| 3.1      | Information & communication technologies (ICTs)       | 49.2        | 80        |
| 3.1.1    | ICT access*   | 33.2        | 106       |
| 3.1.2    | ICT use*  | 12.5        | 109       |
| 3.1.3    | Government's online service*                          | 74.6        | 33        |
| 3.1.4    | E-participation*                                      | 76.3        | 27        |
| 3.2      | General infrastructure                                | 48.5        | 32        |
| 3.2.1    | Electricity output, kWh/cap                           | 993.9       | 94        |
| 3.2.2    | Logistics performance*                                | 62.7        | 34        |
| 3.2.3    | Gross capital formation, % GDP                        | 31.7        | 12 ●      |
| 3.3      | Ecological sustainability                             | 34.6        | 103       |
| 3.3.1    | GDP/unit of energy use                                | 8.4         | 65        |
| 3.3.2    | Environmental performance*                            | 53.6        | 108 ○     |
| 3.3.3    | ISO 14001 environmental certificates/bn PPP\$ GDP     | 0.8         | 69        |
| <b>4</b> | <b>Market sophistication</b>                          | <b>51.9</b> | <b>39</b> |
| 4.1      | Credit  | 31.7        | 74        |
| 4.1.1    | Ease of getting credit*                               | 65.0        | 40        |
| 4.1.2    | Domestic credit to private sector, % GDP              | 52.6        | 67        |
| 4.1.3    | Microfinance gross loans, % GDP                       | 0.6         | 34        |

|          |   |             |           |
|----------|---|-------------|-----------|
| 4.2      | Investment  | 46.9        | 36        |
| 4.2.1    | Ease of protecting minority investors*                  | 73.3        | 13 ●      |
| 4.2.2    | Market capitalization, % GDP                            | 72.4        | 22        |
| 4.2.3    | Venture capital deals/bn PPP\$ GDP                      | 0.0         | 40        |
| 4.3      | Trade, competition, & market scale                      | 77.0        | 16 ●      |
| 4.3.1    | Applied tariff rate, weighted mean, % <sup>Ⓢ</sup>      | 6.3         | 100       |
| 4.3.2    | Intensity of local competition <sup>†</sup>             | 62.5        | 91        |
| 4.3.3    | Domestic market scale, bn PPP\$                         | 8,720.5     | 3 ●       |
| <b>5</b> | <b>Business sophistication</b>                          | <b>34.6</b> | <b>55</b> |
| 5.1      | Knowledge workers                                       | 31.3        | [83]      |
| 5.1.1    | Knowledge-intensive employment, %                       | n/a         | n/a       |
| 5.1.2    | Firms offering formal training, % firms                 | 35.9        | 36        |
| 5.1.3    | GERD performed by business, % of GDP <sup>Ⓢ</sup>       | 0.3         | 46        |
| 5.1.4    | GERD financed by business, %                            | n/a         | n/a       |
| 5.1.5    | Females employed w/advanced degrees, % total            | n/a         | n/a       |
| 5.2      | Innovation linkages                                     | 37.8        | 37        |
| 5.2.1    | University/industry research collaboration <sup>†</sup> | 58.9        | 23        |
| 5.2.2    | State of cluster development <sup>†</sup>               | 58.7        | 26        |
| 5.2.3    | GERD financed by abroad, %                              | n/a         | n/a       |
| 5.2.4    | JV-strategic alliance deals/bn PPP\$ GDP                | 0.0         | 49        |
| 5.2.5    | Patent families 2+ offices/bn PPP\$ GDP                 | 0.3         | 43        |
| 5.3      | Knowledge absorption                                    | 34.7        | 55        |
| 5.3.1    | Intellectual property payments, % total trade           | 1.1         | 29        |
| 5.3.2    | High-tech imports less re-imports, % total trade        | 9.2         | 52        |
| 5.3.3    | ICT services imports, % total trade                     | 0.8         | 78        |
| 5.3.4    | FDI net inflows, % GDP                                  | 1.8         | 87        |
| 5.3.5    | Research talent, % in business enterprise <sup>Ⓢ</sup>  | 38.7        | 33        |
| <b>6</b> | <b>Knowledge &amp; technology outputs</b>               | <b>30.3</b> | <b>38</b> |
| 6.1      | Knowledge creation                                      | 14.2        | 55        |
| 6.1.1    | Patents by origin/bn PPP\$ GDP                          | 1.6         | 53        |
| 6.1.2    | PCT patent applications/bn PPP\$ GDP                    | 0.2         | 54        |
| 6.1.3    | Utility models by origin/bn PPP\$ GDP                   | n/a         | n/a       |
| 6.1.4    | Scientific & technical articles/bn PPP\$ GDP            | 6.9         | 79        |
| 6.1.5    | Citable documents H index                               | 37.1        | 21 ●      |
| 6.2      | Knowledge impact  | 40.5        | 30        |
| 6.2.1    | Growth rate of PPP\$ GDP/worker, %                      | 5.2         | 5 ●       |
| 6.2.2    | New businesses/th pop. 15–64                            | 0.1         | 100 ○     |
| 6.2.3    | Computer software spending, % GDP                       | 0.2         | 66        |
| 6.2.4    | ISO 9001 quality certificates/bn PPP\$ GDP              | 4.5         | 65        |
| 6.2.5    | High- & medium-high-tech manufactures, %                | 0.3         | 40        |
| 6.3      | Knowledge diffusion                                     | 36.2        | 26        |
| 6.3.1    | Intellectual property receipts, % total trade           | 0.1         | 53        |
| 6.3.2    | High-tech exports less re-exports, % total trade        | 3.2         | 45        |
| 6.3.3    | ICT services exports, % total trade                     | 12.6        | 1 ●       |
| 6.3.4    | FDI net outflows, % GDP                                 | 0.3         | 76        |
| <b>7</b> | <b>Creative outputs</b>                                 | <b>25.9</b> | <b>85</b> |
| 7.1      | Intangible assets                                       | 39.0        | 78        |
| 7.1.1    | Trademarks by origin/bn PPP\$ GDP                       | 31.3        | 71        |
| 7.1.2    | Industrial designs by origin/bn PPP\$ GDP               | 0.9         | 66        |
| 7.1.3    | ICTs & business model creation <sup>†</sup>             | 56.6        | 80        |
| 7.1.4    | ICTs & organizational model creation <sup>†</sup>       | 61.9        | 35        |
| 7.2      | Creative goods & services                               | 17.5        | 67        |
| 7.2.1    | Cultural & creative services exports, % of total trade  | 0.1         | 52        |
| 7.2.2    | National feature films/mn pop. 15–69                    | 2.1         | 59        |
| 7.2.3    | Global ent. & media market/th pop. 15–69                | 0.3         | 61 ○      |
| 7.2.4    | Printing & publishing manufactures, %                   | 0.6         | 85        |
| 7.2.5    | Creative goods exports, % total trade                   | 2.6         | 18 ●      |
| 7.3      | Online creativity                                       | 8.1         | 103       |
| 7.3.1    | Generic top-level domains (TLDs)/th pop. 15–69          | 1.0         | 98        |
| 7.3.2    | Country-code TLDs/th pop. 15–69                         | 0.7         | 85        |
| 7.3.3    | Wikipedia edits/mn pop. 15–69                           | 2.9         | 100       |
| 7.3.4    | Video uploads on YouTube/pop. 15–69                     | 2.5         | 68 ○      |

NOTES: ● indicates a strength; ○ a weakness; \* an index; † a survey question.

<sup>Ⓢ</sup> indicates that the country's data are older than the base year; see Appendix II for details, including the year of the data, at <http://globalinnovationindex.org>.

Square brackets indicate that the data minimum coverage (DMC) requirements were not met at the sub-pillar or pillar level; see page 181 of this appendix for details.

## Key indicators

|                            |   |
|----------------------------|---|
| Population (millions)..... | 260.6                                   |
| GDP (US\$ billions).....   | 941.0                                   |
| GDP per capita, PPP\$..... | 11,125.9                                |
| Income group.....          | Lower-middle income                     |
| Region.....                | South East Asia, East Asia, and Oceania |

|  | Score 0–100<br>or value (hard data) | Rank      |
|--|-------------------------------------|-----------|
| <b>Global Innovation Index (out of 127).....</b> | <b>30.1</b>                         | <b>87</b> |
| Innovation Output Sub-Index.....                 | 24.5                                | 73        |
| Innovation Input Sub-Index.....                  | 35.7                                | 99        |
| Innovation Efficiency Ratio.....                 | 0.7                                 | 42        |
| Global Innovation Index 2016 (out of 128).....   | 29.1                                | 88        |

|  |             |            |   |
|--|-------------|------------|---|
| <b>1 Institutions.....</b>                                     | <b>41.2</b> | <b>120</b> | ○ |
| 1.1 Political environment.....                                 | 42.9        | 89         |   |
| 1.1.1 Political stability & safety*.....                       | 49.4        | 94         |   |
| 1.1.2 Government effectiveness*.....                           | 36.4        | 83         |   |
| 1.2 Regulatory environment.....                                | 16.7        | 126        | ○ |
| 1.2.1 Regulatory quality*.....                                 | 36.7        | 82         |   |
| 1.2.2 Rule of law*.....  | 27.4        | 86         |   |
| 1.2.3 Cost of redundancy dismissal, salary weeks.....          | 57.8        | 125        | ○ |
| 1.3 Business environment.....                                  | 64.0        | 79         |   |
| 1.3.1 Ease of starting a business*.....                        | 76.4        | 112        |   |
| 1.3.2 Ease of resolving insolvency*.....                       | 46.5        | 70         |   |
| 1.3.3 Ease of paying taxes*.....                               | 69.3        | 77         |   |
| <b>2 Human capital &amp; research.....</b>                     | <b>23.0</b> | <b>92</b>  |   |
| 2.1 Education.....   | 33.5        | 103        |   |
| 2.1.1 Expenditure on education, % GDP.....                     | 3.3         | 94         |   |
| 2.1.2 Gov't expenditure/pupil, secondary, % GDP/cap.....       | 9.9         | 97         | ○ |
| 2.1.3 School life expectancy, years.....                       | 12.9        | 75         |   |
| 2.1.4 PISA scales in reading, maths, & science.....            | 395.5       | 63         |   |
| 2.1.5 Pupil-teacher ratio, secondary <sup>Ⓔ</sup> .....        | 15.5        | 66         |   |
| 2.2 Tertiary education.....                                    | 27.5        | 87         |   |
| 2.2.1 Tertiary enrolment, % gross <sup>Ⓔ</sup> .....           | 31.1        | 77         |   |
| 2.2.2 Graduates in science & engineering, % <sup>Ⓔ</sup> ..... | 21.7        | 47         |   |
| 2.2.3 Tertiary inbound mobility, % <sup>Ⓔ</sup> .....          | 0.1         | 104        | ○ |
| 2.3 Research & development (R&D).....                          | 8.1         | 63         |   |
| 2.3.1 Researchers, FTE/mn pop. <sup>Ⓔ</sup> .....              | 89.5        | 87         |   |
| 2.3.2 Gross expenditure on R&D, % GDP <sup>Ⓔ</sup> .....       | 0.1         | 105        | ○ |
| 2.3.3 Global R&D companies, avg. expend. top 3, mn \$US.....   | 0.0         | 43         | ○ |
| 2.3.4 QS university ranking, average score top 3*.....         | 29.8        | 38         | ● |
| <b>3 Infrastructure.....</b>                                   | <b>42.0</b> | <b>81</b>  |   |
| 3.1 Information & communication technologies (ICTs).....       | 35.6        | 99         |   |
| 3.1.1 ICT access*.....   | 47.1        | 88         |   |
| 3.1.2 ICT use*.....  | 21.9        | 96         |   |
| 3.1.3 Government's online service*.....                        | 36.2        | 102        |   |
| 3.1.4 E-participation*.....                                    | 37.3        | 101        |   |
| 3.2 General infrastructure.....                                | 46.7        | 35         | ● |
| 3.2.1 Electricity output, kWh/cap.....                         | 898.2       | 96         |   |
| 3.2.2 Logistics performance*.....                              | 42.6        | 62         |   |
| 3.2.3 Gross capital formation, % GDP.....                      | 34.7        | 8          | ● |
| 3.3 Ecological sustainability.....                             | 43.6        | 69         |   |
| 3.3.1 GDP/unit of energy use.....                              | 11.1        | 36         | ● |
| 3.3.2 Environmental performance*.....                          | 65.9        | 91         |   |
| 3.3.3 ISO 14001 environmental certificates/bn PPP\$ GDP.....   | 0.8         | 72         |   |
| <b>4 Market sophistication.....</b>                            | <b>46.0</b> | <b>64</b>  |   |
| 4.1 Credit.....  | 25.0        | 99         |   |
| 4.1.1 Ease of getting credit*.....                             | 60.0        | 55         |   |
| 4.1.2 Domestic credit to private sector, % GDP.....            | 39.1        | 83         |   |
| 4.1.3 Microfinance gross loans, % GDP.....                     | 0.0         | 68         |   |

|  |         |    |   |
|--|---------|----|---|
| 4.2 Investment.....  | 33.2    | 96 |   |
| 4.2.1 Ease of protecting minority investors*.....              | 56.7    | 67 |   |
| 4.2.2 Market capitalization, % GDP.....                        | 41.0    | 38 |   |
| 4.2.3 Venture capital deals/bn PPP\$ GDP.....                  | 0.0     | 80 |   |
| 4.3 Trade, competition, & market scale.....                    | 79.7    | 8  | ● |
| 4.3.1 Applied tariff rate, weighted mean, % <sup>Ⓔ</sup> ..... | 2.3     | 58 |   |
| 4.3.2 Intensity of local competition <sup>†</sup> .....        | 71.2    | 50 |   |
| 4.3.3 Domestic market scale, bn PPP\$.....                     | 3,027.8 | 8  | ● |

**5 Business sophistication.....26.2 96**

|   |      |     |   |
|---|------|-----|---|
| 5.1 Knowledge workers.....  | 9.7  | 123 | ○ |
| 5.1.1 Knowledge-intensive employment, %.....                        | 9.8  | 96  | ○ |
| 5.1.2 Firms offering formal training, % firms.....                  | 7.7  | 90  | ○ |
| 5.1.3 GERD performed by business, % of GDP <sup>Ⓔ</sup> .....       | 0.0  | 76  |   |
| 5.1.4 GERD financed by business, %.....                             | n/a  | n/a |   |
| 5.1.5 Females employed w/advanced degrees, % total.....             | 4.8  | 77  |   |
| 5.2 Innovation linkages.....  | 34.7 | 44  |   |
| 5.2.1 University/industry research collaboration <sup>†</sup> ..... | 57.0 | 27  | ● |
| 5.2.2 State of cluster development <sup>†</sup> .....               | 57.6 | 28  | ● |
| 5.2.3 GERD financed by abroad, %.....                               | n/a  | n/a |   |
| 5.2.4 JV-strategic alliance deals/bn PPP\$ GDP.....                 | 0.0  | 97  |   |
| 5.2.5 Patent families 2+ offices/bn PPP\$ GDP.....                  | 0.0  | 117 | ○ |
| 5.3 Knowledge absorption.....                                       | 34.1 | 58  |   |
| 5.3.1 Intellectual property payments, % total trade.....            | 0.9  | 36  |   |
| 5.3.2 High-tech imports less re-imports, % total trade.....         | 8.5  | 58  |   |
| 5.3.3 ICT services imports, % total trade.....                      | 1.0  | 66  |   |
| 5.3.4 FDI net inflows, % GDP.....                                   | 2.6  | 70  |   |
| 5.3.5 Research talent, % in business enterprise <sup>Ⓔ</sup> .....  | 35.5 | 39  |   |

**6 Knowledge & technology outputs.....20.9 70**

|   |      |     |   |
|---|------|-----|---|
| 6.1 Knowledge creation.....                                       | 2.9  | 113 | ○ |
| 6.1.1 Patents by origin/bn PPP\$ GDP.....                         | 0.4  | 81  |   |
| 6.1.2 PCT patent applications/bn PPP\$ GDP.....                   | 0.0  | 103 | ○ |
| 6.1.3 Utility models by origin/bn PPP\$ GDP.....                  | 0.1  | 53  |   |
| 6.1.4 Scientific & technical articles/bn PPP\$ GDP.....           | 0.7  | 124 | ○ |
| 6.1.5 Citable documents H index.....                              | 11.8 | 55  |   |
| 6.2 Knowledge impact.....   | 39.8 | 33  | ● |
| 6.2.1 Growth rate of PPP\$ GDP/worker, %.....                     | 4.6  | 9   | ● |
| 6.2.2 New businesses/th pop. 15–64 <sup>Ⓔ</sup> .....             | 0.3  | 91  |   |
| 6.2.3 Computer software spending, % GDP.....                      | 0.3  | 36  | ● |
| 6.2.4 ISO 9001 quality certificates/bn PPP\$ GDP.....             | 3.0  | 80  |   |
| 6.2.5 High- & medium-high-tech manufactures, % <sup>Ⓔ</sup> ..... | 0.3  | 43  |   |
| 6.3 Knowledge diffusion.....                                      | 19.9 | 81  |   |
| 6.3.1 Intellectual property receipts, % total trade.....          | 0.0  | 76  |   |
| 6.3.2 High-tech exports less re-exports, % total trade.....       | 3.5  | 43  |   |
| 6.3.3 ICT services exports, % total trade.....                    | 0.6  | 95  |   |
| 6.3.4 FDI net outflows, % GDP.....                                | 1.2  | 48  |   |

**7 Creative outputs.....28.1 77**

|   |      |     |   |
|---|------|-----|---|
| 7.1 Intangible assets.....  | 37.5 | 88  |   |
| 7.1.1 Trademarks by origin/bn PPP\$ GDP.....                      | 13.2 | 95  |   |
| 7.1.2 Industrial designs by origin/bn PPP\$ GDP.....              | 0.9  | 64  |   |
| 7.1.3 ICTs & business model creation <sup>†</sup> .....           | 62.9 | 52  |   |
| 7.1.4 ICTs & organizational model creation <sup>†</sup> .....     | 59.8 | 38  | ● |
| 7.2 Creative goods & services.....                                | 22.3 | 52  |   |
| 7.2.1 Cultural & creative services exports, % of total trade..... | n/a  | n/a |   |
| 7.2.2 National feature films/mn pop. 15–69 <sup>Ⓔ</sup> .....     | 0.5  | 93  |   |
| 7.2.3 Global ent. & media market/th pop. 15–69.....               | 1.8  | 52  |   |
| 7.2.4 Printing & publishing manufactures, % <sup>Ⓔ</sup> .....    | 0.5  | 88  | ○ |
| 7.2.5 Creative goods exports, % total trade.....                  | 3.9  | 13  | ● |
| 7.3 Online creativity.....  | 15.2 | 79  |   |
| 7.3.1 Generic top-level domains (TLDs)/th pop. 15–69.....         | 1.6  | 87  |   |
| 7.3.2 Country-code TLDs/th pop. 15–69.....                        | 2.0  | 66  |   |
| 7.3.3 Wikipedia edits/mn pop. 15–69.....                          | 3.6  | 94  |   |
| 7.3.4 Video uploads on YouTube/pop. 15–69.....                    | 22.8 | 56  |   |

NOTES: ● indicates a strength; ○ a weakness; \* an index; † a survey question.

Ⓔ indicates that the country's data are older than the base year; see Appendix II for details, including the year of the data, at <http://globalinnovationindex.org>.

Square brackets indicate that the data minimum coverage (DMC) requirements were not met at the sub-pillar or pillar level; see page 181 of this appendix for details.



# Iran, Islamic Republic of

## Key indicators

|                       |                           |
|-----------------------|---------------------------|
| Population (millions) | 80.0                      |
| GDP (US\$ billions)   | 412.3                     |
| GDP per capita, PPP\$ | 17,251.3                  |
| Income group          | Upper-middle income       |
| Region                | Central and Southern Asia |

|   | Score 0–100<br>or value (hard data) | Rank       |
|---|-------------------------------------|------------|
| <b>Global Innovation Index (out of 127)</b>                 | <b>32.1</b>                         | <b>75</b>  |
| Innovation Output Sub-Index                                 | 28.5                                | 57         |
| Innovation Input Sub-Index                                  | 35.7                                | 98         |
| Innovation Efficiency Ratio                                 | 0.8                                 | 16 ●       |
| Global Innovation Index 2016 (out of 128)                   | 30.5                                | 78         |
| <b>1 Institutions</b>                                       | <b>46.6</b>                         | <b>106</b> |
| 1.1 Political environment                                   | 39.4                                | 99         |
| 1.1.1 Political stability & safety*                         | 41.9                                | 105        |
| 1.1.2 Government effectiveness*                             | 37.0                                | 82         |
| 1.2 Regulatory environment                                  | 40.3                                | 115        |
| 1.2.1 Regulatory quality*                                   | 9.4                                 | 126 ○      |
| 1.2.2 Rule of law*  | 11.5                                | 116        |
| 1.2.3 Cost of redundancy dismissal, salary weeks            | 23.1                                | 97         |
| 1.3 Business environment                                    | 60.0                                | 98         |
| 1.3.1 Ease of starting a business*                          | 85.1                                | 77         |
| 1.3.2 Ease of resolving insolvency*                         | 25.3                                | 123 ○      |
| 1.3.3 Ease of paying taxes*                                 | 69.8                                | 75         |
| <b>2 Human capital &amp; research</b>                       | <b>37.5</b>                         | <b>45</b>  |
| 2.1 Education   | 38.6                                | 93         |
| 2.1.1 Expenditure on education, % GDP                       | 2.9                                 | 101        |
| 2.1.2 Gov't expenditure/pupil, secondary, % GDP/cap         | 15.1                                | 81         |
| 2.1.3 School life expectancy, years                         | 14.9                                | 53         |
| 2.1.4 PISA scales in reading, maths, & science              | n/a                                 | n/a        |
| 2.1.5 Pupil-teacher ratio, secondary                        | 17.0                                | 74         |
| 2.2 Tertiary education                                      | 63.7                                | 3 ●        |
| 2.2.1 Tertiary enrolment, % gross                           | 71.9                                | 23 ●       |
| 2.2.2 Graduates in science & engineering, %                 | 46.6                                | 2 ●        |
| 2.2.3 Tertiary inbound mobility, %                          | 0.3                                 | 97         |
| 2.3 Research & development (R&D)                            | 10.4                                | 58         |
| 2.3.1 Researchers, FTE/mn pop. <sup>Ⓔ</sup>                 | 691.4                               | 56         |
| 2.3.2 Gross expenditure on R&D, % GDP <sup>Ⓔ</sup>          | 0.3                                 | 78         |
| 2.3.3 Global R&D companies, avg. expend. top 3, mn \$US     | 0.0                                 | 43 ○       |
| 2.3.4 QS university ranking, average score top 3*           | 25.9                                | 45         |
| <b>3 Infrastructure</b>                                     | <b>36.2</b>                         | <b>99</b>  |
| 3.1 Information & communication technologies (ICTs)         | 35.9                                | 98         |
| 3.1.1 ICT access*   | 62.6                                | 68         |
| 3.1.2 ICT use*  | 27.4                                | 91         |
| 3.1.3 Government's online service*                          | 33.3                                | 104        |
| 3.1.4 E-participation*                                      | 20.3                                | 113 ○      |
| 3.2 General infrastructure                                  | 38.1                                | 59         |
| 3.2.1 Electricity output, kWh/cap                           | 3,514.3                             | 57         |
| 3.2.2 Logistics performance*                                | 24.9                                | 94         |
| 3.2.3 Gross capital formation, % GDP                        | 28.9                                | 23 ●       |
| 3.3 Ecological sustainability                               | 34.4                                | 105        |
| 3.3.1 GDP/unit of energy use                                | 5.3                                 | 100        |
| 3.3.2 Environmental performance*                            | 66.3                                | 90         |
| 3.3.3 ISO 14001 environmental certificates/bn PPP\$ GDP     | 0.5                                 | 80         |
| <b>4 Market sophistication</b>                              | <b>35.5</b>                         | <b>112</b> |
| 4.1 Credit  | 33.0                                | 69         |
| 4.1.1 Ease of getting credit*                               | 45.0                                | 84         |
| 4.1.2 Domestic credit to private sector, % GDP <sup>Ⓔ</sup> | 54.4                                | 61         |
| 4.1.3 Microfinance gross loans, % GDP                       | n/a                                 | n/a        |

|  |         |       |
|--|---------|-------|
| 4.2 Investment   | 20.4    | 126 ○ |
| 4.2.1 Ease of protecting minority investors*             | 35.0    | 121 ○ |
| 4.2.2 Market capitalization, % GDP <sup>Ⓔ</sup>          | 27.4    | 52    |
| 4.2.3 Venture capital deals/bn PPP\$ GDP                 | 0.0     | 92 ○  |
| 4.3 Trade, competition, & market scale                   | 52.9    | 99    |
| 4.3.1 Applied tariff rate, weighted mean, % <sup>Ⓔ</sup> | 15.2    | 124 ○ |
| 4.3.2 Intensity of local competition <sup>†</sup>        | 54.0    | 116 ○ |
| 4.3.3 Domestic market scale, bn PPP\$                    | 1,459.2 | 18 ●  |

## 5 Business sophistication

|   |      |       |
|---|------|-------|
| 5.1 Knowledge workers   | 25.5 | 96    |
| 5.1.1 Knowledge-intensive employment, %                             | 17.7 | 81    |
| 5.1.2 Firms offering formal training, % firms                       | n/a  | n/a   |
| 5.1.3 GERD performed by business, % of GDP <sup>Ⓔ</sup>             | 0.1  | 67    |
| 5.1.4 GERD financed by business, % <sup>Ⓔ</sup>                     | 30.9 | 49    |
| 5.1.5 Females employed w/advanced degrees, % total                  | n/a  | n/a   |
| 5.2 Innovation linkages   | 24.5 | 77    |
| 5.2.1 University/industry research collaboration <sup>†</sup>       | 33.6 | 97    |
| 5.2.2 State of cluster development <sup>†</sup>                     | 43.3 | 76    |
| 5.2.3 GERD financed by abroad, %                                    | n/a  | n/a   |
| 5.2.4 JV-strategic alliance deals/bn PPP\$ GDP                      | 0.0  | 94    |
| 5.2.5 Patent families 2+ offices/bn PPP\$ GDP                       | 0.0  | 111 ○ |
| 5.3 Knowledge absorption  | 18.4 | 124 ○ |
| 5.3.1 Intellectual property payments, % total trade <sup>Ⓔ</sup>    | 0.2  | 85    |
| 5.3.2 High-tech imports less re-imports, % total trade <sup>Ⓔ</sup> | 4.0  | 115 ○ |
| 5.3.3 ICT services imports, % total trade <sup>Ⓔ</sup>              | 0.6  | 93    |
| 5.3.4 FDI net inflows, % GDP  | 0.5  | 115   |
| 5.3.5 Research talent, % in business enterprise <sup>Ⓔ</sup>        | 15.0 | 60    |

## 6 Knowledge & technology outputs

|   |      |       |
|---|------|-------|
| 6.1 Knowledge creation  | 25.0 | 36 ●  |
| 6.1.1 Patents by origin/bn PPP\$ GDP <sup>Ⓔ</sup>                   | 10.1 | 12 ●  |
| 6.1.2 PCT patent applications/bn PPP\$ GDP                          | 0.0  | 85    |
| 6.1.3 Utility models by origin/bn PPP\$ GDP                         | n/a  | n/a   |
| 6.1.4 Scientific & technical articles/bn PPP\$ GDP                  | 21.5 | 35 ●  |
| 6.1.5 Citable documents H index                                     | 15.9 | 41    |
| 6.2 Knowledge impact  | 42.5 | 24 ●  |
| 6.2.1 Growth rate of PPP\$ GDP/worker, %                            | 3.6  | 18 ●  |
| 6.2.2 New businesses/th pop. 15–64                                  | n/a  | n/a   |
| 6.2.3 Computer software spending, % GDP                             | 0.2  | 67    |
| 6.2.4 ISO 9001 quality certificates/bn PPP\$ GDP                    | 1.9  | 93    |
| 6.2.5 High- & medium-high-tech manufactures, %                      | 0.3  | 36 ●  |
| 6.3 Knowledge diffusion   | 12.7 | 121 ○ |
| 6.3.1 Intellectual property receipts, % total trade <sup>Ⓔ</sup>    | 0.0  | 82    |
| 6.3.2 High-tech exports less re-exports, % total trade <sup>Ⓔ</sup> | 0.5  | 81    |
| 6.3.3 ICT services exports, % total trade <sup>Ⓔ</sup>              | 0.2  | 116 ○ |
| 6.3.4 FDI net outflows, % GDP                                       | 0.0  | 101   |

## 7 Creative outputs

|  |      |      |
|--|------|------|
| 7.1 Intangible assets  | 47.8 | 47   |
| 7.1.1 Trademarks by origin/bn PPP\$ GDP                      | n/a  | n/a  |
| 7.1.2 Industrial designs by origin/bn PPP\$ GDP <sup>Ⓔ</sup> | 6.5  | 19 ● |
| 7.1.3 ICTs & business model creation <sup>†</sup>            | 58.8 | 70   |
| 7.1.4 ICTs & organizational model creation <sup>†</sup>      | 43.4 | 100  |
| 7.2 Creative goods & services                                | 6.4  | 101  |
| 7.2.1 Cultural & creative services exports, % of total trade | n/a  | n/a  |
| 7.2.2 National feature films/mn pop. 15–69                   | 1.5  | 68   |
| 7.2.3 Global ent. & media market/th pop. 15–69               | 1.3  | 54   |
| 7.2.4 Printing & publishing manufactures, %                  | 0.2  | 98 ○ |
| 7.2.5 Creative goods exports, % total trade <sup>Ⓔ</sup>     | 0.5  | 58   |
| 7.3 Online creativity  | 18.7 | 68   |
| 7.3.1 Generic top-level domains (TLDs)/th pop. 15–69         | 1.8  | 79   |
| 7.3.2 Country-code TLDs/th pop. 15–69                        | 4.3  | 55   |
| 7.3.3 Wikipedia edits/mn pop. 15–69                          | 5.2  | 55   |
| 7.3.4 Video uploads on YouTube/pop. 15–69                    | n/a  | n/a  |

NOTES: ● indicates a strength; ○ a weakness; \* an index; † a survey question.

Ⓔ indicates that the country's data are older than the base year; see Appendix II for details, including the year of the data, at <http://globalinnovationindex.org>.

Square brackets indicate that the data minimum coverage (DMC) requirements were not met at the sub-pillar or pillar level; see page 181 of this appendix for details.



## Key indicators

|                            |             |
|----------------------------|-------------|
| Population (millions)..... | 4.7         |
| GDP (US\$ billions).....   | 307.9       |
| GDP per capita, PPP\$..... | 55,532.9    |
| Income group.....          | High income |
| Region.....                | Europe      |

|  | Score 0–100<br>or value (hard data) | Rank      |
|--|-------------------------------------|-----------|
| <b>Global Innovation Index (out of 127).....</b> | <b>58.1</b>                         | <b>10</b> |
| Innovation Output Sub-Index.....                 | 53.4                                | 8         |
| Innovation Input Sub-Index.....                  | 62.9                                | 19        |
| Innovation Efficiency Ratio.....                 | 0.8                                 | 6 ●       |
| Global Innovation Index 2016 (out of 128).....   | 59.0                                | 7         |

**1 Institutions.....87.6 12**

|   |      |      |
|---|------|------|
| 1.1 Political environment.....                        | 84.0 | 16   |
| 1.1.1 Political stability & safety*.....              | 86.3 | 22   |
| 1.1.2 Government effectiveness*.....                  | 81.6 | 17   |
| 1.2 Regulatory environment.....                       | 88.8 | 15   |
| 1.2.1 Regulatory quality*.....                        | 88.5 | 6 ●  |
| 1.2.2 Rule of law*.....                               | 91.6 | 15   |
| 1.2.3 Cost of redundancy dismissal, salary weeks..... | 14.3 | 56 ○ |
| 1.3 Business environment.....                         | 90.1 | 5 ●  |
| 1.3.1 Ease of starting a business*.....               | 95.9 | 10   |
| 1.3.2 Ease of resolving insolvency*.....              | 80.0 | 16   |
| 1.3.3 Ease of paying taxes*.....                      | 94.4 | 5 ●  |

**2 Human capital & research.....55.1 18**

|  |         |     |
|--|---------|-----|
| 2.1 Education.....   | 60.3    | 20  |
| 2.1.1 Expenditure on education, % GDP.....                             | 5.3     | 36  |
| 2.1.2 Gov't expenditure/pupil, secondary, % GDP/cap <sup>Ⓐ</sup> ..... | 26.0    | 24  |
| 2.1.3 School life expectancy, years.....                               | 19.0    | 7   |
| 2.1.4 PISA scales in reading, maths, & science.....                    | 509.0   | 10  |
| 2.1.5 Pupil-teacher ratio, secondary.....                              | n/a     | n/a |
| 2.2 Tertiary education.....  | 49.0    | 22  |
| 2.2.1 Tertiary enrolment, % gross <sup>Ⓐ</sup> .....                   | 77.6    | 19  |
| 2.2.2 Graduates in science & engineering, % <sup>Ⓐ</sup> .....         | 23.8    | 34  |
| 2.2.3 Tertiary inbound mobility, % <sup>Ⓐ</sup> .....                  | 7.0     | 29  |
| 2.3 Research & development (R&D).....                                  | 55.8    | 19  |
| 2.3.1 Researchers, FTE/mn pop.....                                     | 4,575.2 | 13  |
| 2.3.2 Gross expenditure on R&D, % GDP <sup>Ⓐ</sup> .....               | 1.5     | 23  |
| 2.3.3 Global R&D companies, avg. expend. top 3, mn \$US.....           | 81.1    | 12  |
| 2.3.4 QS university ranking, average score top 3*.....                 | 51.2    | 19  |

**3 Infrastructure.....62.1 17**

|  |         |      |
|--|---------|------|
| 3.1 Information & communication technologies (ICTs).....     | 74.8    | 28   |
| 3.1.1 ICT access*.....                                       | 81.9    | 22   |
| 3.1.2 ICT use*.....  | 73.8    | 21   |
| 3.1.3 Government's online service*.....                      | 72.5    | 39   |
| 3.1.4 E-participation*.....                                  | 71.2    | 39   |
| 3.2 General infrastructure.....                              | 47.1    | 34   |
| 3.2.1 Electricity output, kWh/cap.....                       | 6,102.2 | 32   |
| 3.2.2 Logistics performance*.....                            | 80.1    | 18   |
| 3.2.3 Gross capital formation, % GDP.....                    | 22.5    | 60 ○ |
| 3.3 Ecological sustainability.....                           | 64.3    | 8    |
| 3.3.1 GDP/unit of energy use.....                            | 17.5    | 4 ●  |
| 3.3.2 Environmental performance*.....                        | 86.6    | 19   |
| 3.3.3 ISO 14001 environmental certificates/bn PPP\$ GDP..... | 2.5     | 45   |

**4 Market sophistication.....55.0 25**

|   |      |      |
|---|------|------|
| 4.1 Credit.....                                     | 45.5 | 40   |
| 4.1.1 Ease of getting credit*.....                  | 70.0 | 29   |
| 4.1.2 Domestic credit to private sector, % GDP..... | 54.3 | 62 ○ |
| 4.1.3 Microfinance gross loans, % GDP.....          | n/a  | n/a  |

|   |       |      |
|---|-------|------|
| 4.2 Investment.....                                     | 50.5  | 29   |
| 4.2.1 Ease of protecting minority investors*.....       | 73.3  | 13   |
| 4.2.2 Market capitalization, % GDP.....                 | 45.1  | 35 ○ |
| 4.2.3 Venture capital deals/bn PPP\$ GDP.....           | 0.1   | 17   |
| 4.3 Trade, competition, & market scale.....             | 69.1  | 38   |
| 4.3.1 Applied tariff rate, weighted mean, %.....        | 1.6   | 23   |
| 4.3.2 Intensity of local competition <sup>†</sup> ..... | 69.9  | 63 ○ |
| 4.3.3 Domestic market scale, bn PPP\$.....              | 324.3 | 49   |

**5 Business sophistication.....54.5 10**

|   |      |      |
|---|------|------|
| 5.1 Knowledge workers.....  | 62.7 | 20   |
| 5.1.1 Knowledge-intensive employment, %.....                        | 40.6 | 24   |
| 5.1.2 Firms offering formal training, % firms.....                  | n/a  | n/a  |
| 5.1.3 GERD performed by business, % of GDP <sup>Ⓐ</sup> .....       | 1.1  | 20   |
| 5.1.4 GERD financed by business, % <sup>Ⓐ</sup> .....               | 52.8 | 17   |
| 5.1.5 Females employed w/advanced degrees, % total.....             | 24.9 | 8    |
| 5.2 Innovation linkages.....  | 44.2 | 22   |
| 5.2.1 University/industry research collaboration <sup>†</sup> ..... | 68.5 | 13   |
| 5.2.2 State of cluster development <sup>†</sup> .....               | 65.8 | 16   |
| 5.2.3 GERD financed by abroad, % <sup>Ⓐ</sup> .....                 | 18.6 | 22   |
| 5.2.4 JV-strategic alliance deals/bn PPP\$ GDP.....                 | 0.1  | 26   |
| 5.2.5 Patent families 2+ offices/bn PPP\$ GDP.....                  | 2.5  | 20   |
| 5.3 Knowledge absorption.....                                       | 56.6 | 4 ●  |
| 5.3.1 Intellectual property payments, % total trade.....            | 26.3 | 1 ●  |
| 5.3.2 High-tech imports less re-imports, % total trade.....         | 9.0  | 54 ○ |
| 5.3.3 ICT services imports, % total trade.....                      | 0.7  | 85 ○ |
| 5.3.4 FDI net inflows, % GDP.....                                   | 42.2 | 2 ●  |
| 5.3.5 Research talent, % in business enterprise.....                | 53.8 | 19   |

**6 Knowledge & technology outputs.....55.9 5 ●**

|   |      |     |
|---|------|-----|
| 6.1 Knowledge creation.....                                       | 24.1 | 38  |
| 6.1.1 Patents by origin/bn PPP\$ GDP.....                         | 2.7  | 37  |
| 6.1.2 PCT patent applications/bn PPP\$ GDP.....                   | 1.4  | 25  |
| 6.1.3 Utility models by origin/bn PPP\$ GDP.....                  | n/a  | n/a |
| 6.1.4 Scientific & technical articles/bn PPP\$ GDP.....           | 23.3 | 34  |
| 6.1.5 Citable documents H index.....                              | 31.3 | 28  |
| 6.2 Knowledge impact.....   | 62.5 | 2 ● |
| 6.2.1 Growth rate of PPP\$ GDP/worker, %.....                     | 5.1  | 6 ● |
| 6.2.2 New businesses/th pop. 15–64.....                           | 5.8  | 21  |
| 6.2.3 Computer software spending, % GDP.....                      | 0.8  | 2 ● |
| 6.2.4 ISO 9001 quality certificates/bn PPP\$ GDP.....             | 7.6  | 46  |
| 6.2.5 High- & medium-high-tech manufactures, % <sup>Ⓐ</sup> ..... | 0.6  | 5 ● |
| 6.3 Knowledge diffusion.....                                      | 81.1 | 1 ● |
| 6.3.1 Intellectual property receipts, % total trade.....          | 2.4  | 8   |
| 6.3.2 High-tech exports less re-exports, % total trade.....       | 11.7 | 18  |
| 6.3.3 ICT services exports, % total trade.....                    | 24.0 | 1 ● |
| 6.3.4 FDI net outflows, % GDP.....                                | 39.6 | 1 ● |

**7 Creative outputs.....50.9 13**

|   |      |      |
|---|------|------|
| 7.1 Intangible assets.....  | 62.5 | 11   |
| 7.1.1 Trademarks by origin/bn PPP\$ GDP.....                                    | n/a  | n/a  |
| 7.1.2 Industrial designs by origin/bn PPP\$ GDP.....                            | 1.3  | 53 ○ |
| 7.1.3 ICTs & business model creation <sup>†</sup> .....                         | 80.4 | 9    |
| 7.1.4 ICTs & organizational model creation <sup>†</sup> .....                   | 72.2 | 19   |
| 7.2 Creative goods & services.....  | 28.3 | 33   |
| 7.2.1 Cultural & creative services exports, % of total trade <sup>Ⓐ</sup> ..... | 0.2  | 46 ○ |
| 7.2.2 National feature films/mn pop. 15–69.....                                 | 10.1 | 15   |
| 7.2.3 Global ent. & media market/th pop. 15–69.....                             | 49.3 | 18   |
| 7.2.4 Printing & publishing manufactures, % <sup>Ⓐ</sup> .....                  | 0.8  | 71 ○ |
| 7.2.5 Creative goods exports, % total trade.....                                | 1.9  | 25   |
| 7.3 Online creativity.....  | 50.5 | 16   |
| 7.3.1 Generic top-level domains (TLDs)/th pop. 15–69.....                       | 61.4 | 11   |
| 7.3.2 Country-code TLDs/th pop. 15–69.....                                      | 20.2 | 28   |
| 7.3.3 Wikipedia edits/mn pop. 15–69.....  | 6.5  | 27   |
| 7.3.4 Video uploads on YouTube/pop. 15–69.....                                  | 57.3 | 10   |

NOTES: ● indicates a strength; ○ a weakness; \* an index; † a survey question.

Ⓐ indicates that the country's data are older than the base year; see Appendix II for details, including the year of the data, at <http://globalinnovationindex.org>.

Square brackets indicate that the data minimum coverage (DMC) requirements were not met at the sub-pillar or pillar level; see page 181 of this appendix for details.

## Key indicators

|                            |                                  |
|----------------------------|----------------------------------|
| Population (millions)..... | 8.2                              |
| GDP (US\$ billions).....   | 311.7                            |
| GDP per capita, PPP\$..... | 33,656.1                         |
| Income group.....          | High income                      |
| Region.....                | Northern Africa and Western Asia |

|  | Score 0–100<br>or value (hard data) | Rank      |
|--|-------------------------------------|-----------|
| <b>Global Innovation Index (out of 127).....</b> | <b>53.9</b>                         | <b>17</b> |
| Innovation Output Sub-Index.....                 | 46.8                                | 14        |
| Innovation Input Sub-Index.....                  | 61.0                                | 20        |
| Innovation Efficiency Ratio.....                 | 0.8                                 | 23        |
| Global Innovation Index 2016 (out of 128).....   | 52.3                                | 21        |

|          |   |             |           |
|----------|---|-------------|-----------|
| <b>1</b> | <b>Institutions.....</b>                        | <b>67.9</b> | <b>49</b> |
| 1.1      | Political environment.....                      | 57.1        | 53        |
| 1.1.1    | Political stability & safety*.....              | 36.7        | 115 ○     |
| 1.1.2    | Government effectiveness*.....                  | 77.5        | 23        |
| 1.2      | Regulatory environment.....                     | 67.8        | 49        |
| 1.2.1    | Regulatory quality*.....                        | 74.6        | 22        |
| 1.2.2    | Rule of law*.....                               | 73.6        | 24        |
| 1.2.3    | Cost of redundancy dismissal, salary weeks..... | 27.4        | 111 ○     |
| 1.3      | Business environment.....                       | 78.7        | 35        |
| 1.3.1    | Ease of starting a business*.....               | 92.3        | 35        |
| 1.3.2    | Ease of resolving insolvency*.....              | 72.8        | 29        |
| 1.3.3    | Ease of paying taxes*.....                      | 71.0        | 72 ○      |

|          |  |             |           |
|----------|--|-------------|-----------|
| <b>2</b> | <b>Human capital &amp; research.....</b>               | <b>56.5</b> | <b>15</b> |
| 2.1      | Education.....   | 54.0        | 44        |
| 2.1.1    | Expenditure on education, % GDP.....                   | 5.9         | 24        |
| 2.1.2    | Gov't expenditure/pupil, secondary, % GDP/cap.....     | 16.1        | 74 ○      |
| 2.1.3    | School life expectancy, years.....                     | 16.0        | 33        |
| 2.1.4    | PISA scales in reading, maths, & science.....          | 471.7       | 38 ○      |
| 2.1.5    | Pupil-teacher ratio, secondary <sup>Ⓐ</sup> .....      | 12.4        | 46        |
| 2.2      | Tertiary education.....                                | 36.1        | 62        |
| 2.2.1    | Tertiary enrolment, % gross <sup>Ⓐ</sup> .....         | 66.2        | 33        |
| 2.2.2    | Graduates in science & engineering, %.....             | n/a         | n/a       |
| 2.2.3    | Tertiary inbound mobility, % <sup>Ⓐ</sup> .....        | 2.8         | 61 ○      |
| 2.3      | Research & development (R&D).....                      | 79.4        | 2 ●       |
| 2.3.1    | Researchers, FTE/mn pop. <sup>Ⓐ</sup> .....            | 8,255.4     | 1 ●       |
| 2.3.2    | Gross expenditure on R&D, % GDP.....                   | 4.3         | 1 ●       |
| 2.3.3    | Global R&D companies, avg. expend. top 3, mn \$US..... | 69.2        | 18        |
| 2.3.4    | QS university ranking, average score top 3*.....       | 48.4        | 22        |

|          |  |             |           |
|----------|--|-------------|-----------|
| <b>3</b> | <b>Infrastructure.....</b>                             | <b>57.8</b> | <b>28</b> |
| 3.1      | Information & communication technologies (ICTs).....   | 78.1        | 24        |
| 3.1.1    | ICT access*.....                                       | 82.8        | 18        |
| 3.1.2    | ICT use*.....  | 60.2        | 38        |
| 3.1.3    | Government's online service*.....                      | 86.2        | 18        |
| 3.1.4    | E-participation*.....                                  | 83.1        | 17        |
| 3.2      | General infrastructure.....                            | 43.7        | 42        |
| 3.2.1    | Electricity output, kWh/cap.....                       | 7,849.7     | 23        |
| 3.2.2    | Logistics performance*.....                            | 73.9        | 27        |
| 3.2.3    | Gross capital formation, % GDP.....                    | 19.5        | 89 ○      |
| 3.3      | Ecological sustainability.....                         | 51.5        | 42        |
| 3.3.1    | GDP/unit of energy use.....                            | 11.1        | 37        |
| 3.3.2    | Environmental performance*.....                        | 78.1        | 48        |
| 3.3.3    | ISO 14001 environmental certificates/bn PPP\$ GDP..... | 3.0         | 34        |

|          |   |             |           |
|----------|---|-------------|-----------|
| <b>4</b> | <b>Market sophistication.....</b>             | <b>61.5</b> | <b>15</b> |
| 4.1      | Credit.....                                   | 45.5        | 39        |
| 4.1.1    | Ease of getting credit*.....                  | 65.0        | 40        |
| 4.1.2    | Domestic credit to private sector, % GDP..... | 66.6        | 45        |
| 4.1.3    | Microfinance gross loans, % GDP.....          | n/a         | n/a       |

|       |   |       |     |
|-------|---|-------|-----|
| 4.2   | Investment.....                                   | 71.2  | 6   |
| 4.2.1 | Ease of protecting minority investors*.....       | 75.0  | 9   |
| 4.2.2 | Market capitalization, % GDP.....                 | 81.5  | 19  |
| 4.2.3 | Venture capital deals/bn PPP\$ GDP.....           | 0.4   | 1 ● |
| 4.3   | Trade, competition, & market scale.....           | 67.7  | 44  |
| 4.3.1 | Applied tariff rate, weighted mean, %.....        | 2.2   | 57  |
| 4.3.2 | Intensity of local competition <sup>†</sup> ..... | 69.8  | 64  |
| 4.3.3 | Domestic market scale, bn PPP\$.....              | 297.0 | 52  |

|          |   |             |            |
|----------|---|-------------|------------|
| <b>5</b> | <b>Business sophistication.....</b>                             | <b>61.5</b> | <b>5 ●</b> |
| 5.1      | Knowledge workers.....  | 63.0        | 18         |
| 5.1.1    | Knowledge-intensive employment, %.....                          | 48.3        | 6          |
| 5.1.2    | Firms offering formal training, % firms.....                    | 18.6        | 78 ○       |
| 5.1.3    | GERD performed by business, % of GDP.....                       | 3.7         | 1 ●        |
| 5.1.4    | GERD financed by business, % <sup>Ⓐ</sup> .....                 | 37.0        | 40         |
| 5.1.5    | Females employed w/advanced degrees, % total <sup>Ⓐ</sup> ..... | 28.4        | 4 ●        |
| 5.2      | Innovation linkages.....  | 67.8        | 2 ●        |
| 5.2.1    | University/industry research collaboration <sup>†</sup> .....   | 76.7        | 3 ●        |
| 5.2.2    | State of cluster development <sup>†</sup> .....                 | 53.8        | 33         |
| 5.2.3    | GERD financed by abroad, % <sup>Ⓐ</sup> .....                   | 49.2        | 4 ●        |
| 5.2.4    | JV-strategic alliance deals/bn PPP\$ GDP.....                   | 0.1         | 12         |
| 5.2.5    | Patent families 2+ offices/bn PPP\$ GDP.....                    | 8.0         | 8          |
| 5.3      | Knowledge absorption.....                                       | 53.5        | 9          |
| 5.3.1    | Intellectual property payments, % total trade.....              | 0.6         | 56         |
| 5.3.2    | High-tech imports less re-imports, % total trade.....           | 11.4        | 29         |
| 5.3.3    | ICT services imports, % total trade.....                        | 2.1         | 22         |
| 5.3.4    | FDI net inflows, % GDP.....                                     | 3.4         | 48         |
| 5.3.5    | Research talent, % in business enterprise <sup>Ⓐ</sup> .....    | 83.7        | 1 ●        |

|          |   |             |          |
|----------|---|-------------|----------|
| <b>6</b> | <b>Knowledge &amp; technology outputs.....</b>        | <b>49.6</b> | <b>9</b> |
| 6.1      | Knowledge creation.....                               | 54.6        | 11       |
| 6.1.1    | Patents by origin/bn PPP\$ GDP.....                   | 4.5         | 26       |
| 6.1.2    | PCT patent applications/bn PPP\$ GDP.....             | 6.2         | 7        |
| 6.1.3    | Utility models by origin/bn PPP\$ GDP.....            | n/a         | n/a      |
| 6.1.4    | Scientific & technical articles/bn PPP\$ GDP.....     | 45.8        | 11       |
| 6.1.5    | Citable documents H index.....                        | 47.4        | 16       |
| 6.2      | Knowledge impact.....                                 | 37.2        | 42       |
| 6.2.1    | Growth rate of PPP\$ GDP/worker, %.....               | 0.2         | 82 ○     |
| 6.2.2    | New businesses/th pop. 15–64.....                     | 3.1         | 36       |
| 6.2.3    | Computer software spending, % GDP.....                | 0.3         | 53       |
| 6.2.4    | ISO 9001 quality certificates/bn PPP\$ GDP.....       | 31.8        | 6        |
| 6.2.5    | High- & medium-high-tech manufactures, %.....         | 0.3         | 37       |
| 6.3      | Knowledge diffusion.....                              | 57.1        | 8        |
| 6.3.1    | Intellectual property receipts, % total trade.....    | 0.9         | 17       |
| 6.3.2    | High-tech exports less re-exports, % total trade..... | 15.8        | 8        |
| 6.3.3    | ICT services exports, % total trade.....              | 10.6        | 1 ●      |
| 6.3.4    | FDI net outflows, % GDP.....                          | 2.1         | 28       |

|          |   |             |           |
|----------|---|-------------|-----------|
| <b>7</b> | <b>Creative outputs.....</b>  | <b>43.9</b> | <b>30</b> |
| 7.1      | Intangible assets.....  | 49.3        | 40        |
| 7.1.1    | Trademarks by origin/bn PPP\$ GDP.....                                    | 13.0        | 97 ○      |
| 7.1.2    | Industrial designs by origin/bn PPP\$ GDP.....                            | 3.7         | 32        |
| 7.1.3    | ICTs & business model creation <sup>†</sup> .....                         | 80.9        | 8         |
| 7.1.4    | ICTs & organizational model creation <sup>†</sup> .....                   | 75.5        | 11        |
| 7.2      | Creative goods & services.....  | 33.2        | 24        |
| 7.2.1    | Cultural & creative services exports, % of total trade <sup>Ⓐ</sup> ..... | 1.3         | 8         |
| 7.2.2    | National feature films/mn pop. 15–69.....                                 | 6.1         | 33        |
| 7.2.3    | Global ent. & media market/th pop. 15–69.....                             | 35.9        | 21        |
| 7.2.4    | Printing & publishing manufactures, %.....                                | 1.2         | 46        |
| 7.2.5    | Creative goods exports, % total trade.....                                | 1.8         | 27        |
| 7.3      | Online creativity.....  | 43.7        | 25        |
| 7.3.1    | Generic top-level domains (TLDs)/th pop. 15–69.....                       | 23.2        | 24        |
| 7.3.2    | Country-code TLDs/th pop. 15–69.....                                      | 13.5        | 35        |
| 7.3.3    | Wikipedia edits/mn pop. 15–69.....  | 7.6         | 3 ●       |
| 7.3.4    | Video uploads on YouTube/pop. 15–69.....                                  | 64.9        | 4         |

NOTES: ● indicates a strength; ○ a weakness; \* an index; † a survey question.

<sup>Ⓐ</sup> indicates that the country's data are older than the base year; see Appendix II for details, including the year of the data, at <http://globalinnovationindex.org>.

Square brackets indicate that the data minimum coverage (DMC) requirements were not met at the sub-pillar or pillar level; see page 181 of this appendix for details.

## Key indicators

|                             |             |
|-----------------------------|-------------|
| Population (millions) ..... | 59.8        |
| GDP (US\$ billions) .....   | 1,852.5     |
| GDP per capita, PPP\$ ..... | 35,708.3    |
| Income group .....          | High income |
| Region .....                | Europe      |

|  | Score 0–100<br>or value (hard data) | Rank      |
|--|-------------------------------------|-----------|
| <b>Global Innovation Index (out of 127).....</b> | <b>47.0</b>                         | <b>29</b> |
| Innovation Output Sub-Index .....                | 39.5                                | 29        |
| Innovation Input Sub-Index.....                  | 54.4                                | 29        |
| Innovation Efficiency Ratio.....                 | 0.7                                 | 31        |
| Global Innovation Index 2016 (out of 128) .....  | 47.2                                | 29        |

|  |             |           |
|--|-------------|-----------|
| <b>1 Institutions.....</b>                                     | <b>71.9</b> | <b>38</b> |
| 1.1 Political environment .....                                | 63.0        | 46        |
| 1.1.1 Political stability & safety*.....                       | 72.2        | 46        |
| 1.1.2 Government effectiveness*.....                           | 53.8        | 46        |
| 1.2 Regulatory environment.....                                | 76.9        | 33        |
| 1.2.1 Regulatory quality*.....                                 | 60.8        | 42        |
| 1.2.2 Rule of law*.....  | 46.8        | 50        |
| 1.2.3 Cost of redundancy dismissal, salary weeks.....          | 8.0         | 1 ●       |
| 1.3 Business environment.....                                  | 75.9        | 44        |
| 1.3.1 Ease of starting a business*.....                        | 89.4        | 54        |
| 1.3.2 Ease of resolving insolvency*.....                       | 76.6        | 23        |
| 1.3.3 Ease of paying taxes*.....                               | 61.7        | 91 ○      |
| <b>2 Human capital &amp; research.....</b>                     | <b>46.3</b> | <b>32</b> |
| 2.1 Education.....   | 53.6        | 48        |
| 2.1.1 Expenditure on education, % GDP.....                     | 4.2         | 75 ○      |
| 2.1.2 Gov't expenditure/pupil, secondary, % GDP/cap.....       | 23.3        | 38        |
| 2.1.3 School life expectancy, years.....                       | 16.4        | 23        |
| 2.1.4 PISA scales in reading, maths, & science.....            | 485.0       | 31        |
| 2.1.5 Pupil-teacher ratio, secondary <sup>Ⓢ</sup> .....        | 11.4        | 36        |
| 2.2 Tertiary education.....                                    | 38.9        | 51        |
| 2.2.1 Tertiary enrolment, % gross <sup>Ⓢ</sup> .....           | 63.1        | 39        |
| 2.2.2 Graduates in science & engineering, % <sup>Ⓢ</sup> ..... | 20.2        | 55        |
| 2.2.3 Tertiary inbound mobility, % <sup>Ⓢ</sup> .....          | 4.7         | 39        |
| 2.3 Research & development (R&D).....                          | 46.5        | 21        |
| 2.3.1 Researchers, FTE/mn pop.....                             | 2,018.1     | 36        |
| 2.3.2 Gross expenditure on R&D, % GDP.....                     | 1.3         | 26        |
| 2.3.3 Global R&D companies, avg. expend. top 3, mn \$US.....   | 84.5        | 9 ●       |
| 2.3.4 QS university ranking, average score top 3*.....         | 46.3        | 27        |
| <b>3 Infrastructure.....</b>                                   | <b>61.8</b> | <b>19</b> |
| 3.1 Information & communication technologies (ICTs).....       | 79.5        | 20        |
| 3.1.1 ICT access*.....   | 76.9        | 33        |
| 3.1.2 ICT use*.....  | 62.5        | 34        |
| 3.1.3 Government's online service*.....                        | 87.0        | 17 ●      |
| 3.1.4 E-participation*.....                                    | 91.5        | 8 ●       |
| 3.2 General infrastructure.....                                | 38.7        | 56        |
| 3.2.1 Electricity output, kWh/cap.....                         | 4,597.4     | 47        |
| 3.2.2 Logistics performance*.....                              | 78.2        | 21        |
| 3.2.3 Gross capital formation, % GDP.....                      | 16.6        | 105 ○     |
| 3.3 Ecological sustainability.....                             | 67.2        | 4 ●       |
| 3.3.1 GDP/unit of energy use.....                              | 13.2        | 18        |
| 3.3.2 Environmental performance*.....                          | 84.5        | 29        |
| 3.3.3 ISO 14001 environmental certificates/bn PPP\$ GDP.....   | 10.3        | 7 ●       |
| <b>4 Market sophistication.....</b>                            | <b>52.6</b> | <b>36</b> |
| 4.1 Credit.....  | 39.9        | 50        |
| 4.1.1 Ease of getting credit*.....                             | 45.0        | 84 ○      |
| 4.1.2 Domestic credit to private sector, % GDP.....            | 88.0        | 34        |
| 4.1.3 Microfinance gross loans, % GDP.....                     | n/a         | n/a       |

|   |         |      |
|---|---------|------|
| 4.2 Investment.....                                     | 38.5    | 71 ○ |
| 4.2.1 Ease of protecting minority investors*.....       | 63.3    | 41   |
| 4.2.2 Market capitalization, % GDP <sup>Ⓢ</sup> .....   | 27.3    | 53 ○ |
| 4.2.3 Venture capital deals/bn PPP\$ GDP.....           | 0.0     | 30   |
| 4.3 Trade, competition, & market scale.....             | 79.3    | 10 ● |
| 4.3.1 Applied tariff rate, weighted mean, %.....        | 1.6     | 23   |
| 4.3.2 Intensity of local competition <sup>†</sup> ..... | 71.8    | 45   |
| 4.3.3 Domestic market scale, bn PPP\$.....              | 2,220.6 | 12 ● |

|   |             |           |
|---|-------------|-----------|
| <b>5 Business sophistication.....</b>                               | <b>39.6</b> | <b>35</b> |
| 5.1 Knowledge workers.....  | 47.6        | 40        |
| 5.1.1 Knowledge-intensive employment, %.....                        | 35.7        | 35        |
| 5.1.2 Firms offering formal training, % firms.....                  | n/a         | n/a       |
| 5.1.3 GERD performed by business, % of GDP.....                     | 0.7         | 25        |
| 5.1.4 GERD financed by business, % <sup>Ⓢ</sup> .....               | 46.2        | 26        |
| 5.1.5 Females employed w/advanced degrees, % total.....             | 11.5        | 60 ○      |
| 5.2 Innovation linkages.....  | 35.3        | 43        |
| 5.2.1 University/industry research collaboration <sup>†</sup> ..... | 44.7        | 43        |
| 5.2.2 State of cluster development <sup>†</sup> .....               | 72.6        | 4 ●       |
| 5.2.3 GERD financed by abroad, % <sup>Ⓢ</sup> .....                 | 9.3         | 49        |
| 5.2.4 JV-strategic alliance deals/bn PPP\$ GDP.....                 | 0.0         | 61 ○      |
| 5.2.5 Patent families 2+ offices/bn PPP\$ GDP.....                  | 1.8         | 25        |
| 5.3 Knowledge absorption.....                                       | 35.8        | 51        |
| 5.3.1 Intellectual property payments, % total trade.....            | 0.9         | 39        |
| 5.3.2 High-tech imports less re-imports, % total trade.....         | 8.1         | 64        |
| 5.3.3 ICT services imports, % total trade.....                      | 1.7         | 29        |
| 5.3.4 FDI net inflows, % GDP.....                                   | 0.8         | 109 ○     |
| 5.3.5 Research talent, % in business enterprise.....                | 38.6        | 34        |

|  |             |           |
|--|-------------|-----------|
| <b>6 Knowledge &amp; technology outputs.....</b>               | <b>36.1</b> | <b>26</b> |
| 6.1 Knowledge creation.....                                    | 30.9        | 31        |
| 6.1.1 Patents by origin/bn PPP\$ GDP.....                      | 1.8         | 49        |
| 6.1.2 PCT patent applications/bn PPP\$ GDP.....                | 1.5         | 23        |
| 6.1.3 Utility models by origin/bn PPP\$ GDP <sup>Ⓢ</sup> ..... | 1.1         | 21        |
| 6.1.4 Scientific & technical articles/bn PPP\$ GDP.....        | 27.6        | 27        |
| 6.1.5 Citable documents H index.....                           | 68.9        | 7 ●       |
| 6.2 Knowledge impact.....                                      | 51.0        | 9 ●       |
| 6.2.1 Growth rate of PPP\$ GDP/worker, %.....                  | 0.2         | 80 ○      |
| 6.2.2 New businesses/th pop. 15–64.....                        | 2.3         | 44        |
| 6.2.3 Computer software spending, % GDP.....                   | 0.6         | 15 ●      |
| 6.2.4 ISO 9001 quality certificates/bn PPP\$ GDP.....          | 61.1        | 1 ●       |
| 6.2.5 High- & medium-high-tech manufactures, %.....            | 0.4         | 26        |
| 6.3 Knowledge diffusion.....                                   | 26.4        | 47        |
| 6.3.1 Intellectual property receipts, % total trade.....       | 0.6         | 22        |
| 6.3.2 High-tech exports less re-exports, % total trade.....    | 5.7         | 31        |
| 6.3.3 ICT services exports, % total trade.....                 | 1.5         | 67        |
| 6.3.4 FDI net outflows, % GDP.....                             | 0.9         | 54        |

|   |             |           |
|---|-------------|-----------|
| <b>7 Creative outputs.....</b>  | <b>42.9</b> | <b>33</b> |
| 7.1 Intangible assets.....  | 53.5        | 27        |
| 7.1.1 Trademarks by origin/bn PPP\$ GDP <sup>Ⓢ</sup> .....                      | 49.9        | 50        |
| 7.1.2 Industrial designs by origin/bn PPP\$ GDP <sup>Ⓢ</sup> .....              | 18.5        | 1 ●       |
| 7.1.3 ICTs & business model creation <sup>†</sup> .....                         | 61.7        | 57        |
| 7.1.4 ICTs & organizational model creation <sup>†</sup> .....                   | 50.5        | 75 ○      |
| 7.2 Creative goods & services.....  | 25.8        | 44        |
| 7.2.1 Cultural & creative services exports, % of total trade <sup>Ⓢ</sup> ..... | 0.3         | 41        |
| 7.2.2 National feature films/mn pop. 15–69.....                                 | 4.4         | 45        |
| 7.2.3 Global ent. & media market/th pop. 15–69.....                             | 28.1        | 23        |
| 7.2.4 Printing & publishing manufactures, %.....                                | 1.2         | 48        |
| 7.2.5 Creative goods exports, % total trade.....                                | 2.3         | 19        |
| 7.3 Online creativity.....  | 38.6        | 29        |
| 7.3.1 Generic top-level domains (TLDs)/th pop. 15–69.....                       | 23.1        | 25        |
| 7.3.2 Country-code TLDs/th pop. 15–69.....                                      | 21.4        | 26        |
| 7.3.3 Wikipedia edits/mn pop. 15–69.....  | 6.5         | 29        |
| 7.3.4 Video uploads on YouTube/pop. 15–69.....                                  | 47.3        | 19        |

NOTES: ● indicates a strength; ○ a weakness; \* an index; † a survey question.

Ⓢ indicates that the country's data are older than the base year; see Appendix II for details, including the year of the data, at <http://globalinnovationindex.org>.

Square brackets indicate that the data minimum coverage (DMC) requirements were not met at the sub-pillar or pillar level; see page 181 of this appendix for details.

## Jamaica

## Key indicators

|                            |                                 |
|----------------------------|---------------------------------|
| Population (millions)..... | 2.8                             |
| GDP (US\$ billions).....   | 13.8                            |
| GDP per capita, PPP\$..... | 8,758.5                         |
| Income group.....          | Upper-middle income             |
| Region.....                | Latin America and the Caribbean |

|  | Score 0–100<br>or value (hard data) | Rank      |
|--|-------------------------------------|-----------|
| <b>Global Innovation Index (out of 127).....</b> | <b>30.4</b>                         | <b>84</b> |
| Innovation Output Sub-Index.....                 | 22.0                                | 84        |
| Innovation Input Sub-Index.....                  | 38.7                                | 84        |
| Innovation Efficiency Ratio.....                 | 0.6                                 | 86        |
| Global Innovation Index 2016 (out of 128).....   | 29.0                                | 89        |

**1 Institutions..... 65.8 57**

|   |      |      |
|---|------|------|
| 1.1 Political environment.....                        | 57.3 | 51   |
| 1.1.1 Political stability & safety*.....              | 66.1 | 56   |
| 1.1.2 Government effectiveness*.....                  | 48.5 | 55   |
| 1.2 Regulatory environment.....                       | 63.4 | 67   |
| 1.2.1 Regulatory quality*.....                        | 44.9 | 68   |
| 1.2.2 Rule of law*.....                               | 32.6 | 72   |
| 1.2.3 Cost of redundancy dismissal, salary weeks..... | 14.0 | 54   |
| 1.3 Business environment.....                         | 76.6 | 40   |
| 1.3.1 Ease of starting a business*.....               | 95.6 | 12 ● |
| 1.3.2 Ease of resolving insolvency*.....              | 69.2 | 35 ● |
| 1.3.3 Ease of paying taxes*.....                      | 65.2 | 85   |

**2 Human capital & research..... 23.8 88**

|  |      |       |
|--|------|-------|
| 2.1 Education.....   | 47.9 | 62    |
| 2.1.1 Expenditure on education, % GDP.....                   | 5.4  | 34 ●  |
| 2.1.2 Gov't expenditure/pupil, secondary, % GDP/cap.....     | 27.1 | 19 ●  |
| 2.1.3 School life expectancy, years.....                     | n/a  | n/a   |
| 2.1.4 PISA scales in reading, maths, & science.....          | n/a  | n/a   |
| 2.1.5 Pupil-teacher ratio, secondary.....                    | 16.4 | 72    |
| 2.2 Tertiary education.....                                  | 23.4 | [98]  |
| 2.2.1 Tertiary enrolment, % gross.....                       | 27.2 | 85    |
| 2.2.2 Graduates in science & engineering, %.....             | n/a  | n/a   |
| 2.2.3 Tertiary inbound mobility, %.....                      | n/a  | n/a   |
| 2.3 Research & development (R&D).....                        | 0.0  | 115 ○ |
| 2.3.1 Researchers, FTE/mn pop.....                           | n/a  | n/a   |
| 2.3.2 Gross expenditure on R&D, % GDP.....                   | n/a  | n/a   |
| 2.3.3 Global R&D companies, avg. expend. top 3, mn \$US..... | 0.0  | 43 ○  |
| 2.3.4 QS university ranking, average score top 3*.....       | 0.0  | 75 ○  |

**3 Infrastructure..... 32.8 108**

|  |         |       |
|--|---------|-------|
| 3.1 Information & communication technologies (ICTs).....     | 36.6    | 96    |
| 3.1.1 ICT access*.....                                       | 48.3    | 85    |
| 3.1.2 ICT use*.....  | 35.5    | 76    |
| 3.1.3 Government's online service*.....                      | 35.5    | 103   |
| 3.1.4 E-participation*.....                                  | 27.1    | 110 ○ |
| 3.2 General infrastructure.....                              | 18.9    | 120 ○ |
| 3.2.1 Electricity output, kWh/cap.....                       | 1,516.2 | 86    |
| 3.2.2 Logistics performance*.....                            | 15.6    | 111 ○ |
| 3.2.3 Gross capital formation, % GDP.....                    | 15.4    | 109 ○ |
| 3.3 Ecological sustainability.....                           | 42.9    | 73    |
| 3.3.1 GDP/unit of energy use.....                            | 8.1     | 69    |
| 3.3.2 Environmental performance*.....                        | 77.0    | 53    |
| 3.3.3 ISO 14001 environmental certificates/bn PPP\$ GDP..... | 0.5     | 82    |

**4 Market sophistication..... 39.8 95**

|   |      |      |
|---|------|------|
| 4.1 Credit.....                                     | 31.2 | 75   |
| 4.1.1 Ease of getting credit*.....                  | 80.0 | 15 ● |
| 4.1.2 Domestic credit to private sector, % GDP..... | 29.9 | 99   |
| 4.1.3 Microfinance gross loans, % GDP.....          | 0.1  | 53   |

|  |      |       |
|--|------|-------|
| 4.2 Investment.....  | 43.8 | 44    |
| 4.2.1 Ease of protecting minority investors*.....              | 58.3 | 62    |
| 4.2.2 Market capitalization, % GDP <sup>Ⓔ</sup> .....          | 34.7 | 43    |
| 4.2.3 Venture capital deals/bn PPP\$ GDP.....                  | n/a  | n/a   |
| 4.3 Trade, competition, & market scale.....                    | 44.4 | 117 ○ |
| 4.3.1 Applied tariff rate, weighted mean, % <sup>Ⓔ</sup> ..... | 9.6  | 112 ○ |
| 4.3.2 Intensity of local competition <sup>†</sup> .....        | 74.8 | 27 ●  |
| 4.3.3 Domestic market scale, bn PPP\$.....                     | 25.4 | 115 ○ |

**5 Business sophistication..... 31.3 69**

|   |      |      |
|---|------|------|
| 5.1 Knowledge workers.....  | 32.1 | [81] |
| 5.1.1 Knowledge-intensive employment, % <sup>Ⓔ</sup> .....          | 20.1 | 73   |
| 5.1.2 Firms offering formal training, % firms <sup>Ⓔ</sup> .....    | 25.9 | 60   |
| 5.1.3 GERD performed by business, % of GDP.....                     | n/a  | n/a  |
| 5.1.4 GERD financed by business, %.....                             | n/a  | n/a  |
| 5.1.5 Females employed w/advanced degrees, % total.....             | n/a  | n/a  |
| 5.2 Innovation linkages.....  | 28.9 | 58   |
| 5.2.1 University/industry research collaboration <sup>†</sup> ..... | 40.8 | 64   |
| 5.2.2 State of cluster development <sup>†</sup> .....               | 44.3 | 70   |
| 5.2.3 GERD financed by abroad, %.....                               | n/a  | n/a  |
| 5.2.4 JV-strategic alliance deals/bn PPP\$ GDP.....                 | 0.0  | 34   |
| 5.2.5 Patent families 2+ offices/bn PPP\$ GDP.....                  | 0.2  | 55   |
| 5.3 Knowledge absorption.....                                       | 32.9 | 64   |
| 5.3.1 Intellectual property payments, % total trade.....            | 1.0  | 35 ● |
| 5.3.2 High-tech imports less re-imports, % total trade.....         | 6.0  | 93   |
| 5.3.3 ICT services imports, % total trade.....                      | 1.5  | 41   |
| 5.3.4 FDI net inflows, % GDP.....                                   | 4.9  | 28 ● |
| 5.3.5 Research talent, % in business enterprise.....                | n/a  | n/a  |

**6 Knowledge & technology outputs..... 14.4 108**

|   |       |       |
|---|-------|-------|
| 6.1 Knowledge creation.....                                 | 4.8   | 88    |
| 6.1.1 Patents by origin/bn PPP\$ GDP.....                   | 0.3   | 89    |
| 6.1.2 PCT patent applications/bn PPP\$ GDP.....             | n/a   | n/a   |
| 6.1.3 Utility models by origin/bn PPP\$ GDP.....            | n/a   | n/a   |
| 6.1.4 Scientific & technical articles/bn PPP\$ GDP.....     | 6.6   | 82    |
| 6.1.5 Citable documents H index.....                        | 4.3   | 99    |
| 6.2 Knowledge impact.....                                   | 22.0  | 100   |
| 6.2.1 Growth rate of PPP\$ GDP/worker, %.....               | (0.5) | 93    |
| 6.2.2 New businesses/th pop. 15–64.....                     | 1.0   | 70    |
| 6.2.3 Computer software spending, % GDP.....                | 0.3   | 38 ●  |
| 6.2.4 ISO 9001 quality certificates/bn PPP\$ GDP.....       | 1.1   | 108   |
| 6.2.5 High- & medium-high-tech manufactures, %.....         | n/a   | n/a   |
| 6.3 Knowledge diffusion.....                                | 16.3  | 106   |
| 6.3.1 Intellectual property receipts, % total trade.....    | 0.1   | 51    |
| 6.3.2 High-tech exports less re-exports, % total trade..... | 0.0   | 124 ○ |
| 6.3.3 ICT services exports, % total trade.....              | 2.3   | 47    |
| 6.3.4 FDI net outflows, % GDP.....                          | (0.2) | 118 ○ |

**7 Creative outputs..... 29.7 67**

|   |       |       |
|---|-------|-------|
| 7.1 Intangible assets.....  | 52.7  | 29 ●  |
| 7.1.1 Trademarks by origin/bn PPP\$ GDP.....                      | 126.4 | 6 ●   |
| 7.1.2 Industrial designs by origin/bn PPP\$ GDP.....              | 2.6   | 39    |
| 7.1.3 ICTs & business model creation <sup>†</sup> .....           | 62.0  | 55    |
| 7.1.4 ICTs & organizational model creation <sup>†</sup> .....     | 50.7  | 74    |
| 7.2 Creative goods & services.....                                | 2.0   | [120] |
| 7.2.1 Cultural & creative services exports, % of total trade..... | 0.1   | 60    |
| 7.2.2 National feature films/mn pop. 15–69.....                   | n/a   | n/a   |
| 7.2.3 Global ent. & media market/th pop. 15–69.....               | n/a   | n/a   |
| 7.2.4 Printing & publishing manufactures, %.....                  | n/a   | n/a   |
| 7.2.5 Creative goods exports, % total trade.....                  | 0.0   | 108 ○ |
| 7.3 Online creativity.....  | 11.3  | 95    |
| 7.3.1 Generic top-level domains (TLDs)/th pop. 15–69.....         | 1.9   | 78    |
| 7.3.2 Country-code TLDs/th pop. 15–69.....                        | 1.0   | 81    |
| 7.3.3 Wikipedia edits/mn pop. 15–69 <sup>Ⓔ</sup> .....            | 3.2   | 98    |
| 7.3.4 Video uploads on YouTube/pop. 15–69.....                    | n/a   | n/a   |

NOTES: ● indicates a strength; ○ a weakness; \* an index; † a survey question.

Ⓔ indicates that the country's data are older than the base year; see Appendix II for details, including the year of the data, at <http://globalinnovationindex.org>.

Square brackets indicate that the data minimum coverage (DMC) requirements were not met at the sub-pillar or pillar level; see page 181 of this appendix for details.

## Key indicators

|                             |   |
|-----------------------------|---|
| Population (millions) ..... | 126.3                                   |
| GDP (US\$ billions) .....   | 4,730.3                                 |
| GDP per capita, PPP\$ ..... | 38,054.2                                |
| Income group .....          | High income                             |
| Region .....                | South East Asia, East Asia, and Oceania |

|   | Score 0–100<br>or value (hard data) | Rank      |
|---|-------------------------------------|-----------|
| <b>Global Innovation Index (out of 127)</b> ..... | <b>54.7</b>                         | <b>14</b> |
| Innovation Output Sub-Index .....                 | 44.0                                | 20        |
| Innovation Input Sub-Index .....                  | 65.5                                | 11        |
| Innovation Efficiency Ratio .....                 | 0.7                                 | 49        |
| Global Innovation Index 2016 (out of 128) .....   | 54.5                                | 16        |

**1 Institutions** ..... **87.4** **13**

|  |      |     |
|--|------|-----|
| 1.1 Political environment .....                        | 87.9 | 11  |
| 1.1.1 Political stability & safety* .....              | 87.6 | 15  |
| 1.1.2 Government effectiveness* .....                  | 88.2 | 10  |
| 1.2 Regulatory environment .....                       | 89.0 | 14  |
| 1.2.1 Regulatory quality* .....                        | 72.2 | 24  |
| 1.2.2 Rule of law* .....                               | 83.6 | 19  |
| 1.2.3 Cost of redundancy dismissal, salary weeks ..... | 8.0  | 1 ● |
| 1.3 Business environment .....                         | 85.5 | 21  |
| 1.3.1 Ease of starting a business* .....               | 86.1 | 72  |
| 1.3.2 Ease of resolving insolvency* .....              | 93.3 | 2 ● |
| 1.3.3 Ease of paying taxes* .....                      | 77.0 | 59  |

**2 Human capital & research** ..... **56.7** **14**

|   |         |      |
|---|---------|------|
| 2.1 Education .....   | 53.8    | 46   |
| 2.1.1 Expenditure on education, % GDP .....                   | 3.8     | 85 ○ |
| 2.1.2 Gov't expenditure/pupil, secondary, % GDP/cap .....     | 25.1    | 29   |
| 2.1.3 School life expectancy, years .....                     | 15.4    | 39   |
| 2.1.4 PISA scales in reading, maths, & science .....          | 528.9   | 3 ●  |
| 2.1.5 Pupil-teacher ratio, secondary <sup>Ⓜ</sup> .....       | 11.7    | 38   |
| 2.2 Tertiary education .....                                  | 37.1    | 60   |
| 2.2.1 Tertiary enrolment, % gross <sup>Ⓜ</sup> .....          | 63.4    | 37   |
| 2.2.2 Graduates in science & engineering, % .....             | 19.9    | 59 ○ |
| 2.2.3 Tertiary inbound mobility, % <sup>Ⓜ</sup> .....         | 3.4     | 53   |
| 2.3 Research & development (R&D) .....                        | 79.4    | 3 ●  |
| 2.3.1 Researchers, FTE/mn pop. .....                          | 5,230.7 | 9    |
| 2.3.2 Gross expenditure on R&D, % GDP .....                   | 3.5     | 3 ●  |
| 2.3.3 Global R&D companies, avg. expend. top 3, mn \$US ..... | 93.2    | 4 ●  |
| 2.3.4 QS university ranking, average score top 3* .....       | 79.7    | 8    |

**3 Infrastructure** ..... **64.3** **9**

|   |         |     |
|---|---------|-----|
| 3.1 Information & communication technologies (ICTs) .....     | 88.8    | 5   |
| 3.1.1 ICT access* .....                                       | 88.0    | 10  |
| 3.1.2 ICT use* .....  | 81.4    | 8   |
| 3.1.3 Government's online service* .....                      | 87.7    | 15  |
| 3.1.4 E-participation* .....                                  | 98.3    | 2 ● |
| 3.2 General infrastructure .....                              | 49.7    | 28  |
| 3.2.1 Electricity output, kWh/cap .....                       | 7,948.1 | 20  |
| 3.2.2 Logistics performance* .....                            | 88.2    | 12  |
| 3.2.3 Gross capital formation, % GDP .....                    | 21.5    | 71  |
| 3.3 Ecological sustainability .....                           | 54.3    | 32  |
| 3.3.1 GDP/unit of energy use .....                            | 10.2    | 46  |
| 3.3.2 Environmental performance* .....                        | 80.6    | 39  |
| 3.3.3 ISO 14001 environmental certificates/bn PPP\$ GDP ..... | 5.4     | 20  |

**4 Market sophistication** ..... **64.3** **12**

|  |       |      |
|--|-------|------|
| 4.1 Credit .....                                     | 61.8  | 12   |
| 4.1.1 Ease of getting credit* .....                  | 50.0  | 72 ○ |
| 4.1.2 Domestic credit to private sector, % GDP ..... | 182.9 | 4 ●  |
| 4.1.3 Microfinance gross loans, % GDP .....          | n/a   | n/a  |

|   |         |     |
|---|---------|-----|
| 4.2 Investment .....                                    | 43.7    | 45  |
| 4.2.1 Ease of protecting minority investors* .....      | 60.0    | 52  |
| 4.2.2 Market capitalization, % GDP .....                | 111.7   | 7   |
| 4.2.3 Venture capital deals/bn PPP\$ GDP .....          | 0.0     | 49  |
| 4.3 Trade, competition, & market scale .....            | 87.5    | 3 ● |
| 4.3.1 Applied tariff rate, weighted mean, % .....       | 1.4     | 20  |
| 4.3.2 Intensity of local competition <sup>†</sup> ..... | 87.1    | 1 ● |
| 4.3.3 Domestic market scale, bn PPP\$ .....             | 4,931.9 | 4 ● |

**5 Business sophistication** ..... **54.5** **11**

|   |      |       |
|---|------|-------|
| 5.1 Knowledge workers .....   | 64.1 | 15    |
| 5.1.1 Knowledge-intensive employment, % .....                       | 24.8 | 55    |
| 5.1.2 Firms offering formal training, % firms .....                 | n/a  | n/a   |
| 5.1.3 GERD performed by business, % of GDP .....                    | 2.7  | 3 ●   |
| 5.1.4 GERD financed by business, % .....                            | 78.0 | 1 ●   |
| 5.1.5 Females employed w/advanced degrees, % total .....            | 20.3 | 22    |
| 5.2 Innovation linkages .....                                       | 45.3 | 19    |
| 5.2.1 University/industry research collaboration <sup>†</sup> ..... | 62.5 | 17    |
| 5.2.2 State of cluster development <sup>†</sup> .....               | 70.3 | 7     |
| 5.2.3 GERD financed by abroad, % .....                              | 0.5  | 92 ○  |
| 5.2.4 JV-strategic alliance deals/bn PPP\$ GDP .....                | 0.0  | 38    |
| 5.2.5 Patent families 2+ offices/bn PPP\$ GDP .....                 | 15.5 | 1 ●   |
| 5.3 Knowledge absorption .....                                      | 54.1 | 8     |
| 5.3.1 Intellectual property payments, % total trade .....           | 2.2  | 9     |
| 5.3.2 High-tech imports less re-imports, % total trade .....        | 14.9 | 15    |
| 5.3.3 ICT services imports, % total trade .....                     | 1.5  | 43    |
| 5.3.4 FDI net inflows, % GDP .....                                  | 0.2  | 122 ○ |
| 5.3.5 Research talent, % in business enterprise .....               | 73.4 | 3 ●   |

**6 Knowledge & technology outputs** ..... **47.1** **12**

|   |      |       |
|---|------|-------|
| 6.1 Knowledge creation .....                                      | 56.7 | 9     |
| 6.1.1 Patents by origin/bn PPP\$ GDP .....                        | 53.4 | 1 ●   |
| 6.1.2 PCT patent applications/bn PPP\$ GDP .....                  | 9.2  | 1 ●   |
| 6.1.3 Utility models by origin/bn PPP\$ GDP .....                 | 1.1  | 22    |
| 6.1.4 Scientific & technical articles/bn PPP\$ GDP .....          | 15.1 | 51    |
| 6.1.5 Citable documents H index .....                             | 71.8 | 6     |
| 6.2 Knowledge impact .....  | 33.2 | 55    |
| 6.2.1 Growth rate of PPP\$ GDP/worker, % .....                    | 0.1  | 85 ○  |
| 6.2.2 New businesses/th pop. 15–64 .....                          | 0.2  | 96 ○  |
| 6.2.3 Computer software spending, % GDP .....                     | 0.3  | 60    |
| 6.2.4 ISO 9001 quality certificates/bn PPP\$ GDP .....            | 9.7  | 37    |
| 6.2.5 High- & medium-high-tech manufactures, % <sup>Ⓜ</sup> ..... | 0.5  | 9     |
| 6.3 Knowledge diffusion .....                                     | 51.6 | 10    |
| 6.3.1 Intellectual property receipts, % total trade .....         | 4.7  | 2 ●   |
| 6.3.2 High-tech exports less re-exports, % total trade .....      | 12.8 | 16    |
| 6.3.3 ICT services exports, % total trade .....                   | 0.4  | 105 ○ |
| 6.3.4 FDI net outflows, % GDP .....                               | 2.9  | 21    |

**7 Creative outputs** ..... **40.8** **36**

|  |      |      |
|--|------|------|
| 7.1 Intangible assets .....  | 52.0 | 30   |
| 7.1.1 Trademarks by origin/bn PPP\$ GDP .....                      | 59.9 | 35   |
| 7.1.2 Industrial designs by origin/bn PPP\$ GDP .....              | 5.1  | 24   |
| 7.1.3 ICTs & business model creation <sup>†</sup> .....            | 71.3 | 29   |
| 7.1.4 ICTs & organizational model creation <sup>†</sup> .....      | 66.3 | 27   |
| 7.2 Creative goods & services .....                                | 34.3 | 21   |
| 7.2.1 Cultural & creative services exports, % of total trade ..... | 0.1  | 55 ○ |
| 7.2.2 National feature films/mn pop. 15–69 .....                   | 6.7  | 26   |
| 7.2.3 Global ent. & media market/th pop. 15–69 .....               | 61.8 | 10   |
| 7.2.4 Printing & publishing manufactures, % <sup>Ⓜ</sup> .....     | 2.1  | 20   |
| 7.2.5 Creative goods exports, % total trade .....                  | 2.2  | 20   |
| 7.3 Online creativity .....  | 25.1 | 50   |
| 7.3.1 Generic top-level domains (TLDs)/th pop. 15–69 .....         | 15.1 | 31   |
| 7.3.2 Country-code TLDs/th pop. 15–69 .....                        | 5.1  | 49   |
| 7.3.3 Wikipedia edits/mn pop. 15–69 .....                          | 5.7  | 47   |
| 7.3.4 Video uploads on YouTube/pop. 15–69 .....                    | 25.3 | 49 ○ |

NOTES: ● indicates a strength; ○ a weakness; \* an index; † a survey question.

Ⓜ indicates that the country's data are older than the base year; see Appendix II for details, including the year of the data, at <http://globalinnovationindex.org>.

Square brackets indicate that the data minimum coverage (DMC) requirements were not met at the sub-pillar or pillar level; see page 181 of this appendix for details.



## Key indicators

|                            |                                  |
|----------------------------|----------------------------------|
| Population (millions)..... | 7.7                              |
| GDP (US\$ billions).....   | 39.5                             |
| GDP per capita, PPP\$..... | 12,122.9                         |
| Income group.....          | Upper-middle income              |
| Region.....                | Northern Africa and Western Asia |

|  | Score 0–100<br>or value (hard data) | Rank      |
|--|-------------------------------------|-----------|
| <b>Global Innovation Index (out of 127).....</b> | <b>30.5</b>                         | <b>83</b> |
| Innovation Output Sub-Index.....                 | 24.0                                | 74        |
| Innovation Input Sub-Index.....                  | 37.1                                | 92        |
| Innovation Efficiency Ratio.....                 | 0.6                                 | 57        |
| Global Innovation Index 2016 (out of 128).....   | 30.0                                | 82        |

|  |             |              |
|--|-------------|--------------|
| <b>1 Institutions.....</b>   | <b>61.6</b> | <b>64</b>    |
| 1.1 Political environment.....   | 47.8        | 73           |
| 1.1.1 Political stability & safety*.....                               | 49.9        | 91           |
| 1.1.2 Government effectiveness*.....                                   | 45.6        | 62           |
| 1.2 Regulatory environment.....  | 74.1        | 36 ●         |
| 1.2.1 Regulatory quality*.....   | 43.3        | 69           |
| 1.2.2 Rule of law*.....  | 52.9        | 44           |
| 1.2.3 Cost of redundancy dismissal, salary weeks.....                  | 8.0         | 1 ●          |
| 1.3 Business environment.....  | 63.0        | 82           |
| 1.3.1 Ease of starting a business*.....                                | 84.6        | 81           |
| 1.3.2 Ease of resolving insolvency*.....                               | 30.4        | 115 ○        |
| 1.3.3 Ease of paying taxes*.....                                       | 73.9        | 64           |
| <b>2 Human capital &amp; research.....</b>                             | <b>26.7</b> | <b>83</b>    |
| 2.1 Education.....   | 32.3        | 105 ○        |
| 2.1.1 Expenditure on education, % GDP.....                             | n/a         | n/a          |
| 2.1.2 Gov't expenditure/pupil, secondary, % GDP/cap <sup>Ⓔ</sup> ..... | 16.5        | 71           |
| 2.1.3 School life expectancy, years <sup>Ⓔ</sup> .....                 | 12.8        | 80           |
| 2.1.4 PISA scales in reading, maths, & science.....                    | 399.0       | 62 ○         |
| 2.1.5 Pupil-teacher ratio, secondary.....                              | n/a         | n/a          |
| 2.2 Tertiary education.....  | 41.2        | 43           |
| 2.2.1 Tertiary enrolment, % gross.....                                 | 44.9        | 59           |
| 2.2.2 Graduates in science & engineering, % <sup>Ⓔ</sup> .....         | 16.1        | 78 ○         |
| 2.2.3 Tertiary inbound mobility, %.....                                | 12.9        | 13 ●         |
| 2.3 Research & development (R&D).....                                  | 6.7         | 68           |
| 2.3.1 Researchers, FTE/mn pop.....                                     | 308.0       | 70           |
| 2.3.2 Gross expenditure on R&D, % GDP <sup>Ⓔ</sup> .....               | 0.4         | 70           |
| 2.3.3 Global R&D companies, avg. expend. top 3, mn \$US.....           | 0.0         | 43 ○         |
| 2.3.4 QS university ranking, average score top 3*.....                 | 13.3        | 58           |
| <b>3 Infrastructure.....</b>   | <b>40.1</b> | <b>87</b>    |
| 3.1 Information & communication technologies (ICTs).....               | 46.1        | 87           |
| 3.1.1 ICT access*.....   | 61.0        | 70           |
| 3.1.2 ICT use*.....  | 32.0        | 83           |
| 3.1.3 Government's online service*.....                                | 45.7        | 91           |
| 3.1.4 E-participation*.....  | 45.8        | 95           |
| 3.2 General infrastructure.....  | 31.0        | 89           |
| 3.2.1 Electricity output, kWh/cap.....                                 | 2,756.4     | 64           |
| 3.2.2 Logistics performance*.....                                      | 41.3        | 66           |
| 3.2.3 Gross capital formation, % GDP.....                              | 19.5        | 88           |
| 3.3 Ecological sustainability.....                                     | 43.0        | 72           |
| 3.3.1 GDP/unit of energy use.....                                      | 9.1         | 60           |
| 3.3.2 Environmental performance*.....                                  | 72.2        | 68           |
| 3.3.3 ISO 14001 environmental certificates/bn PPP\$ GDP.....           | 0.8         | 71           |
| <b>4 Market sophistication.....</b>                                    | <b>32.3</b> | <b>116 ○</b> |
| 4.1 Credit.....  | 11.8        | 124 ○        |
| 4.1.1 Ease of getting credit*.....                                     | 0.0         | 126 ○        |
| 4.1.2 Domestic credit to private sector, % GDP.....                    | 70.3        | 42 ●         |
| 4.1.3 Microfinance gross loans, % GDP.....                             | 0.4         | 36           |

|   |      |       |
|---|------|-------|
| 4.2 Investment.....                                     | 25.6 | 122 ○ |
| 4.2.1 Ease of protecting minority investors*.....       | 35.0 | 121 ○ |
| 4.2.2 Market capitalization, % GDP.....                 | 67.8 | 23 ●  |
| 4.2.3 Venture capital deals/bn PPP\$ GDP.....           | 0.0  | 65    |
| 4.3 Trade, competition, & market scale.....             | 59.5 | 74    |
| 4.3.1 Applied tariff rate, weighted mean, %.....        | 4.0  | 79    |
| 4.3.2 Intensity of local competition <sup>†</sup> ..... | 73.3 | 37 ●  |
| 4.3.3 Domestic market scale, bn PPP\$.....              | 86.2 | 76    |

|   |             |              |
|---|-------------|--------------|
| <b>5 Business sophistication.....</b>                               | <b>24.7</b> | <b>[104]</b> |
| 5.1 Knowledge workers.....  | 0.0         | [127]        |
| 5.1.1 Knowledge-intensive employment, %.....                        | n/a         | n/a          |
| 5.1.2 Firms offering formal training, % firms.....                  | 3.4         | 92 ○         |
| 5.1.3 GERD performed by business, % of GDP.....                     | n/a         | n/a          |
| 5.1.4 GERD financed by business, %.....                             | n/a         | n/a          |
| 5.1.5 Females employed w/advanced degrees, % total.....             | n/a         | n/a          |
| 5.2 Innovation linkages.....  | 34.7        | 45           |
| 5.2.1 University/industry research collaboration <sup>†</sup> ..... | 47.3        | 37 ●         |
| 5.2.2 State of cluster development <sup>†</sup> .....               | 54.7        | 30 ●         |
| 5.2.3 GERD financed by abroad, %.....                               | n/a         | n/a          |
| 5.2.4 JV-strategic alliance deals/bn PPP\$ GDP.....                 | 0.0         | 32 ●         |
| 5.2.5 Patent families 2+ offices/bn PPP\$ GDP.....                  | 0.1         | 65           |
| 5.3 Knowledge absorption.....                                       | 39.3        | [34]         |
| 5.3.1 Intellectual property payments, % total trade.....            | n/a         | n/a          |
| 5.3.2 High-tech imports less re-imports, % total trade.....         | 6.8         | 79           |
| 5.3.3 ICT services imports, % total trade.....                      | n/a         | n/a          |
| 5.3.4 FDI net inflows, % GDP.....                                   | 4.8         | 29 ●         |
| 5.3.5 Research talent, % in business enterprise.....                | n/a         | n/a          |
| <b>6 Knowledge &amp; technology outputs.....</b>                    | <b>19.3</b> | <b>79</b>    |
| 6.1 Knowledge creation.....   | 10.8        | 62           |
| 6.1.1 Patents by origin/bn PPP\$ GDP.....                           | 0.5         | 76           |
| 6.1.2 PCT patent applications/bn PPP\$ GDP.....                     | n/a         | n/a          |
| 6.1.3 Utility models by origin/bn PPP\$ GDP.....                    | n/a         | n/a          |
| 6.1.4 Scientific & technical articles/bn PPP\$ GDP.....             | 16.0        | 46           |
| 6.1.5 Citable documents H index.....                                | 7.8         | 77           |
| 6.2 Knowledge impact.....   | 26.2        | 85           |
| 6.2.1 Growth rate of PPP\$ GDP/worker, %.....                       | 0.4         | 72           |
| 6.2.2 New businesses/th pop. 15–64.....                             | 1.0         | 71           |
| 6.2.3 Computer software spending, % GDP.....                        | 0.3         | 54           |
| 6.2.4 ISO 9001 quality certificates/bn PPP\$ GDP.....               | 4.1         | 69           |
| 6.2.5 High- & medium-high-tech manufactures, % <sup>Ⓔ</sup> .....   | 0.2         | 55           |
| 6.3 Knowledge diffusion.....  | 21.0        | 68           |
| 6.3.1 Intellectual property receipts, % total trade.....            | n/a         | n/a          |
| 6.3.2 High-tech exports less re-exports, % total trade.....         | 0.7         | 73           |
| 6.3.3 ICT services exports, % total trade.....                      | n/a         | n/a          |
| 6.3.4 FDI net outflows, % GDP.....                                  | 0.1         | 92           |
| <b>7 Creative outputs.....</b>                                      | <b>28.6</b> | <b>72</b>    |
| 7.1 Intangible assets.....  | 38.9        | 79           |
| 7.1.1 Trademarks by origin/bn PPP\$ GDP.....                        | 32.9        | 68           |
| 7.1.2 Industrial designs by origin/bn PPP\$ GDP.....                | 0.7         | 73           |
| 7.1.3 ICTs & business model creation <sup>†</sup> .....             | 64.6        | 48           |
| 7.1.4 ICTs & organizational model creation <sup>†</sup> .....       | 53.3        | 64           |
| 7.2 Creative goods & services.....                                  | 17.2        | 68           |
| 7.2.1 Cultural & creative services exports, % of total trade.....   | n/a         | n/a          |
| 7.2.2 National feature films/mn pop. 15–69.....                     | n/a         | n/a          |
| 7.2.3 Global ent. & media market/th pop. 15–69.....                 | 1.7         | 53 ○         |
| 7.2.4 Printing & publishing manufactures, % <sup>Ⓔ</sup> .....      | 1.2         | 51           |
| 7.2.5 Creative goods exports, % total trade.....                    | 1.0         | 42 ●         |
| 7.3 Online creativity.....  | 19.4        | 63           |
| 7.3.1 Generic top-level domains (TLDs)/th pop. 15–69.....           | 6.6         | 49           |
| 7.3.2 Country-code TLDs/th pop. 15–69.....                          | 0.3         | 98 ○         |
| 7.3.3 Wikipedia edits/mn pop. 15–69.....                            | 5.4         | 52           |
| 7.3.4 Video uploads on YouTube/pop. 15–69.....                      | 18.8        | 59 ○         |

NOTES: ● indicates a strength; ○ a weakness; \* an index; † a survey question.

Ⓔ indicates that the country's data are older than the base year; see Appendix II for details, including the year of the data, at <http://globalinnovationindex.org>.

Square brackets indicate that the data minimum coverage (DMC) requirements were not met at the sub-pillar or pillar level; see page 181 of this appendix for details.



## Key indicators

|                             |                           |
|-----------------------------|---------------------------|
| Population (millions) ..... | 17.9                      |
| GDP (US\$ billions) .....   | 128.1                     |
| GDP per capita, PPP\$ ..... | 24,267.9                  |
| Income group .....          | Upper-middle income       |
| Region .....                | Central and Southern Asia |

|   | Score 0–100<br>or value (hard data) | Rank      |
|---|-------------------------------------|-----------|
| <b>Global Innovation Index (out of 127)</b> ..... | <b>31.5</b>                         | <b>78</b> |
| Innovation Output Sub-Index .....                 | 19.8                                | 93        |
| Innovation Input Sub-Index .....                  | 43.2                                | 64        |
| Innovation Efficiency Ratio .....                 | 0.5                                 | 116 ○     |
| Global Innovation Index 2016 (out of 128) .....   | 31.5                                | 75        |

|  |             |           |
|--|-------------|-----------|
| <b>1 Institutions</b> .....                            | <b>66.1</b> | <b>55</b> |
| 1.1 Political environment .....                        | 51.1        | 67        |
| 1.1.1 Political stability & safety* .....              | 61.5        | 69        |
| 1.1.2 Government effectiveness* .....                  | 40.8        | 75        |
| 1.2 Regulatory environment .....                       | 66.9        | 54        |
| 1.2.1 Regulatory quality* .....                        | 41.5        | 71        |
| 1.2.2 Rule of law* .....                               | 28.7        | 83        |
| 1.2.3 Cost of redundancy dismissal, salary weeks ..... | 8.7         | 22 ●      |
| 1.3 Business environment .....                         | 80.2        | 31 ●      |
| 1.3.1 Ease of starting a business* .....               | 91.9        | 38        |
| 1.3.2 Ease of resolving insolvency* .....              | 69.2        | 34 ●      |
| 1.3.3 Ease of paying taxes* .....                      | 79.5        | 51        |

|   |             |           |
|---|-------------|-----------|
| <b>2 Human capital &amp; research</b> .....                       | <b>31.0</b> | <b>71</b> |
| 2.1 Education .....   | 43.4        | 78        |
| 2.1.1 Expenditure on education, % GDP .....                       | 2.8         | 104 ○     |
| 2.1.2 Gov't expenditure/pupil, secondary, % GDP/cap .....         | 19.2        | 56        |
| 2.1.3 School life expectancy, years .....                         | 15.0        | 48        |
| 2.1.4 PISA scales in reading, maths, & science <sup>Ⓐ</sup> ..... | 416.4       | 53        |
| 2.1.5 Pupil-teacher ratio, secondary .....                        | 6.8         | 1 ●       |
| 2.2 Tertiary education .....                                      | 37.7        | 57        |
| 2.2.1 Tertiary enrolment, % gross .....                           | 46.3        | 57        |
| 2.2.2 Graduates in science & engineering, % .....                 | 25.7        | 26 ●      |
| 2.2.3 Tertiary inbound mobility, % .....                          | 2.0         | 68        |
| 2.3 Research & development (R&D) .....                            | 11.9        | 55        |
| 2.3.1 Researchers, FTE/mn pop. <sup>Ⓐ</sup> .....                 | 734.1       | 54        |
| 2.3.2 Gross expenditure on R&D, % GDP <sup>Ⓐ</sup> .....          | 0.2         | 92        |
| 2.3.3 Global R&D companies, avg. expend. top 3, mn \$US .....     | 0.0         | 43 ○      |
| 2.3.4 QS university ranking, average score top 3* .....           | 35.1        | 35 ●      |

|   |             |           |
|---|-------------|-----------|
| <b>3 Infrastructure</b> .....                                 | <b>47.9</b> | <b>60</b> |
| 3.1 Information & communication technologies (ICTs) .....     | 65.8        | 46        |
| 3.1.1 ICT access* .....                                       | 75.6        | 37        |
| 3.1.2 ICT use* .....  | 51.5        | 57        |
| 3.1.3 Government's online service* .....                      | 76.8        | 31 ●      |
| 3.1.4 E-participation* .....                                  | 59.3        | 65        |
| 3.2 General infrastructure .....                              | 41.3        | 49        |
| 3.2.1 Electricity output, kWh/cap .....                       | 6,076.8     | 33 ●      |
| 3.2.2 Logistics performance* .....                            | 31.9        | 77        |
| 3.2.3 Gross capital formation, % GDP .....                    | 28.1        | 28 ●      |
| 3.3 Ecological sustainability .....                           | 36.5        | 94        |
| 3.3.1 GDP/unit of energy use .....                            | 5.1         | 102       |
| 3.3.2 Environmental performance* .....                        | 73.3        | 64        |
| 3.3.3 ISO 14001 environmental certificates/bn PPP\$ GDP ..... | 0.3         | 99        |

|  |             |           |
|--|-------------|-----------|
| <b>4 Market sophistication</b> .....                 | <b>43.2</b> | <b>80</b> |
| 4.1 Credit .....                                     | 23.5        | 105       |
| 4.1.1 Ease of getting credit* .....                  | 55.0        | 67        |
| 4.1.2 Domestic credit to private sector, % GDP ..... | 37.7        | 85        |
| 4.1.3 Microfinance gross loans, % GDP .....          | 0.1         | 59        |

|   |       |      |
|---|-------|------|
| 4.2 Investment .....  | 42.2  | 53   |
| 4.2.1 Ease of protecting minority investors* .....          | 80.0  | 3 ●  |
| 4.2.2 Market capitalization, % GDP .....                    | 18.9  | 62   |
| 4.2.3 Venture capital deals/bn PPP\$ GDP <sup>Ⓐ</sup> ..... | 0.0   | 88 ○ |
| 4.3 Trade, competition, & market scale .....                | 64.0  | 52   |
| 4.3.1 Applied tariff rate, weighted mean, % .....           | 4.7   | 86   |
| 4.3.2 Intensity of local competition <sup>†</sup> .....     | 60.5  | 97   |
| 4.3.3 Domestic market scale, bn PPP\$ .....                 | 460.7 | 39   |

|   |             |           |
|---|-------------|-----------|
| <b>5 Business sophistication</b> .....                                | <b>27.6</b> | <b>87</b> |
| 5.1 Knowledge workers .....   | 38.9        | 58        |
| 5.1.1 Knowledge-intensive employment, % .....                         | 33.3        | 41        |
| 5.1.2 Firms offering formal training, % firms .....                   | 28.3        | 55        |
| 5.1.3 GERD performed by business, % of GDP <sup>Ⓐ</sup> .....         | 0.0         | 70        |
| 5.1.4 GERD financed by business, % <sup>Ⓐ</sup> .....                 | 28.9        | 52        |
| 5.1.5 Females employed w/advanced degrees, % total <sup>Ⓐ</sup> ..... | 17.5        | 29        |
| 5.2 Innovation linkages .....   | 16.5        | 121 ○     |
| 5.2.1 University/industry research collaboration <sup>†</sup> .....   | 40.9        | 63        |
| 5.2.2 State of cluster development <sup>†</sup> .....                 | 33.3        | 109 ○     |
| 5.2.3 GERD financed by abroad, % <sup>Ⓐ</sup> .....                   | 0.8         | 88 ○      |
| 5.2.4 JV-strategic alliance deals/bn PPP\$ GDP .....                  | 0.0         | 78        |
| 5.2.5 Patent families 2+ offices/bn PPP\$ GDP .....                   | 0.2         | 57        |
| 5.3 Knowledge absorption .....  | 27.5        | 89        |
| 5.3.1 Intellectual property payments, % total trade .....             | 0.3         | 75        |
| 5.3.2 High-tech imports less re-imports, % total trade .....          | 7.6         | 69        |
| 5.3.3 ICT services imports, % total trade .....                       | 0.7         | 82        |
| 5.3.4 FDI net inflows, % GDP .....                                    | 3.7         | 43        |
| 5.3.5 Research talent, % in business enterprise .....                 | n/a         | n/a       |

|   |             |           |
|---|-------------|-----------|
| <b>6 Knowledge &amp; technology outputs</b> .....                 | <b>17.8</b> | <b>88</b> |
| 6.1 Knowledge creation .....                                      | 10.7        | 64        |
| 6.1.1 Patents by origin/bn PPP\$ GDP .....                        | 2.9         | 35        |
| 6.1.2 PCT patent applications/bn PPP\$ GDP .....                  | 0.1         | 76        |
| 6.1.3 Utility models by origin/bn PPP\$ GDP .....                 | 1.0         | 26        |
| 6.1.4 Scientific & technical articles/bn PPP\$ GDP .....          | 1.8         | 118 ○     |
| 6.1.5 Citable documents H index .....                             | 3.6         | 107       |
| 6.2 Knowledge impact .....  | 21.9        | 101       |
| 6.2.1 Growth rate of PPP\$ GDP/worker, % .....                    | 1.0         | 57        |
| 6.2.2 New businesses/th pop. 15–64 <sup>Ⓐ</sup> .....             | 1.7         | 50        |
| 6.2.3 Computer software spending, % GDP .....                     | 0.0         | 119 ○     |
| 6.2.4 ISO 9001 quality certificates/bn PPP\$ GDP .....            | 1.1         | 106       |
| 6.2.5 High- & medium-high-tech manufactures, % <sup>Ⓐ</sup> ..... | 0.1         | 67        |
| 6.3 Knowledge diffusion .....                                     | 20.9        | 69        |
| 6.3.1 Intellectual property receipts, % total trade .....         | 0.0         | 101 ○     |
| 6.3.2 High-tech exports less re-exports, % total trade .....      | 5.9         | 30 ●      |
| 6.3.3 ICT services exports, % total trade .....                   | 0.3         | 109 ○     |
| 6.3.4 FDI net outflows, % GDP .....                               | 1.2         | 46        |

|  |             |           |
|--|-------------|-----------|
| <b>7 Creative outputs</b> .....                                    | <b>21.9</b> | <b>95</b> |
| 7.1 Intangible assets .....  | 32.1        | 99        |
| 7.1.1 Trademarks by origin/bn PPP\$ GDP <sup>Ⓐ</sup> .....         | 16.7        | 90        |
| 7.1.2 Industrial designs by origin/bn PPP\$ GDP .....              | 0.2         | 96        |
| 7.1.3 ICTs & business model creation <sup>†</sup> .....            | 54.4        | 85        |
| 7.1.4 ICTs & organizational model creation <sup>†</sup> .....      | 49.2        | 77        |
| 7.2 Creative goods & services .....                                | 5.6         | 107       |
| 7.2.1 Cultural & creative services exports, % of total trade ..... | 0.0         | 77        |
| 7.2.2 National feature films/mn pop. 15–69 .....                   | 1.3         | 73        |
| 7.2.3 Global ent. & media market/th pop. 15–69 .....               | n/a         | n/a       |
| 7.2.4 Printing & publishing manufactures, % <sup>Ⓐ</sup> .....     | 0.7         | 79        |
| 7.2.5 Creative goods exports, % total trade .....                  | 0.2         | 80        |
| 7.3 Online creativity .....  | 17.7        | 72        |
| 7.3.1 Generic top-level domains (TLDs)/th pop. 15–69 .....         | 0.3         | 112 ○     |
| 7.3.2 Country-code TLDs/th pop. 15–69 .....                        | 3.1         | 57        |
| 7.3.3 Wikipedia edits/mn pop. 15–69 .....                          | 5.2         | 56        |
| 7.3.4 Video uploads on YouTube/pop. 15–69 .....                    | n/a         | n/a       |

NOTES: ● indicates a strength; ○ a weakness; \* an index; † a survey question.

Ⓐ indicates that the country's data are older than the base year; see Appendix II for details, including the year of the data, at <http://globalinnovationindex.org>.

Square brackets indicate that the data minimum coverage (DMC) requirements were not met at the sub-pillar or pillar level; see page 181 of this appendix for details.

## Kenya

## Key indicators

|                             |                     |
|-----------------------------|---------------------|
| Population (millions) ..... | 47.3                |
| GDP (US\$ billions) .....   | 69.2                |
| GDP per capita, PPP\$ ..... | 3,207.7             |
| Income group .....          | Lower-middle income |
| Region .....                | Sub-Saharan Africa  |

|   | Score 0–100<br>or value (hard data) | Rank      |
|---|-------------------------------------|-----------|
| <b>Global Innovation Index (out of 127)</b> ..... | <b>31.0</b>                         | <b>80</b> |
| Innovation Output Sub-Index .....                 | 24.7                                | 70        |
| Innovation Input Sub-Index .....                  | 37.2                                | 91        |
| Innovation Efficiency Ratio .....                 | 0.7                                 | 50        |
| Global Innovation Index 2016 (out of 128) .....   | 30.4                                | 80        |

|  |             |              |
|--|-------------|--------------|
| <b>1 Institutions</b> .....  | <b>53.8</b> | <b>84</b>    |
| 1.1 Political environment .....  | 33.7        | 109          |
| 1.1.1 Political stability & safety* .....                              | 32.5        | 118 ○        |
| 1.1.2 Government effectiveness* .....                                  | 34.8        | 87           |
| 1.2 Regulatory environment .....                                       | 64.9        | 63           |
| 1.2.1 Regulatory quality* .....  | 34.6        | 89           |
| 1.2.2 Rule of law* .....   | 25.1        | 91           |
| 1.2.3 Cost of redundancy dismissal, salary weeks .....                 | 8.0         | 1 ●          |
| 1.3 Business environment .....   | 62.7        | 83           |
| 1.3.1 Ease of starting a business* .....                               | 83.1        | 90           |
| 1.3.2 Ease of resolving insolvency* .....                              | 43.4        | 83           |
| 1.3.3 Ease of paying taxes* .....                                      | 61.7        | 90           |
| <b>2 Human capital &amp; research</b> .....                            | <b>14.1</b> | <b>119 ○</b> |
| 2.1 Education .....  | 33.3        | 104          |
| 2.1.1 Expenditure on education, % GDP .....                            | 5.3         | 39           |
| 2.1.2 Gov't expenditure/pupil, secondary, % GDP/cap <sup>Ⓐ</sup> ..... | 24.9        | 31           |
| 2.1.3 School life expectancy, years <sup>Ⓐ</sup> .....                 | 11.1        | 94           |
| 2.1.4 PISA scales in reading, maths, & science .....                   | n/a         | n/a          |
| 2.1.5 Pupil-teacher ratio, secondary <sup>Ⓐ</sup> .....                | 41.1        | 111 ○        |
| 2.2 Tertiary education .....   | 2.9         | [122]        |
| 2.2.1 Tertiary enrolment, % gross <sup>Ⓐ</sup> .....                   | 4.0         | 118 ○        |
| 2.2.2 Graduates in science & engineering, % .....                      | n/a         | n/a          |
| 2.2.3 Tertiary inbound mobility, % .....                               | n/a         | n/a          |
| 2.3 Research & development (R&D) .....                                 | 6.2         | 73           |
| 2.3.1 Researchers, FTE/mn pop. <sup>Ⓐ</sup> .....                      | 230.7       | 73           |
| 2.3.2 Gross expenditure on R&D, % GDP <sup>Ⓐ</sup> .....               | 0.8         | 45           |
| 2.3.3 Global R&D companies, avg. expend. top 3, mn \$US .....          | 0.0         | 43 ○         |
| 2.3.4 QS university ranking, average score top 3* .....                | 4.3         | 73           |
| <b>3 Infrastructure</b> .....  | <b>36.7</b> | <b>97</b>    |
| 3.1 Information & communication technologies (ICTs) .....              | 41.1        | 93           |
| 3.1.1 ICT access* .....  | 35.4        | 103          |
| 3.1.2 ICT use* .....   | 20.5        | 99           |
| 3.1.3 Government's online service* .....                               | 55.8        | 75           |
| 3.1.4 E-participation* .....   | 52.5        | 82           |
| 3.2 General infrastructure .....                                       | 36.5        | 69           |
| 3.2.1 Electricity output, kWh/cap .....                                | 206.4       | 111 ○        |
| 3.2.2 Logistics performance* .....                                     | 58.6        | 41           |
| 3.2.3 Gross capital formation, % GDP .....                             | 22.5        | 59           |
| 3.3 Ecological sustainability .....                                    | 32.5        | 112          |
| 3.3.1 GDP/unit of energy use .....                                     | 5.2         | 101          |
| 3.3.2 Environmental performance* .....                                 | 62.5        | 99           |
| 3.3.3 ISO 14001 environmental certificates/bn PPP\$ GDP .....          | 0.4         | 90           |
| <b>4 Market sophistication</b> .....                                   | <b>48.2</b> | <b>56</b>    |
| 4.1 Credit .....   | 53.0        | 22 ●         |
| 4.1.1 Ease of getting credit* .....                                    | 70.0        | 29           |
| 4.1.2 Domestic credit to private sector, % GDP .....                   | 34.9        | 92           |
| 4.1.3 Microfinance gross loans, % GDP .....                            | 4.3         | 9 ●          |

|   |             |           |
|---|-------------|-----------|
| 4.2 Investment .....  | 33.4        | 93        |
| 4.2.1 Ease of protecting minority investors* .....                              | 53.3        | 80        |
| 4.2.2 Market capitalization, % GDP <sup>Ⓐ</sup> .....                           | 24.3        | 58        |
| 4.2.3 Venture capital deals/bn PPP\$ GDP .....                                  | 0.1         | 29        |
| 4.3 Trade, competition, & market scale .....                                    | 58.3        | 76        |
| 4.3.1 Applied tariff rate, weighted mean, % .....                               | 7.6         | 107       |
| 4.3.2 Intensity of local competition <sup>†</sup> .....                         | 77.2        | 18 ●      |
| 4.3.3 Domestic market scale, bn PPP\$ .....                                     | 152.7       | 67        |
| <b>5 Business sophistication</b> .....  | <b>33.2</b> | <b>62</b> |
| 5.1 Knowledge workers .....   | 26.4        | 95        |
| 5.1.1 Knowledge-intensive employment, % .....                                   | n/a         | n/a       |
| 5.1.2 Firms offering formal training, % firms .....                             | 40.6        | 33        |
| 5.1.3 GERD performed by business, % of GDP <sup>Ⓐ</sup> .....                   | 0.1         | 68        |
| 5.1.4 GERD financed by business, % <sup>Ⓐ</sup> .....                           | 4.3         | 79        |
| 5.1.5 Females employed w/advanced degrees, % total .....                        | n/a         | n/a       |
| 5.2 Innovation linkages .....   | 47.5        | 11 ●      |
| 5.2.1 University/industry research collaboration <sup>†</sup> .....             | 57.6        | 25 ●      |
| 5.2.2 State of cluster development <sup>†</sup> .....                           | 52.6        | 38        |
| 5.2.3 GERD financed by abroad, % <sup>Ⓐ</sup> .....                             | 47.1        | 6 ●       |
| 5.2.4 JV-strategic alliance deals/bn PPP\$ GDP .....                            | 0.0         | 44        |
| 5.2.5 Patent families 2+ offices/bn PPP\$ GDP .....                             | 0.0         | 91        |
| 5.3 Knowledge absorption .....  | 25.7        | 94        |
| 5.3.1 Intellectual property payments, % total trade <sup>Ⓐ</sup> .....          | 1.0         | 34        |
| 5.3.2 High-tech imports less re-imports, % total trade <sup>Ⓐ</sup> .....       | 10.8        | 36 ●      |
| 5.3.3 ICT services imports, % total trade <sup>Ⓐ</sup> .....                    | 0.1         | 120 ○     |
| 5.3.4 FDI net inflows, % GDP .....  | 1.5         | 96        |
| 5.3.5 Research talent, % in business enterprise <sup>Ⓐ</sup> .....              | 11.4        | 64        |
| <b>6 Knowledge &amp; technology outputs</b> .....                               | <b>21.6</b> | <b>63</b> |
| 6.1 Knowledge creation .....  | 11.7        | 59        |
| 6.1.1 Patents by origin/bn PPP\$ GDP .....                                      | 1.0         | 65        |
| 6.1.2 PCT patent applications/bn PPP\$ GDP .....                                | 0.0         | 93 ○      |
| 6.1.3 Utility models by origin/bn PPP\$ GDP .....                               | 0.8         | 30        |
| 6.1.4 Scientific & technical articles/bn PPP\$ GDP .....                        | 11.6        | 61        |
| 6.1.5 Citable documents H index .....   | 14.0        | 52        |
| 6.2 Knowledge impact .....  | 29.6        | 71        |
| 6.2.1 Growth rate of PPP\$ GDP/worker, % .....                                  | 2.8         | 22 ●      |
| 6.2.2 New businesses/th pop. 15–64 .....  | 1.8         | 49        |
| 6.2.3 Computer software spending, % GDP .....                                   | 0.2         | 74        |
| 6.2.4 ISO 9001 quality certificates/bn PPP\$ GDP .....                          | 4.6         | 64        |
| 6.2.5 High- & medium-high-tech manufactures, % <sup>Ⓐ</sup> .....               | 0.1         | 78        |
| 6.3 Knowledge diffusion .....   | 23.5        | 61        |
| 6.3.1 Intellectual property receipts, % total trade <sup>Ⓐ</sup> .....          | 0.4         | 28 ●      |
| 6.3.2 High-tech exports less re-exports, % total trade <sup>Ⓐ</sup> .....       | 0.6         | 79        |
| 6.3.3 ICT services exports, % total trade <sup>Ⓐ</sup> .....                    | 4.3         | 17 ●      |
| 6.3.4 FDI net outflows, % GDP .....   | (0.0)       | 111 ○     |
| <b>7 Creative outputs</b> .....   | <b>27.8</b> | <b>79</b> |
| 7.1 Intangible assets .....   | 40.9        | 71        |
| 7.1.1 Trademarks by origin/bn PPP\$ GDP .....                                   | 32.9        | 67        |
| 7.1.2 Industrial designs by origin/bn PPP\$ GDP .....                           | 0.5         | 78        |
| 7.1.3 ICTs & business model creation <sup>†</sup> .....                         | 67.8        | 37        |
| 7.1.4 ICTs & organizational model creation <sup>†</sup> .....                   | 57.5        | 46        |
| 7.2 Creative goods & services .....   | 22.9        | 49        |
| 7.2.1 Cultural & creative services exports, % of total trade <sup>Ⓐ</sup> ..... | 0.0         | 88 ○      |
| 7.2.2 National feature films/mn pop. 15–69 .....                                | n/a         | n/a       |
| 7.2.3 Global ent. & media market/th pop. 15–69 .....                            | 2.3         | 50        |
| 7.2.4 Printing & publishing manufactures, % <sup>Ⓐ</sup> .....                  | 3.8         | 4 ●       |
| 7.2.5 Creative goods exports, % total trade <sup>Ⓐ</sup> .....                  | 0.3         | 68        |
| 7.3 Online creativity .....   | 6.6         | 106       |
| 7.3.1 Generic top-level domains (TLDs)/th pop. 15–69 .....                      | 1.1         | 93        |
| 7.3.2 Country-code TLDs/th pop. 15–69 .....                                     | 0.7         | 86        |
| 7.3.3 Wikipedia edits/mn pop. 15–69 <sup>Ⓐ</sup> .....                          | 2.4         | 105       |
| 7.3.4 Video uploads on YouTube/pop. 15–69 .....                                 | 1.0         | 70 ○      |

NOTES: ● indicates a strength; ○ a weakness; \* an index; † a survey question.

<sup>Ⓐ</sup> indicates that the country's data are older than the base year; see Appendix II for details, including the year of the data, at <http://globalinnovationindex.org>.

Square brackets indicate that the data minimum coverage (DMC) requirements were not met at the sub-pillar or pillar level; see page 181 of this appendix for details.

## Key indicators

|                            |   |
|----------------------------|---|
| Population (millions)..... | 50.5                                    |
| GDP (US\$ billions).....   | 1,404.4                                 |
| GDP per capita, PPP\$..... | 36,511.0                                |
| Income group.....          | High income                             |
| Region.....                | South East Asia, East Asia, and Oceania |

|  | Score 0–100<br>or value (hard data) | Rank      |
|--|-------------------------------------|-----------|
| <b>Global Innovation Index (out of 127).....</b> | <b>57.7</b>                         | <b>11</b> |
| Innovation Output Sub-Index.....                 | 52.1                                | 9         |
| Innovation Input Sub-Index.....                  | 63.3                                | 16        |
| Innovation Efficiency Ratio.....                 | 0.8                                 | 14        |
| Global Innovation Index 2016 (out of 128).....   | 57.1                                | 11        |

|  |             |            |
|--|-------------|------------|
| <b>1 Institutions.....</b>                                     | <b>74.5</b> | <b>35</b>  |
| 1.1 Political environment.....                                 | 67.4        | 42         |
| 1.1.1 Political stability & safety*.....                       | 66.2        | 55         |
| 1.1.2 Government effectiveness*.....                           | 68.5        | 34         |
| 1.2 Regulatory environment.....                                | 65.5        | 61         |
| 1.2.1 Regulatory quality*.....                                 | 71.7        | 26         |
| 1.2.2 Rule of law*.....  | 67.3        | 30         |
| 1.2.3 Cost of redundancy dismissal, salary weeks.....          | 27.4        | 107 ○      |
| 1.3 Business environment.....                                  | 90.5        | 3 ●        |
| 1.3.1 Ease of starting a business*.....                        | 95.8        | 11         |
| 1.3.2 Ease of resolving insolvency*.....                       | 89.2        | 4 ●        |
| 1.3.3 Ease of paying taxes*.....                               | 86.6        | 21         |
| <b>2 Human capital &amp; research.....</b>                     | <b>66.2</b> | <b>2 ●</b> |
| 2.1 Education.....   | 55.6        | 40         |
| 2.1.1 Expenditure on education, % GDP <sup>Ⓔ</sup> .....       | 4.6         | 62         |
| 2.1.2 Gov't expenditure/pupil, secondary, % GDP/cap.....       | 23.4        | 37         |
| 2.1.3 School life expectancy, years <sup>Ⓔ</sup> .....         | 16.6        | 18         |
| 2.1.4 PISA scales in reading, maths, & science.....            | 519.1       | 7          |
| 2.1.5 Pupil-teacher ratio, secondary <sup>Ⓔ</sup> .....        | 15.6        | 68         |
| 2.2 Tertiary education.....                                    | 54.8        | 15         |
| 2.2.1 Tertiary enrolment, % gross <sup>Ⓔ</sup> .....           | 95.3        | 2 ●        |
| 2.2.2 Graduates in science & engineering, % <sup>Ⓔ</sup> ..... | 31.9        | 8          |
| 2.2.3 Tertiary inbound mobility, % <sup>Ⓔ</sup> .....          | 1.7         | 75 ○       |
| 2.3 Research & development (R&D).....                          | 88.2        | 1 ●        |
| 2.3.1 Researchers, FTE/mn pop.....                             | 7,087.4     | 3 ●        |
| 2.3.2 Gross expenditure on R&D, % GDP.....                     | 4.2         | 2 ●        |
| 2.3.3 Global R&D companies, avg. expend. top 3, mn \$US.....   | 92.8        | 5          |
| 2.3.4 QS university ranking, average score top 3*.....         | 75.7        | 9          |
| <b>3 Infrastructure.....</b>                                   | <b>63.4</b> | <b>13</b>  |
| 3.1 Information & communication technologies (ICTs).....       | 91.6        | 2 ●        |
| 3.1.1 ICT access*.....   | 89.9        | 8          |
| 3.1.2 ICT use*.....  | 85.7        | 3 ●        |
| 3.1.3 Government's online service*.....                        | 94.2        | 5          |
| 3.1.4 E-participation*.....                                    | 96.6        | 4 ●        |
| 3.2 General infrastructure.....                                | 57.6        | 11         |
| 3.2.1 Electricity output, kWh/cap.....                         | 10,756.7    | 11         |
| 3.2.2 Logistics performance*.....                              | 76.5        | 24         |
| 3.2.3 Gross capital formation, % GDP.....                      | 28.9        | 22         |
| 3.3 Ecological sustainability.....                             | 40.9        | 79         |
| 3.3.1 GDP/unit of energy use.....                              | 6.3         | 91 ○       |
| 3.3.2 Environmental performance*.....                          | 70.6        | 73         |
| 3.3.3 ISO 14001 environmental certificates/bn PPP\$ GDP.....   | 2.9         | 37         |
| <b>4 Market sophistication.....</b>                            | <b>61.6</b> | <b>14</b>  |
| 4.1 Credit.....  | 60.6        | 13         |
| 4.1.1 Ease of getting credit*.....                             | 65.0        | 40         |
| 4.1.2 Domestic credit to private sector, % GDP.....            | 140.6       | 11         |
| 4.1.3 Microfinance gross loans, % GDP.....                     | n/a         | n/a        |

|   |         |      |
|---|---------|------|
| 4.2 Investment.....                                     | 47.6    | 32   |
| 4.2.1 Ease of protecting minority investors*.....       | 73.3    | 13   |
| 4.2.2 Market capitalization, % GDP.....                 | 89.4    | 12   |
| 4.2.3 Venture capital deals/bn PPP\$ GDP.....           | 0.0     | 53   |
| 4.3 Trade, competition, & market scale.....             | 76.5    | 18   |
| 4.3.1 Applied tariff rate, weighted mean, %.....        | 4.8     | 88 ○ |
| 4.3.2 Intensity of local competition <sup>†</sup> ..... | 81.9    | 7    |
| 4.3.3 Domestic market scale, bn PPP\$.....              | 1,928.6 | 13   |

**5 Business sophistication..... 51.1 17**

|   |      |       |
|---|------|-------|
| 5.1 Knowledge workers.....  | 61.3 | 22    |
| 5.1.1 Knowledge-intensive employment, %.....                        | 21.4 | 68 ○  |
| 5.1.2 Firms offering formal training, % firms.....                  | n/a  | n/a   |
| 5.1.3 GERD performed by business, % of GDP.....                     | 3.3  | 2 ●   |
| 5.1.4 GERD financed by business, %.....                             | 74.5 | 3 ●   |
| 5.1.5 Females employed w/advanced degrees, % total.....             | 16.2 | 35    |
| 5.2 Innovation linkages.....  | 41.0 | 28    |
| 5.2.1 University/industry research collaboration <sup>†</sup> ..... | 56.0 | 28    |
| 5.2.2 State of cluster development <sup>†</sup> .....               | 58.6 | 27    |
| 5.2.3 GERD financed by abroad, %.....                               | 0.8  | 89 ○  |
| 5.2.4 JV-strategic alliance deals/bn PPP\$ GDP.....                 | 0.0  | 43    |
| 5.2.5 Patent families 2+ offices/bn PPP\$ GDP.....                  | 16.3 | 1 ●   |
| 5.3 Knowledge absorption.....                                       | 50.9 | 12    |
| 5.3.1 Intellectual property payments, % total trade.....            | 1.7  | 17    |
| 5.3.2 High-tech imports less re-imports, % total trade.....         | 15.2 | 14    |
| 5.3.3 ICT services imports, % total trade.....                      | 0.5  | 100 ○ |
| 5.3.4 FDI net inflows, % GDP.....                                   | 0.7  | 111 ○ |
| 5.3.5 Research talent, % in business enterprise.....                | 79.7 | 2 ●   |

**6 Knowledge & technology outputs..... 54.7 6**

|   |      |      |
|---|------|------|
| 6.1 Knowledge creation.....                                 | 80.4 | 2 ●  |
| 6.1.1 Patents by origin/bn PPP\$ GDP.....                   | 90.3 | 1 ●  |
| 6.1.2 PCT patent applications/bn PPP\$ GDP.....             | 8.1  | 1 ●  |
| 6.1.3 Utility models by origin/bn PPP\$ GDP.....            | 4.5  | 1 ●  |
| 6.1.4 Scientific & technical articles/bn PPP\$ GDP.....     | 29.2 | 25   |
| 6.1.5 Citable documents H index.....                        | 41.8 | 19   |
| 6.2 Knowledge impact.....                                   | 38.8 | 38   |
| 6.2.1 Growth rate of PPP\$ GDP/worker, %.....               | 1.3  | 48   |
| 6.2.2 New businesses/th pop. 15–64.....                     | 2.3  | 45   |
| 6.2.3 Computer software spending, % GDP.....                | 0.3  | 50   |
| 6.2.4 ISO 9001 quality certificates/bn PPP\$ GDP.....       | 6.5  | 55   |
| 6.2.5 High- & medium-high-tech manufactures, %.....         | 0.5  | 8    |
| 6.3 Knowledge diffusion.....                                | 45.0 | 13   |
| 6.3.1 Intellectual property receipts, % total trade.....    | 1.0  | 14   |
| 6.3.2 High-tech exports less re-exports, % total trade..... | 24.8 | 5    |
| 6.3.3 ICT services exports, % total trade.....              | 0.6  | 94 ○ |
| 6.3.4 FDI net outflows, % GDP.....                          | 2.1  | 30   |

**7 Creative outputs..... 49.4 15**

|   |       |      |
|---|-------|------|
| 7.1 Intangible assets.....  | 70.4  | 3 ●  |
| 7.1.1 Trademarks by origin/bn PPP\$ GDP.....                                    | 103.3 | 14   |
| 7.1.2 Industrial designs by origin/bn PPP\$ GDP.....                            | 35.6  | 1 ●  |
| 7.1.3 ICTs & business model creation <sup>†</sup> .....                         | 76.7  | 18   |
| 7.1.4 ICTs & organizational model creation <sup>†</sup> .....                   | 66.8  | 26   |
| 7.2 Creative goods & services.....  | 28.0  | 35   |
| 7.2.1 Cultural & creative services exports, % of total trade <sup>Ⓔ</sup> ..... | 0.3   | 42   |
| 7.2.2 National feature films/mn pop. 15–69.....                                 | 6.9   | 24   |
| 7.2.3 Global ent. & media market/th pop. 15–69.....                             | 47.1  | 19   |
| 7.2.4 Printing & publishing manufactures, %.....                                | 0.3   | 97 ○ |
| 7.2.5 Creative goods exports, % total trade.....                                | 3.1   | 16   |
| 7.3 Online creativity.....  | 28.8  | 40   |
| 7.3.1 Generic top-level domains (TLDs)/th pop. 15–69.....                       | 8.2   | 43   |
| 7.3.2 Country-code TLDs/th pop. 15–69.....                                      | 8.0   | 42   |
| 7.3.3 Wikipedia edits/mn pop. 15–69.....  | 5.6   | 50   |
| 7.3.4 Video uploads on YouTube/pop. 15–69.....                                  | 45.4  | 21   |

NOTES: ● indicates a strength; ○ a weakness; \* an index; † a survey question.

Ⓔ indicates that the country's data are older than the base year; see Appendix II for details, including the year of the data, at <http://globalinnovationindex.org>.

Square brackets indicate that the data minimum coverage (DMC) requirements were not met at the sub-pillar or pillar level; see page 181 of this appendix for details.

## Key indicators

|                            |                                  |
|----------------------------|----------------------------------|
| Population (millions)..... | 4.0                              |
| GDP (US\$ billions).....   | 110.5                            |
| GDP per capita, PPP\$..... | 70,166.0                         |
| Income group.....          | High income                      |
| Region.....                | Northern Africa and Western Asia |

|  | Score 0–100<br>or value (hard data) | Rank      |
|--|-------------------------------------|-----------|
| <b>Global Innovation Index (out of 127).....</b> | <b>36.1</b>                         | <b>56</b> |
| Innovation Output Sub-Index.....                 | 31.9                                | 45        |
| Innovation Input Sub-Index.....                  | 40.3                                | 80        |
| Innovation Efficiency Ratio.....                 | 0.8                                 | 18 ●      |
| Global Innovation Index 2016 (out of 128).....   | 33.6                                | 67        |

|   |             |           |
|---|-------------|-----------|
| <b>1 Institutions.....</b>                            | <b>55.8</b> | <b>76</b> |
| 1.1 Political environment.....                        | 51.4        | 66        |
| 1.1.1 Political stability & safety*.....              | 61.2        | 71        |
| 1.1.2 Government effectiveness*.....                  | 41.5        | 71        |
| 1.2 Regulatory environment.....                       | 49.7        | 100       |
| 1.2.1 Regulatory quality*.....                        | 38.1        | 77        |
| 1.2.2 Rule of law*.....                               | 40.4        | 58        |
| 1.2.3 Cost of redundancy dismissal, salary weeks..... | 28.1        | 113 ○     |
| 1.3 Business environment.....                         | 66.3        | 74        |
| 1.3.1 Ease of starting a business*.....               | 66.8        | 121 ○     |
| 1.3.2 Ease of resolving insolvency*.....              | 39.6        | 96        |
| 1.3.3 Ease of paying taxes*.....                      | 92.5        | 6 ●       |

|  |             |           |
|--|-------------|-----------|
| <b>2 Human capital &amp; research.....</b>                   | <b>31.3</b> | <b>68</b> |
| 2.1 Education.....   | 48.0        | 61        |
| 2.1.1 Expenditure on education, % GDP.....                   | n/a         | n/a       |
| 2.1.2 Gov't expenditure/pupil, secondary, % GDP/cap.....     | 17.6        | 65        |
| 2.1.3 School life expectancy, years <sup>Ⓐ</sup> .....       | 13.2        | 68        |
| 2.1.4 PISA scales in reading, maths, & science.....          | n/a         | n/a       |
| 2.1.5 Pupil-teacher ratio, secondary.....                    | 7.2         | 3 ●       |
| 2.2 Tertiary education.....                                  | 42.6        | 41        |
| 2.2.1 Tertiary enrolment, % gross <sup>Ⓐ</sup> .....         | 27.0        | 86        |
| 2.2.2 Graduates in science & engineering, %.....             | 26.7        | 21 ●      |
| 2.2.3 Tertiary inbound mobility, %.....                      | n/a         | n/a       |
| 2.3 Research & development (R&D).....                        | 3.4         | 86        |
| 2.3.1 Researchers, FTE/mn pop. <sup>Ⓐ</sup> .....            | 128.4       | 83        |
| 2.3.2 Gross expenditure on R&D, % GDP <sup>Ⓐ</sup> .....     | 0.3         | 80        |
| 2.3.3 Global R&D companies, avg. expend. top 3, mn \$US..... | 0.0         | 43 ○      |
| 2.3.4 QS university ranking, average score top 3*.....       | 5.3         | 70        |

|  |             |           |
|--|-------------|-----------|
| <b>3 Infrastructure.....</b>                                 | <b>51.4</b> | <b>49</b> |
| 3.1 Information & communication technologies (ICTs).....     | 66.3        | 45        |
| 3.1.1 ICT access*.....                                       | 74.0        | 39        |
| 3.1.2 ICT use*.....  | 61.5        | 36 ●      |
| 3.1.3 Government's online service*.....                      | 65.2        | 53        |
| 3.1.4 E-participation*.....                                  | 64.4        | 54        |
| 3.2 General infrastructure.....                              | 50.9        | 23 ●      |
| 3.2.1 Electricity output, kWh/cap.....                       | 17,370.7    | 6 ●       |
| 3.2.2 Logistics performance*.....                            | 50.3        | 52        |
| 3.2.3 Gross capital formation, % GDP.....                    | 23.5        | 52        |
| 3.3 Ecological sustainability.....                           | 36.9        | 92        |
| 3.3.1 GDP/unit of energy use.....                            | 7.6         | 76        |
| 3.3.2 Environmental performance*.....                        | 64.4        | 95        |
| 3.3.3 ISO 14001 environmental certificates/bn PPP\$ GDP..... | 0.3         | 93        |

|   |             |           |
|---|-------------|-----------|
| <b>4 Market sophistication.....</b>                 | <b>47.8</b> | <b>58</b> |
| 4.1 Credit.....                                     | 39.6        | 51        |
| 4.1.1 Ease of getting credit*.....                  | 40.0        | 98        |
| 4.1.2 Domestic credit to private sector, % GDP..... | 98.6        | 27 ●      |
| 4.1.3 Microfinance gross loans, % GDP.....          | n/a         | n/a       |

|   |       |      |
|---|-------|------|
| 4.2 Investment.....   | 37.0  | 79   |
| 4.2.1 Ease of protecting minority investors*.....           | 55.0  | 75   |
| 4.2.2 Market capitalization, % GDP.....                     | n/a   | n/a  |
| 4.2.3 Venture capital deals/bn PPP\$ GDP <sup>Ⓐ</sup> ..... | 0.0   | 87 ○ |
| 4.3 Trade, competition, & market scale.....                 | 66.8  | 47   |
| 4.3.1 Applied tariff rate, weighted mean, %.....            | 3.0   | 68   |
| 4.3.2 Intensity of local competition <sup>†</sup> .....     | 70.2  | 58   |
| 4.3.3 Domestic market scale, bn PPP\$.....                  | 301.1 | 50   |

|   |             |            |          |
|---|-------------|------------|----------|
| <b>5 Business sophistication.....</b>                               | <b>15.2</b> | <b>127</b> | <b>○</b> |
| 5.1 Knowledge workers.....  | 1.7         | [126]      |          |
| 5.1.1 Knowledge-intensive employment, %.....                        | n/a         | n/a        |          |
| 5.1.2 Firms offering formal training, % firms.....                  | n/a         | n/a        |          |
| 5.1.3 GERD performed by business, % of GDP.....                     | n/a         | n/a        |          |
| 5.1.4 GERD financed by business, % <sup>Ⓐ</sup> .....               | 1.4         | 86 ○       |          |
| 5.1.5 Females employed w/advanced degrees, % total.....             | n/a         | n/a        |          |
| 5.2 Innovation linkages.....  | 19.6        | 110        |          |
| 5.2.1 University/industry research collaboration <sup>†</sup> ..... | 27.3        | 113 ○      |          |
| 5.2.2 State of cluster development <sup>†</sup> .....               | 49.1        | 46         |          |
| 5.2.3 GERD financed by abroad, % <sup>Ⓐ</sup> .....                 | 1.2         | 84         |          |
| 5.2.4 JV-strategic alliance deals/bn PPP\$ GDP.....                 | 0.0         | 55         |          |
| 5.2.5 Patent families 2+ offices/bn PPP\$ GDP.....                  | 0.0         | 102        |          |
| 5.3 Knowledge absorption.....                                       | 24.4        | 100        |          |
| 5.3.1 Intellectual property payments, % total trade.....            | n/a         | n/a        |          |
| 5.3.2 High-tech imports less re-imports, % total trade.....         | 6.4         | 92         |          |
| 5.3.3 ICT services imports, % total trade.....                      | 0.6         | 90         |          |
| 5.3.4 FDI net inflows, % GDP.....                                   | 0.5         | 117 ○      |          |
| 5.3.5 Research talent, % in business enterprise.....                | n/a         | n/a        |          |

|   |             |           |
|---|-------------|-----------|
| <b>6 Knowledge &amp; technology outputs.....</b>                  | <b>29.7</b> | <b>41</b> |
| 6.1 Knowledge creation.....                                       | 3.5         | 106       |
| 6.1.1 Patents by origin/bn PPP\$ GDP.....                         | 0.0         | 123 ○     |
| 6.1.2 PCT patent applications/bn PPP\$ GDP.....                   | n/a         | n/a       |
| 6.1.3 Utility models by origin/bn PPP\$ GDP.....                  | n/a         | n/a       |
| 6.1.4 Scientific & technical articles/bn PPP\$ GDP.....           | 2.6         | 115 ○     |
| 6.1.5 Citable documents H index.....                              | 7.4         | 80        |
| 6.2 Knowledge impact.....   | 24.2        | 92        |
| 6.2.1 Growth rate of PPP\$ GDP/worker, %.....                     | (1.3)       | 100 ○     |
| 6.2.2 New businesses/th pop. 15–64.....                           | n/a         | n/a       |
| 6.2.3 Computer software spending, % GDP.....                      | 0.4         | 21 ●      |
| 6.2.4 ISO 9001 quality certificates/bn PPP\$ GDP.....             | 1.2         | 104       |
| 6.2.5 High- & medium-high-tech manufactures, % <sup>Ⓐ</sup> ..... | 0.1         | 69        |
| 6.3 Knowledge diffusion.....                                      | 61.6        | 6 ●       |
| 6.3.1 Intellectual property receipts, % total trade.....          | n/a         | n/a       |
| 6.3.2 High-tech exports less re-exports, % total trade.....       | 0.3         | 96        |
| 6.3.3 ICT services exports, % total trade.....                    | 4.9         | 12 ●      |
| 6.3.4 FDI net outflows, % GDP.....                                | 7.5         | 1 ●       |

|   |             |           |
|---|-------------|-----------|
| <b>7 Creative outputs.....</b>                                    | <b>34.1</b> | <b>55</b> |
| 7.1 Intangible assets.....  | 50.2        | 37        |
| 7.1.1 Trademarks by origin/bn PPP\$ GDP.....                      | n/a         | n/a       |
| 7.1.2 Industrial designs by origin/bn PPP\$ GDP.....              | n/a         | n/a       |
| 7.1.3 ICTs & business model creation <sup>†</sup> .....           | 53.4        | 89        |
| 7.1.4 ICTs & organizational model creation <sup>†</sup> .....     | 47.0        | 85        |
| 7.2 Creative goods & services.....                                | 10.0        | 90        |
| 7.2.1 Cultural & creative services exports, % of total trade..... | n/a         | n/a       |
| 7.2.2 National feature films/mn pop. 15–69.....                   | n/a         | n/a       |
| 7.2.3 Global ent. & media market/th pop. 15–69.....               | 10.7        | 35        |
| 7.2.4 Printing & publishing manufactures, % <sup>Ⓐ</sup> .....    | 0.6         | 84        |
| 7.2.5 Creative goods exports, % total trade.....                  | 0.4         | 62        |
| 7.3 Online creativity.....  | 25.9        | 46        |
| 7.3.1 Generic top-level domains (TLDs)/th pop. 15–69.....         | 8.1         | 44        |
| 7.3.2 Country-code TLDs/th pop. 15–69.....                        | 0.4         | 93        |
| 7.3.3 Wikipedia edits/mn pop. 15–69 <sup>Ⓐ</sup> .....            | 5.1         | 58        |
| 7.3.4 Video uploads on YouTube/pop. 15–69.....                    | 45.8        | 20 ●      |

NOTES: ● indicates a strength; ○ a weakness; \* an index; † a survey question.

<sup>Ⓐ</sup> indicates that the country's data are older than the base year; see Appendix II for details, including the year of the data, at <http://globalinnovationindex.org>.

Square brackets indicate that the data minimum coverage (DMC) requirements were not met at the sub-pillar or pillar level; see page 181 of this appendix for details.

## Key indicators

|                            |                           |
|----------------------------|---------------------------|
| Population (millions)..... | 6.0                       |
| GDP (US\$ billions).....   | 5.8                       |
| GDP per capita, PPP\$..... | 3,362.6                   |
| Income group.....          | Lower-middle income       |
| Region.....                | Central and Southern Asia |

|  | Score 0–100<br>or value (hard data) | Rank      |
|--|-------------------------------------|-----------|
| <b>Global Innovation Index (out of 127).....</b> | <b>28.0</b>                         | <b>95</b> |
| Innovation Output Sub-Index.....                 | 17.9                                | 104       |
| Innovation Input Sub-Index.....                  | 38.2                                | 86        |
| Innovation Efficiency Ratio.....                 | 0.5                                 | 114       |
| Global Innovation Index 2016 (out of 128).....   | 26.6                                | 103       |

**1 Institutions.....47.6 102**

|   |      |       |
|---|------|-------|
| 1.1 Political environment.....                        | 30.8 | 116   |
| 1.1.1 Political stability & safety*.....              | 42.7 | 103   |
| 1.1.2 Government effectiveness*.....                  | 19.0 | 117   |
| 1.2 Regulatory environment.....                       | 50.9 | 95    |
| 1.2.1 Regulatory quality*.....                        | 30.2 | 97    |
| 1.2.2 Rule of law*.....                               | 10.3 | 119 ○ |
| 1.2.3 Cost of redundancy dismissal, salary weeks..... | 17.3 | 71    |
| 1.3 Business environment.....                         | 61.2 | 92    |
| 1.3.1 Ease of starting a business*.....               | 93.0 | 27 ●  |
| 1.3.2 Ease of resolving insolvency*.....              | 34.1 | 108   |
| 1.3.3 Ease of paying taxes*.....                      | 56.4 | 102   |

**2 Human capital & research.....30.6 74**

|  |      |      |
|--|------|------|
| 2.1 Education.....   | 58.0 | 32 ● |
| 2.1.1 Expenditure on education, % GDP.....                   | 5.5  | 31 ● |
| 2.1.2 Gov't expenditure/pupil, secondary, % GDP/cap.....     | n/a  | n/a  |
| 2.1.3 School life expectancy, years.....                     | 13.1 | 72   |
| 2.1.4 PISA scales in reading, maths, & science.....          | n/a  | n/a  |
| 2.1.5 Pupil-teacher ratio, secondary <sup>Ⓢ</sup> .....      | 12.4 | 45   |
| 2.2 Tertiary education.....                                  | 32.8 | 73   |
| 2.2.1 Tertiary enrolment, % gross <sup>Ⓢ</sup> .....         | 45.9 | 58   |
| 2.2.2 Graduates in science & engineering, %.....             | 18.3 | 67   |
| 2.2.3 Tertiary inbound mobility, % <sup>Ⓢ</sup> .....        | 4.5  | 41   |
| 2.3 Research & development (R&D).....                        | 0.8  | 106  |
| 2.3.1 Researchers, FTE/mn pop.....                           | n/a  | n/a  |
| 2.3.2 Gross expenditure on R&D, % GDP.....                   | 0.1  | 100  |
| 2.3.3 Global R&D companies, avg. expend. top 3, mn \$US..... | 0.0  | 43 ○ |
| 2.3.4 QS university ranking, average score top 3*.....       | 0.0  | 75 ○ |

**3 Infrastructure.....38.2 94**

|  |         |       |
|--|---------|-------|
| 3.1 Information & communication technologies (ICTs).....                   | 41.8    | 92    |
| 3.1.1 ICT access*.....   | 42.5    | 97    |
| 3.1.2 ICT use*.....  | 22.5    | 95    |
| 3.1.3 Government's online service*.....                                    | 42.8    | 96    |
| 3.1.4 E-participation*.....  | 59.3    | 65    |
| 3.2 General infrastructure.....  | 37.2    | 64    |
| 3.2.1 Electricity output, kWh/cap.....                                     | 2,499.5 | 71    |
| 3.2.2 Logistics performance*.....  | 4.3     | 123 ○ |
| 3.2.3 Gross capital formation, % GDP.....                                  | 33.4    | 11 ●  |
| 3.3 Ecological sustainability.....   | 35.7    | 100   |
| 3.3.1 GDP/unit of energy use.....  | 4.8     | 106   |
| 3.3.2 Environmental performance*.....                                      | 73.1    | 65    |
| 3.3.3 ISO 14001 environmental certificates/bn PPP\$ GDP <sup>Ⓢ</sup> ..... | 0.1     | 122 ○ |

**4 Market sophistication.....46.9 61**

|   |      |      |
|---|------|------|
| 4.1 Credit.....                                     | 50.7 | 27 ● |
| 4.1.1 Ease of getting credit*.....                  | 70.0 | 29 ● |
| 4.1.2 Domestic credit to private sector, % GDP..... | 23.0 | 107  |
| 4.1.3 Microfinance gross loans, % GDP.....          | 4.2  | 11 ● |

|   |      |       |
|---|------|-------|
| 4.2 Investment.....                                     | 42.6 | 52    |
| 4.2.1 Ease of protecting minority investors*.....       | 63.3 | 41    |
| 4.2.2 Market capitalization, % GDP <sup>Ⓢ</sup> .....   | 2.5  | 84 ○  |
| 4.2.3 Venture capital deals/bn PPP\$ GDP.....           | n/a  | n/a   |
| 4.3 Trade, competition, & market scale.....             | 47.4 | 109   |
| 4.3.1 Applied tariff rate, weighted mean, %.....        | 2.7  | 62    |
| 4.3.2 Intensity of local competition <sup>†</sup> ..... | 52.5 | 121 ○ |
| 4.3.3 Domestic market scale, bn PPP\$.....              | 21.0 | 119 ○ |

**5 Business sophistication.....27.5 89**

|  |      |      |
|--|------|------|
| 5.1 Knowledge workers.....   | 36.3 | 70   |
| 5.1.1 Knowledge-intensive employment, %.....                           | 18.3 | 78   |
| 5.1.2 Firms offering formal training, % firms.....                     | 62.7 | 6 ●  |
| 5.1.3 GERD performed by business, % of GDP.....                        | 0.0  | 79   |
| 5.1.4 GERD financed by business, %.....                                | 2.2  | 83   |
| 5.1.5 Females employed w/advanced degrees, % total <sup>Ⓢ</sup> .....  | 10.8 | 61   |
| 5.2 Innovation linkages.....   | 17.5 | 118  |
| 5.2.1 University/industry research collaboration <sup>†</sup> .....    | 28.5 | 109  |
| 5.2.2 State of cluster development <sup>†</sup> .....                  | 32.7 | 112  |
| 5.2.3 GERD financed by abroad, %.....                                  | 1.0  | 87   |
| 5.2.4 JV-strategic alliance deals/bn PPP\$ GDP.....                    | 0.1  | 19 ● |
| 5.2.5 Patent families 2+ offices/bn PPP\$ GDP.....                     | 0.1  | 80   |
| 5.3 Knowledge absorption.....  | 28.7 | 84   |
| 5.3.1 Intellectual property payments, % total trade <sup>Ⓢ</sup> ..... | 0.1  | 95   |
| 5.3.2 High-tech imports less re-imports, % total trade.....            | 6.5  | 85   |
| 5.3.3 ICT services imports, % total trade.....                         | 0.6  | 91   |
| 5.3.4 FDI net inflows, % GDP.....                                      | 10.3 | 8 ●  |
| 5.3.5 Research talent, % in business enterprise.....                   | n/a  | n/a  |

**6 Knowledge & technology outputs.....18.3 87**

|  |      |       |
|--|------|-------|
| 6.1 Knowledge creation.....  | 12.2 | 58    |
| 6.1.1 Patents by origin/bn PPP\$ GDP.....                              | 6.4  | 19 ●  |
| 6.1.2 PCT patent applications/bn PPP\$ GDP <sup>Ⓢ</sup> .....          | 0.0  | 79    |
| 6.1.3 Utility models by origin/bn PPP\$ GDP.....                       | 0.7  | 32    |
| 6.1.4 Scientific & technical articles/bn PPP\$ GDP.....                | 5.6  | 95    |
| 6.1.5 Citable documents H index.....                                   | 1.5  | 122 ○ |
| 6.2 Knowledge impact.....  | 23.9 | 94    |
| 6.2.1 Growth rate of PPP\$ GDP/worker, %.....                          | 2.6  | 29 ●  |
| 6.2.2 New businesses/th pop. 15–64.....                                | 1.1  | 67    |
| 6.2.3 Computer software spending, % GDP.....                           | 0.1  | 90    |
| 6.2.4 ISO 9001 quality certificates/bn PPP\$ GDP.....                  | 0.0  | 126 ○ |
| 6.2.5 High- & medium-high-tech manufactures, % <sup>Ⓢ</sup> .....      | 0.0  | 95    |
| 6.3 Knowledge diffusion.....   | 18.7 | 92    |
| 6.3.1 Intellectual property receipts, % total trade <sup>Ⓢ</sup> ..... | 0.0  | 77    |
| 6.3.2 High-tech exports less re-exports, % total trade.....            | 1.2  | 67    |
| 6.3.3 ICT services exports, % total trade.....                         | 0.7  | 93    |
| 6.3.4 FDI net outflows, % GDP.....                                     | 1.2  | 44    |

**7 Creative outputs.....17.4 111**

|   |      |       |
|---|------|-------|
| 7.1 Intangible assets.....  | 25.7 | 121 ○ |
| 7.1.1 Trademarks by origin/bn PPP\$ GDP.....                      | 16.8 | 89    |
| 7.1.2 Industrial designs by origin/bn PPP\$ GDP.....              | 1.0  | 60    |
| 7.1.3 ICTs & business model creation <sup>†</sup> .....           | 41.1 | 118 ○ |
| 7.1.4 ICTs & organizational model creation <sup>†</sup> .....     | 38.0 | 111   |
| 7.2 Creative goods & services.....                                | 4.3  | 112   |
| 7.2.1 Cultural & creative services exports, % of total trade..... | n/a  | n/a   |
| 7.2.2 National feature films/mn pop. 15–69 <sup>Ⓢ</sup> .....     | 0.5  | 91    |
| 7.2.3 Global ent. & media market/th pop. 15–69.....               | n/a  | n/a   |
| 7.2.4 Printing & publishing manufactures, % <sup>Ⓢ</sup> .....    | 0.7  | 83    |
| 7.2.5 Creative goods exports, % total trade.....                  | 0.1  | 98    |
| 7.3 Online creativity.....  | 14.0 | 82    |
| 7.3.1 Generic top-level domains (TLDs)/th pop. 15–69.....         | 0.2  | 114   |
| 7.3.2 Country-code TLDs/th pop. 15–69.....                        | 0.4  | 92    |
| 7.3.3 Wikipedia edits/mn pop. 15–69 <sup>Ⓢ</sup> .....            | 4.3  | 73    |
| 7.3.4 Video uploads on YouTube/pop. 15–69.....                    | n/a  | n/a   |

NOTES: ● indicates a strength; ○ a weakness; \* an index; † a survey question.

Ⓢ indicates that the country's data are older than the base year; see Appendix II for details, including the year of the data, at <http://globalinnovationindex.org>.

Square brackets indicate that the data minimum coverage (DMC) requirements were not met at the sub-pillar or pillar level; see page 181 of this appendix for details.



## Key indicators

|                            |             |
|----------------------------|-------------|
| Population (millions)..... | 2.0         |
| GDP (US\$ billions).....   | 27.9        |
| GDP per capita, PPP\$..... | 24,712.2    |
| Income group.....          | High income |
| Region.....                | Europe      |

|  | Score 0–100<br>or value (hard data) | Rank      |
|--|-------------------------------------|-----------|
| <b>Global Innovation Index (out of 127).....</b> | <b>44.6</b>                         | <b>33</b> |
| Innovation Output Sub-Index.....                 | 38.0                                | 33        |
| Innovation Input Sub-Index.....                  | 51.3                                | 35        |
| Innovation Efficiency Ratio.....                 | 0.7                                 | 26        |
| Global Innovation Index 2016 (out of 128).....   | 44.3                                | 34        |

**1 Institutions.....77.8 28**

|   |      |      |
|---|------|------|
| 1.1 Political environment.....                        | 72.6 | 35   |
| 1.1.1 Political stability & safety*.....              | 74.8 | 42   |
| 1.1.2 Government effectiveness*.....                  | 70.4 | 27   |
| 1.2 Regulatory environment.....                       | 78.1 | 29   |
| 1.2.1 Regulatory quality*.....                        | 69.9 | 30   |
| 1.2.2 Rule of law*.....                               | 62.4 | 36   |
| 1.2.3 Cost of redundancy dismissal, salary weeks..... | 13.0 | 47   |
| 1.3 Business environment.....                         | 82.6 | 26   |
| 1.3.1 Ease of starting a business*.....               | 94.2 | 20   |
| 1.3.2 Ease of resolving insolvency*.....              | 64.0 | 41   |
| 1.3.3 Ease of paying taxes*.....                      | 89.8 | 14 ● |

**2 Human capital & research.....35.2 52**

|  |         |      |
|--|---------|------|
| 2.1 Education.....   | 57.2    | 35   |
| 2.1.1 Expenditure on education, % GDP.....                   | 4.9     | 57   |
| 2.1.2 Gov't expenditure/pupil, secondary, % GDP/cap.....     | 25.5    | 28   |
| 2.1.3 School life expectancy, years.....                     | 16.1    | 29   |
| 2.1.4 PISA scales in reading, maths, & science.....          | 486.8   | 30   |
| 2.1.5 Pupil-teacher ratio, secondary <sup>Ⓐ</sup> .....      | 8.2     | 10 ● |
| 2.2 Tertiary education.....                                  | 37.7    | 56   |
| 2.2.1 Tertiary enrolment, % gross <sup>Ⓐ</sup> .....         | 67.0    | 32   |
| 2.2.2 Graduates in science & engineering, %.....             | 17.9    | 68 ○ |
| 2.2.3 Tertiary inbound mobility, % <sup>Ⓐ</sup> .....        | 5.0     | 36   |
| 2.3 Research & development (R&D).....                        | 10.6    | 57   |
| 2.3.1 Researchers, FTE/mn pop.....                           | 1,833.5 | 41   |
| 2.3.2 Gross expenditure on R&D, % GDP.....                   | 0.6     | 53   |
| 2.3.3 Global R&D companies, avg. expend. top 3, mn \$US..... | 0.0     | 43 ○ |
| 2.3.4 QS university ranking, average score top 3*.....       | 6.1     | 67   |

**3 Infrastructure.....53.1 42**

|  |         |      |
|--|---------|------|
| 3.1 Information & communication technologies (ICTs).....     | 62.5    | 55   |
| 3.1.1 ICT access*.....                                       | 73.8    | 40   |
| 3.1.2 ICT use*.....  | 62.7    | 33   |
| 3.1.3 Government's online service*.....                      | 60.9    | 62   |
| 3.1.4 E-participation*.....                                  | 52.5    | 82 ○ |
| 3.2 General infrastructure.....                              | 37.5    | 63   |
| 3.2.1 Electricity output, kWh/cap.....                       | 2,583.4 | 67   |
| 3.2.2 Logistics performance*.....                            | 58.4    | 42   |
| 3.2.3 Gross capital formation, % GDP.....                    | 21.6    | 70   |
| 3.3 Ecological sustainability.....                           | 59.2    | 19   |
| 3.3.1 GDP/unit of energy use.....                            | 9.8     | 53   |
| 3.3.2 Environmental performance*.....                        | 85.7    | 22   |
| 3.3.3 ISO 14001 environmental certificates/bn PPP\$ GDP..... | 7.9     | 12 ● |

**4 Market sophistication.....52.1 38**

|   |      |     |
|---|------|-----|
| 4.1 Credit.....                                     | 51.9 | 25  |
| 4.1.1 Ease of getting credit*.....                  | 85.0 | 7 ● |
| 4.1.2 Domestic credit to private sector, % GDP..... | 48.8 | 73  |
| 4.1.3 Microfinance gross loans, % GDP.....          | n/a  | n/a |

|   |      |      |
|---|------|------|
| 4.2 Investment.....                                     | 44.2 | 42   |
| 4.2.1 Ease of protecting minority investors*.....       | 63.3 | 41   |
| 4.2.2 Market capitalization, % GDP.....                 | n/a  | n/a  |
| 4.2.3 Venture capital deals/bn PPP\$ GDP.....           | 0.0  | 52   |
| 4.3 Trade, competition, & market scale.....             | 60.1 | 69   |
| 4.3.1 Applied tariff rate, weighted mean, %.....        | 1.6  | 23   |
| 4.3.2 Intensity of local competition <sup>†</sup> ..... | 73.7 | 34   |
| 4.3.3 Domestic market scale, bn PPP\$.....              | 50.9 | 93 ○ |

**5 Business sophistication.....38.2 39**

|   |      |      |
|---|------|------|
| 5.1 Knowledge workers.....  | 43.0 | 46   |
| 5.1.1 Knowledge-intensive employment, %.....                        | 41.2 | 22   |
| 5.1.2 Firms offering formal training, % firms.....                  | 25.2 | 64 ○ |
| 5.1.3 GERD performed by business, % of GDP.....                     | 0.2  | 56   |
| 5.1.4 GERD financed by business, %.....                             | 20.1 | 63 ○ |
| 5.1.5 Females employed w/advanced degrees, % total.....             | 23.6 | 12   |
| 5.2 Innovation linkages.....  | 40.6 | 29   |
| 5.2.1 University/industry research collaboration <sup>†</sup> ..... | 39.2 | 74   |
| 5.2.2 State of cluster development <sup>†</sup> .....               | 41.2 | 82 ○ |
| 5.2.3 GERD financed by abroad, %.....                               | 45.0 | 7 ●  |
| 5.2.4 JV-strategic alliance deals/bn PPP\$ GDP.....                 | 0.0  | 68   |
| 5.2.5 Patent families 2+ offices/bn PPP\$ GDP.....                  | 0.5  | 36   |
| 5.3 Knowledge absorption.....                                       | 30.9 | 76   |
| 5.3.1 Intellectual property payments, % total trade.....            | 0.2  | 83 ○ |
| 5.3.2 High-tech imports less re-imports, % total trade.....         | 10.9 | 34   |
| 5.3.3 ICT services imports, % total trade.....                      | 1.3  | 53   |
| 5.3.4 FDI net inflows, % GDP.....                                   | 3.2  | 51   |
| 5.3.5 Research talent, % in business enterprise.....                | 16.7 | 59 ○ |

**6 Knowledge & technology outputs.....26.5 48**

|   |      |      |
|---|------|------|
| 6.1 Knowledge creation.....                                       | 13.0 | 56   |
| 6.1.1 Patents by origin/bn PPP\$ GDP.....                         | 3.4  | 31   |
| 6.1.2 PCT patent applications/bn PPP\$ GDP.....                   | 0.5  | 38   |
| 6.1.3 Utility models by origin/bn PPP\$ GDP.....                  | n/a  | n/a  |
| 6.1.4 Scientific & technical articles/bn PPP\$ GDP.....           | 14.9 | 52   |
| 6.1.5 Citable documents H index.....                              | 7.8  | 77   |
| 6.2 Knowledge impact.....   | 39.2 | 37   |
| 6.2.1 Growth rate of PPP\$ GDP/worker, %.....                     | 1.4  | 44   |
| 6.2.2 New businesses/th pop. 15–64.....                           | 10.6 | 10 ● |
| 6.2.3 Computer software spending, % GDP.....                      | 0.1  | 87 ○ |
| 6.2.4 ISO 9001 quality certificates/bn PPP\$ GDP.....             | 22.8 | 15   |
| 6.2.5 High- & medium-high-tech manufactures, % <sup>Ⓐ</sup> ..... | 0.2  | 65   |
| 6.3 Knowledge diffusion.....                                      | 27.3 | 46   |
| 6.3.1 Intellectual property receipts, % total trade.....          | 0.0  | 70   |
| 6.3.2 High-tech exports less re-exports, % total trade.....       | 8.0  | 24   |
| 6.3.3 ICT services exports, % total trade.....                    | 2.5  | 44   |
| 6.3.4 FDI net outflows, % GDP.....                                | 1.3  | 41   |

**7 Creative outputs.....49.4 14 ●**

|   |      |      |
|---|------|------|
| 7.1 Intangible assets.....  | 47.0 | 49   |
| 7.1.1 Trademarks by origin/bn PPP\$ GDP.....                                    | 72.8 | 24   |
| 7.1.2 Industrial designs by origin/bn PPP\$ GDP.....                            | 3.9  | 31   |
| 7.1.3 ICTs & business model creation <sup>†</sup> .....                         | 60.5 | 63   |
| 7.1.4 ICTs & organizational model creation <sup>†</sup> .....                   | 56.6 | 50   |
| 7.2 Creative goods & services.....  | 53.4 | 2 ●  |
| 7.2.1 Cultural & creative services exports, % of total trade <sup>Ⓐ</sup> ..... | 1.2  | 9 ●  |
| 7.2.2 National feature films/mn pop. 15–69.....                                 | 12.2 | 11 ● |
| 7.2.3 Global ent. & media market/th pop. 15–69.....                             | n/a  | n/a  |
| 7.2.4 Printing & publishing manufactures, % <sup>Ⓐ</sup> .....                  | 3.0  | 8 ●  |
| 7.2.5 Creative goods exports, % total trade.....                                | 4.2  | 12 ● |
| 7.3 Online creativity.....  | 50.2 | 17   |
| 7.3.1 Generic top-level domains (TLDs)/th pop. 15–69.....                       | 9.4  | 40   |
| 7.3.2 Country-code TLDs/th pop. 15–69.....                                      | 43.0 | 16   |
| 7.3.3 Wikipedia edits/mn pop. 15–69.....  | 6.9  | 14 ● |
| 7.3.4 Video uploads on YouTube/pop. 15–69.....                                  | 81.8 | 2 ●  |

NOTES: ● indicates a strength; ○ a weakness; \* an index; † a survey question.

Ⓐ indicates that the country's data are older than the base year; see Appendix II for details, including the year of the data, at <http://globalinnovationindex.org>.

Square brackets indicate that the data minimum coverage (DMC) requirements were not met at the sub-pillar or pillar level; see page 181 of this appendix for details.



## Key indicators

|                            |                                  |
|----------------------------|----------------------------------|
| Population (millions)..... | 6.0                              |
| GDP (US\$ billions).....   | 51.8                             |
| GDP per capita, PPP\$..... | 18,239.8                         |
| Income group.....          | Upper-middle income              |
| Region.....                | Northern Africa and Western Asia |

|  | Score 0–100<br>or value (hard data) | Rank      |
|--|-------------------------------------|-----------|
| <b>Global Innovation Index (out of 127).....</b> | <b>30.6</b>                         | <b>81</b> |
| Innovation Output Sub-Index.....                 | 23.3                                | 78        |
| Innovation Input Sub-Index.....                  | 38.0                                | 87        |
| Innovation Efficiency Ratio.....                 | 0.6                                 | 69        |
| Global Innovation Index 2016 (out of 128).....   | 32.7                                | 70        |

**1 Institutions.....47.9 100**

|   |      |     |   |
|---|------|-----|---|
| 1.1 Political environment.....                        | 26.1 | 121 | ○ |
| 1.1.1 Political stability & safety*.....              | 22.1 | 122 | ○ |
| 1.1.2 Government effectiveness*.....                  | 30.1 | 92  |   |
| 1.2 Regulatory environment.....                       | 55.8 | 83  |   |
| 1.2.1 Regulatory quality*.....                        | 35.0 | 88  |   |
| 1.2.2 Rule of law*.....                               | 16.4 | 106 |   |
| 1.2.3 Cost of redundancy dismissal, salary weeks..... | 15.1 | 60  |   |
| 1.3 Business environment.....                         | 61.9 | 88  |   |
| 1.3.1 Ease of starting a business*.....               | 78.5 | 104 |   |
| 1.3.2 Ease of resolving insolvency*.....              | 30.0 | 116 | ○ |
| 1.3.3 Ease of paying taxes*.....                      | 77.2 | 57  |   |

**2 Human capital & research.....29.0 78**

|  |       |     |   |
|--|-------|-----|---|
| 2.1 Education.....   | 28.8  | 111 | ○ |
| 2.1.1 Expenditure on education, % GDP.....                     | 2.6   | 109 | ○ |
| 2.1.2 Gov't expenditure/pupil, secondary, % GDP/cap.....       | 6.0   | 103 | ○ |
| 2.1.3 School life expectancy, years.....                       | 11.1  | 93  |   |
| 2.1.4 PISA scales in reading, maths, & science.....            | 376.4 | 66  | ○ |
| 2.1.5 Pupil-teacher ratio, secondary <sup>Ⓐ</sup> .....        | 7.7   | 5   | ● |
| 2.2 Tertiary education.....                                    | 43.7  | 37  |   |
| 2.2.1 Tertiary enrolment, % gross.....                         | 38.5  | 68  |   |
| 2.2.2 Graduates in science & engineering, % <sup>Ⓐ</sup> ..... | 23.3  | 35  |   |
| 2.2.3 Tertiary inbound mobility, %.....                        | 9.9   | 19  | ● |
| 2.3 Research & development (R&D).....                          | 14.6  | 49  |   |
| 2.3.1 Researchers, FTE/mn pop.....                             | n/a   | n/a |   |
| 2.3.2 Gross expenditure on R&D, % GDP.....                     | n/a   | n/a |   |
| 2.3.3 Global R&D companies, avg. expend. top 3, mn \$US.....   | 0.0   | 43  | ○ |
| 2.3.4 QS university ranking, average score top 3*.....         | 29.3  | 39  |   |

**3 Infrastructure.....40.0 88**

|  |         |     |   |
|--|---------|-----|---|
| 3.1 Information & communication technologies (ICTs).....     | 55.4    | 70  |   |
| 3.1.1 ICT access*.....                                       | 65.7    | 62  |   |
| 3.1.2 ICT use*.....  | 55.1    | 48  |   |
| 3.1.3 Government's online service*.....                      | 51.4    | 81  |   |
| 3.1.4 E-participation*.....                                  | 49.2    | 89  |   |
| 3.2 General infrastructure.....                              | 22.2    | 115 | ○ |
| 3.2.1 Electricity output, kWh/cap.....                       | 3,945.5 | 54  |   |
| 3.2.2 Logistics performance*.....                            | 30.3    | 81  |   |
| 3.2.3 Gross capital formation, % GDP.....                    | n/a     | n/a |   |
| 3.3 Ecological sustainability.....                           | 42.6    | 76  |   |
| 3.3.1 GDP/unit of energy use.....                            | 9.9     | 52  |   |
| 3.3.2 Environmental performance*.....                        | 69.1    | 83  |   |
| 3.3.3 ISO 14001 environmental certificates/bn PPP\$ GDP..... | 0.4     | 86  |   |

**4 Market sophistication.....39.4 96**

|   |       |    |   |
|---|-------|----|---|
| 4.1 Credit.....                                     | 28.0  | 86 |   |
| 4.1.1 Ease of getting credit*.....                  | 40.0  | 98 |   |
| 4.1.2 Domestic credit to private sector, % GDP..... | 106.6 | 25 | ● |
| 4.1.3 Microfinance gross loans, % GDP.....          | 0.1   | 57 |   |

|   |      |     |   |
|---|------|-----|---|
| 4.2 Investment.....                                     | 28.9 | 118 | ○ |
| 4.2.1 Ease of protecting minority investors*.....       | 40.0 | 111 | ○ |
| 4.2.2 Market capitalization, % GDP <sup>Ⓐ</sup> .....   | 22.6 | 59  |   |
| 4.2.3 Venture capital deals/bn PPP\$ GDP.....           | 0.1  | 23  | ● |
| 4.3 Trade, competition, & market scale.....             | 61.3 | 63  |   |
| 4.3.1 Applied tariff rate, weighted mean, %.....        | 2.8  | 63  |   |
| 4.3.2 Intensity of local competition <sup>†</sup> ..... | 73.9 | 32  | ● |
| 4.3.3 Domestic market scale, bn PPP\$.....              | 85.2 | 78  |   |

**5 Business sophistication.....33.5 61**

|   |      |      |   |
|---|------|------|---|
| 5.1 Knowledge workers.....  | 43.0 | [47] |   |
| 5.1.1 Knowledge-intensive employment, % <sup>Ⓐ</sup> .....                | 31.8 | 45   |   |
| 5.1.2 Firms offering formal training, % firms.....                        | 26.6 | 58   |   |
| 5.1.3 GERD performed by business, % of GDP.....                           | n/a  | n/a  |   |
| 5.1.4 GERD financed by business, %.....                                   | n/a  | n/a  |   |
| 5.1.5 Females employed w/advanced degrees, % total.....                   | n/a  | n/a  |   |
| 5.2 Innovation linkages.....  | 28.7 | 60   |   |
| 5.2.1 University/industry research collaboration <sup>†</sup> .....       | 43.9 | 48   |   |
| 5.2.2 State of cluster development <sup>†</sup> .....                     | 47.2 | 53   |   |
| 5.2.3 GERD financed by abroad, %.....                                     | n/a  | n/a  |   |
| 5.2.4 JV-strategic alliance deals/bn PPP\$ GDP.....                       | 0.0  | 75   |   |
| 5.2.5 Patent families 2+ offices/bn PPP\$ GDP.....                        | 0.1  | 81   |   |
| 5.3 Knowledge absorption.....   | 28.8 | 83   |   |
| 5.3.1 Intellectual property payments, % total trade <sup>Ⓐ</sup> .....    | 0.1  | 89   |   |
| 5.3.2 High-tech imports less re-imports, % total trade <sup>Ⓐ</sup> ..... | 3.8  | 116  | ○ |
| 5.3.3 ICT services imports, % total trade <sup>Ⓐ</sup> .....              | 1.8  | 28   | ● |
| 5.3.4 FDI net inflows, % GDP.....   | 5.8  | 23   | ● |
| 5.3.5 Research talent, % in business enterprise.....                      | n/a  | n/a  |   |

**6 Knowledge & technology outputs.....19.1 82**

|   |      |     |   |
|---|------|-----|---|
| 6.1 Knowledge creation.....   | 12.9 | 57  |   |
| 6.1.1 Patents by origin/bn PPP\$ GDP.....                                 | 1.3  | 58  |   |
| 6.1.2 PCT patent applications/bn PPP\$ GDP.....                           | n/a  | n/a |   |
| 6.1.3 Utility models by origin/bn PPP\$ GDP.....                          | n/a  | n/a |   |
| 6.1.4 Scientific & technical articles/bn PPP\$ GDP.....                   | 15.7 | 48  |   |
| 6.1.5 Citable documents H index.....                                      | 10.2 | 60  |   |
| 6.2 Knowledge impact.....   | 15.9 | 110 | ○ |
| 6.2.1 Growth rate of PPP\$ GDP/worker, %.....                             | n/a  | n/a |   |
| 6.2.2 New businesses/th pop. 15–64.....                                   | n/a  | n/a |   |
| 6.2.3 Computer software spending, % GDP.....                              | 0.0  | 104 |   |
| 6.2.4 ISO 9001 quality certificates/bn PPP\$ GDP.....                     | 7.6  | 47  |   |
| 6.2.5 High- & medium-high-tech manufactures, % <sup>Ⓐ</sup> .....         | 0.2  | 54  |   |
| 6.3 Knowledge diffusion.....  | 28.4 | 44  |   |
| 6.3.1 Intellectual property receipts, % total trade <sup>Ⓐ</sup> .....    | 0.1  | 59  |   |
| 6.3.2 High-tech exports less re-exports, % total trade <sup>Ⓐ</sup> ..... | 0.2  | 100 |   |
| 6.3.3 ICT services exports, % total trade <sup>Ⓐ</sup> .....              | 2.8  | 36  | ● |
| 6.3.4 FDI net outflows, % GDP.....  | 2.8  | 23  | ● |

**7 Creative outputs.....27.5 81**

|   |      |     |   |
|---|------|-----|---|
| 7.1 Intangible assets.....  | 32.4 | 98  |   |
| 7.1.1 Trademarks by origin/bn PPP\$ GDP.....                      | 15.1 | 93  |   |
| 7.1.2 Industrial designs by origin/bn PPP\$ GDP.....              | n/a  | n/a |   |
| 7.1.3 ICTs & business model creation <sup>†</sup> .....           | 48.5 | 109 | ○ |
| 7.1.4 ICTs & organizational model creation <sup>†</sup> .....     | 41.4 | 105 | ○ |
| 7.2 Creative goods & services.....                                | 28.8 | 32  | ● |
| 7.2.1 Cultural & creative services exports, % of total trade..... | 0.2  | 44  |   |
| 7.2.2 National feature films/mn pop. 15–69.....                   | 3.6  | 52  |   |
| 7.2.3 Global ent. & media market/th pop. 15–69.....               | 3.0  | 49  |   |
| 7.2.4 Printing & publishing manufactures, % <sup>Ⓐ</sup> .....    | 4.2  | 3   | ● |
| 7.2.5 Creative goods exports, % total trade <sup>Ⓐ</sup> .....    | 0.8  | 47  |   |
| 7.3 Online creativity.....  | 16.4 | 76  |   |
| 7.3.1 Generic top-level domains (TLDs)/th pop. 15–69.....         | 6.9  | 48  |   |
| 7.3.2 Country-code TLDs/th pop. 15–69.....                        | 0.3  | 99  |   |
| 7.3.3 Wikipedia edits/mn pop. 15–69 <sup>Ⓐ</sup> .....            | 4.3  | 72  |   |
| 7.3.4 Video uploads on YouTube/pop. 15–69.....                    | 16.9 | 60  |   |

NOTES: ● indicates a strength; ○ a weakness; \* an index; † a survey question.

Ⓐ indicates that the country's data are older than the base year; see Appendix II for details, including the year of the data, at <http://globalinnovationindex.org>.

Square brackets indicate that the data minimum coverage (DMC) requirements were not met at the sub-pillar or pillar level; see page 181 of this appendix for details.

## Lithuania

## Key indicators

|                            |             |
|----------------------------|-------------|
| Population (millions)..... | 2.9         |
| GDP (US\$ billions).....   | 42.8        |
| GDP per capita, PPP\$..... | 28,359.1    |
| Income group.....          | High income |
| Region.....                | Europe      |

|  | Score 0–100<br>or value (hard data) | Rank      |
|--|-------------------------------------|-----------|
| <b>Global Innovation Index (out of 127).....</b> | <b>41.2</b>                         | <b>40</b> |
| Innovation Output Sub-Index.....                 | 30.4                                | 49        |
| Innovation Input Sub-Index.....                  | 51.9                                | 34        |
| Innovation Efficiency Ratio.....                 | 0.6                                 | 84        |
| Global Innovation Index 2016 (out of 128).....   | 41.8                                | 36        |

|  |             |           |
|--|-------------|-----------|
| <b>1 Institutions.....</b>                                   | <b>74.1</b> | <b>36</b> |
| 1.1 Political environment.....                               | 76.9        | 27        |
| 1.1.1 Political stability & safety*.....                     | 80.8        | 32        |
| 1.1.2 Government effectiveness*.....                         | 73.0        | 25        |
| 1.2 Regulatory environment.....                              | 69.4        | 46        |
| 1.2.1 Regulatory quality*.....                               | 74.9        | 20 ●      |
| 1.2.2 Rule of law*.....                                      | 68.2        | 29        |
| 1.2.3 Cost of redundancy dismissal, salary weeks.....        | 24.6        | 100 ○     |
| 1.3 Business environment.....                                | 75.9        | 42        |
| 1.3.1 Ease of starting a business*.....                      | 93.0        | 26        |
| 1.3.2 Ease of resolving insolvency*.....                     | 49.2        | 61        |
| 1.3.3 Ease of paying taxes*.....                             | 85.4        | 25        |
| <b>2 Human capital &amp; research.....</b>                   | <b>37.5</b> | <b>46</b> |
| 2.1 Education.....   | 53.7        | 47        |
| 2.1.1 Expenditure on education, % GDP.....                   | 4.6         | 63        |
| 2.1.2 Gov't expenditure/pupil, secondary, % GDP/cap.....     | 17.8        | 64        |
| 2.1.3 School life expectancy, years.....                     | 16.5        | 21 ●      |
| 2.1.4 PISA scales in reading, maths, & science.....          | 475.4       | 35        |
| 2.1.5 Pupil-teacher ratio, secondary <sup>Ⓐ</sup> .....      | 8.1         | 8 ●       |
| 2.2 Tertiary education.....                                  | 39.4        | 50        |
| 2.2.1 Tertiary enrolment, % gross <sup>Ⓐ</sup> .....         | 68.5        | 29        |
| 2.2.2 Graduates in science & engineering, %.....             | 22.2        | 43        |
| 2.2.3 Tertiary inbound mobility, % <sup>Ⓐ</sup> .....        | 2.5         | 64        |
| 2.3 Research & development (R&D).....                        | 19.5        | 45        |
| 2.3.1 Researchers, FTE/mn pop.....                           | 2,822.4     | 30        |
| 2.3.2 Gross expenditure on R&D, % GDP.....                   | 1.0         | 35        |
| 2.3.3 Global R&D companies, avg. expend. top 3, mn \$US..... | 0.0         | 43 ○      |
| 2.3.4 QS university ranking, average score top 3*.....       | 20.1        | 50        |
| <b>3 Infrastructure.....</b>                                 | <b>57.2</b> | <b>31</b> |
| 3.1 Information & communication technologies (ICTs).....     | 75.1        | 27        |
| 3.1.1 ICT access*.....                                       | 70.8        | 49        |
| 3.1.2 ICT use*.....  | 64.0        | 29        |
| 3.1.3 Government's online service*.....                      | 82.6        | 22 ●      |
| 3.1.4 E-participation*.....                                  | 83.1        | 17 ●      |
| 3.2 General infrastructure.....                              | 35.4        | 73        |
| 3.2.1 Electricity output, kWh/cap.....                       | 1,265.5     | 90 ○      |
| 3.2.2 Logistics performance*.....                            | 72.5        | 28        |
| 3.2.3 Gross capital formation, % GDP.....                    | 17.7        | 100 ○     |
| 3.3 Ecological sustainability.....                           | 61.2        | 16 ●      |
| 3.3.1 GDP/unit of energy use.....                            | 10.4        | 43        |
| 3.3.2 Environmental performance*.....                        | 85.5        | 23        |
| 3.3.3 ISO 14001 environmental certificates/bn PPP\$ GDP..... | 8.7         | 10 ●      |
| <b>4 Market sophistication.....</b>                          | <b>53.0</b> | <b>32</b> |
| 4.1 Credit.....  | 43.0        | 44        |
| 4.1.1 Ease of getting credit*.....                           | 70.0        | 29        |
| 4.1.2 Domestic credit to private sector, % GDP.....          | 41.8        | 80        |
| 4.1.3 Microfinance gross loans, % GDP.....                   | n/a         | n/a       |

|   |      |     |
|---|------|-----|
| 4.2 Investment.....   | 52.7 | 27  |
| 4.2.1 Ease of protecting minority investors*.....           | 61.7 | 50  |
| 4.2.2 Market capitalization, % GDP.....                     | n/a  | n/a |
| 4.2.3 Venture capital deals/bn PPP\$ GDP <sup>Ⓐ</sup> ..... | 0.1  | 18  |
| 4.3 Trade, competition, & market scale.....                 | 63.5 | 55  |
| 4.3.1 Applied tariff rate, weighted mean, %.....            | 1.6  | 23  |
| 4.3.2 Intensity of local competition <sup>†</sup> .....     | 75.2 | 26  |
| 4.3.3 Domestic market scale, bn PPP\$.....                  | 85.8 | 77  |

**5 Business sophistication..... 37.8 41**

|   |      |       |
|---|------|-------|
| 5.1 Knowledge workers.....  | 53.1 | 31    |
| 5.1.1 Knowledge-intensive employment, %.....                        | 41.8 | 20    |
| 5.1.2 Firms offering formal training, % firms.....                  | 42.0 | 30    |
| 5.1.3 GERD performed by business, % of GDP.....                     | 0.3  | 47    |
| 5.1.4 GERD financed by business, %.....                             | 28.0 | 54    |
| 5.1.5 Females employed w/advanced degrees, % total.....             | 27.2 | 5 ●   |
| 5.2 Innovation linkages.....  | 35.9 | 42    |
| 5.2.1 University/industry research collaboration <sup>†</sup> ..... | 51.9 | 33    |
| 5.2.2 State of cluster development <sup>†</sup> .....               | 39.0 | 88 ○  |
| 5.2.3 GERD financed by abroad, %.....                               | 34.6 | 13 ●  |
| 5.2.4 JV-strategic alliance deals/bn PPP\$ GDP.....                 | 0.0  | 99 ○  |
| 5.2.5 Patent families 2+ offices/bn PPP\$ GDP.....                  | 0.4  | 42    |
| 5.3 Knowledge absorption.....                                       | 24.2 | 103 ○ |
| 5.3.1 Intellectual property payments, % total trade.....            | 0.2  | 88 ○  |
| 5.3.2 High-tech imports less re-imports, % total trade.....         | 6.7  | 82    |
| 5.3.3 ICT services imports, % total trade.....                      | 0.6  | 88 ○  |
| 5.3.4 FDI net inflows, % GDP.....                                   | 1.6  | 92 ○  |
| 5.3.5 Research talent, % in business enterprise.....                | 22.7 | 52    |

**6 Knowledge & technology outputs..... 21.3 66**

|   |      |      |
|---|------|------|
| 6.1 Knowledge creation.....                                 | 14.6 | 54   |
| 6.1.1 Patents by origin/bn PPP\$ GDP.....                   | 1.7  | 51   |
| 6.1.2 PCT patent applications/bn PPP\$ GDP.....             | 0.3  | 46   |
| 6.1.3 Utility models by origin/bn PPP\$ GDP.....            | n/a  | n/a  |
| 6.1.4 Scientific & technical articles/bn PPP\$ GDP.....     | 24.8 | 33   |
| 6.1.5 Citable documents H index.....                        | 10.7 | 57   |
| 6.2 Knowledge impact.....                                   | 28.1 | 78   |
| 6.2.1 Growth rate of PPP\$ GDP/worker, %.....               | 0.3  | 76   |
| 6.2.2 New businesses/th pop. 15–64.....                     | 4.2  | 30   |
| 6.2.3 Computer software spending, % GDP.....                | 0.1  | 96 ○ |
| 6.2.4 ISO 9001 quality certificates/bn PPP\$ GDP.....       | 15.0 | 23 ● |
| 6.2.5 High- & medium-high-tech manufactures, %.....         | 0.2  | 61   |
| 6.3 Knowledge diffusion.....                                | 21.1 | 66   |
| 6.3.1 Intellectual property receipts, % total trade.....    | 0.1  | 62   |
| 6.3.2 High-tech exports less re-exports, % total trade..... | 6.1  | 28   |
| 6.3.3 ICT services exports, % total trade.....              | 0.8  | 88 ○ |
| 6.3.4 FDI net outflows, % GDP.....                          | 0.8  | 58   |

**7 Creative outputs..... 39.6 38**

|   |      |      |
|---|------|------|
| 7.1 Intangible assets.....  | 48.8 | 43   |
| 7.1.1 Trademarks by origin/bn PPP\$ GDP.....                                    | 50.6 | 48   |
| 7.1.2 Industrial designs by origin/bn PPP\$ GDP.....                            | 2.0  | 45   |
| 7.1.3 ICTs & business model creation <sup>†</sup> .....                         | 70.9 | 30   |
| 7.1.4 ICTs & organizational model creation <sup>†</sup> .....                   | 68.9 | 24   |
| 7.2 Creative goods & services.....  | 25.4 | 45   |
| 7.2.1 Cultural & creative services exports, % of total trade <sup>Ⓐ</sup> ..... | 0.4  | 29   |
| 7.2.2 National feature films/mn pop. 15–69.....                                 | 4.4  | 46   |
| 7.2.3 Global ent. & media market/th pop. 15–69.....                             | n/a  | n/a  |
| 7.2.4 Printing & publishing manufactures, %.....                                | 1.1  | 60   |
| 7.2.5 Creative goods exports, % total trade.....                                | 2.1  | 23   |
| 7.3 Online creativity.....  | 35.4 | 32   |
| 7.3.1 Generic top-level domains (TLDs)/th pop. 15–69.....                       | 13.8 | 33   |
| 7.3.2 Country-code TLDs/th pop. 15–69.....                                      | 26.6 | 23 ● |
| 7.3.3 Wikipedia edits/mn pop. 15–69.....  | 6.4  | 30   |
| 7.3.4 Video uploads on YouTube/pop. 15–69.....                                  | 39.5 | 31   |

NOTES: ● indicates a strength; ○ a weakness; \* an index; † a survey question.

Ⓐ indicates that the country's data are older than the base year; see Appendix II for details, including the year of the data, at <http://globalinnovationindex.org>.

Square brackets indicate that the data minimum coverage (DMC) requirements were not met at the sub-pillar or pillar level; see page 181 of this appendix for details.

## Key indicators

|                             |             |
|-----------------------------|-------------|
| Population (millions) ..... | 0.6         |
| GDP (US\$ billions) .....   | 61.0        |
| GDP per capita, PPP\$ ..... | 98,987.2    |
| Income group .....          | High income |
| Region .....                | Europe      |

|   | Score 0–100<br>or value (hard data) | Rank      |
|---|-------------------------------------|-----------|
| <b>Global Innovation Index (out of 127)</b> .....             | <b>56.4</b>                         | <b>12</b> |
| Innovation Output Sub-Index .....                             | 55.4                                | 4 ●       |
| Innovation Input Sub-Index .....                              | 57.4                                | 24        |
| Innovation Efficiency Ratio .....                             | 1.0                                 | 1 ●       |
| Global Innovation Index 2016 (out of 128) .....               | 57.1                                | 12        |
| <b>1 Institutions</b> .....                                   | <b>82.6</b>                         | <b>19</b> |
| 1.1 Political environment .....                               | 92.2                                | 4 ●       |
| 1.1.1 Political stability & safety* .....                     | 98.0                                | 2 ●       |
| 1.1.2 Government effectiveness* .....                         | 86.5                                | 14        |
| 1.2 Regulatory environment .....                              | 81.2                                | 23        |
| 1.2.1 Regulatory quality* .....                               | 84.9                                | 13        |
| 1.2.2 Rule of law* .....                                      | 93.9                                | 9         |
| 1.2.3 Cost of redundancy dismissal, salary weeks .....        | 21.7                                | 92 ○      |
| 1.3 Business environment .....                                | 74.3                                | 54        |
| 1.3.1 Ease of starting a business* .....                      | 88.7                                | 55        |
| 1.3.2 Ease of resolving insolvency* .....                     | 45.4                                | 74        |
| 1.3.3 Ease of paying taxes* .....                             | 88.9                                | 15        |
| <b>2 Human capital &amp; research</b> .....                   | <b>42.9</b>                         | <b>33</b> |
| 2.1 Education .....   | 48.5                                | 59        |
| 2.1.1 Expenditure on education, % GDP <sup>Ⓢ</sup> .....      | 4.1                                 | 76        |
| 2.1.2 Gov't expenditure/pupil, secondary, % GDP/cap .....     | 19.4                                | 55        |
| 2.1.3 School life expectancy, years <sup>Ⓢ</sup> .....        | 13.9                                | 64        |
| 2.1.4 PISA scales in reading, maths, & science .....          | 483.3                               | 32        |
| 2.1.5 Pupil-teacher ratio, secondary <sup>Ⓢ</sup> .....       | 9.1                                 | 16        |
| 2.2 Tertiary education .....                                  | 43.9                                | 36        |
| 2.2.1 Tertiary enrolment, % gross <sup>Ⓢ</sup> .....          | 19.4                                | 92 ○      |
| 2.2.2 Graduates in science & engineering, % .....             | 16.3                                | 77 ○      |
| 2.2.3 Tertiary inbound mobility, % <sup>Ⓢ</sup> .....         | 40.6                                | 1 ●       |
| 2.3 Research & development (R&D) .....                        | 36.2                                | 31        |
| 2.3.1 Researchers, FTE/mn pop. .....                          | 5,058.3                             | 10        |
| 2.3.2 Gross expenditure on R&D, % GDP .....                   | 1.3                                 | 27        |
| 2.3.3 Global R&D companies, avg. expend. top 3, mn \$US ..... | 53.9                                | 26        |
| 2.3.4 QS university ranking, average score top 3* .....       | 0.0                                 | 75 ○      |
| <b>3 Infrastructure</b> .....                                 | <b>60.1</b>                         | <b>24</b> |
| 3.1 Information & communication technologies (ICTs) .....     | 79.3                                | 21        |
| 3.1.1 ICT access* .....                                       | 95.4                                | 1 ●       |
| 3.1.2 ICT use* .....  | 80.5                                | 10        |
| 3.1.3 Government's online service* .....                      | 71.7                                | 40        |
| 3.1.4 E-participation* .....                                  | 69.5                                | 43        |
| 3.2 General infrastructure .....                              | 44.2                                | 41        |
| 3.2.1 Electricity output, kWh/cap .....                       | 2,289.5                             | 75        |
| 3.2.2 Logistics performance* .....                            | 99.7                                | 2 ●       |
| 3.2.3 Gross capital formation, % GDP .....                    | 18.6                                | 96 ○      |
| 3.3 Ecological sustainability .....                           | 56.9                                | 25        |
| 3.3.1 GDP/unit of energy use .....                            | 13.3                                | 17        |
| 3.3.2 Environmental performance* .....                        | 86.6                                | 20        |
| 3.3.3 ISO 14001 environmental certificates/bn PPP\$ GDP ..... | 1.9                                 | 49        |
| <b>4 Market sophistication</b> .....                          | <b>43.4</b>                         | <b>78</b> |
| 4.1 Credit .....  | 26.4                                | 94 ○      |
| 4.1.1 Ease of getting credit* .....                           | 15.0                                | 121 ○     |
| 4.1.2 Domestic credit to private sector, % GDP .....          | 95.4                                | 31        |
| 4.1.3 Microfinance gross loans, % GDP .....                   | n/a                                 | n/a       |

|   |             |            |
|---|-------------|------------|
| 4.2 Investment .....  | 43.4        | 46         |
| 4.2.1 Ease of protecting minority investors* .....                              | 45.0        | 98 ○       |
| 4.2.2 Market capitalization, % GDP .....  | 81.6        | 18         |
| 4.2.3 Venture capital deals/bn PPP\$ GDP .....                                  | 0.2         | 13         |
| 4.3 Trade, competition, & market scale .....                                    | 60.5        | 66         |
| 4.3.1 Applied tariff rate, weighted mean, % .....                               | 1.6         | 23         |
| 4.3.2 Intensity of local competition <sup>†</sup> .....                         | 71.9        | 41         |
| 4.3.3 Domestic market scale, bn PPP\$ .....                                     | 58.7        | 91 ○       |
| <b>5 Business sophistication</b> .....  | <b>57.8</b> | <b>7</b>   |
| 5.1 Knowledge workers .....   | 59.9        | 23         |
| 5.1.1 Knowledge-intensive employment, % .....                                   | 56.8        | 1 ●        |
| 5.1.2 Firms offering formal training, % firms .....                             | n/a         | n/a        |
| 5.1.3 GERD performed by business, % of GDP .....                                | 0.7         | 29         |
| 5.1.4 GERD financed by business, % <sup>Ⓢ</sup> .....                           | 16.5        | 66         |
| 5.1.5 Females employed w/advanced degrees, % total .....                        | 20.6        | 21         |
| 5.2 Innovation linkages .....   | 64.4        | 3 ●        |
| 5.2.1 University/industry research collaboration <sup>†</sup> .....             | 60.8        | 20         |
| 5.2.2 State of cluster development <sup>†</sup> .....                           | 69.7        | 10         |
| 5.2.3 GERD financed by abroad, % <sup>Ⓢ</sup> .....                             | 32.3        | 15         |
| 5.2.4 JV-strategic alliance deals/bn PPP\$ GDP .....                            | 0.1         | 8          |
| 5.2.5 Patent families 2+ offices/bn PPP\$ GDP .....                             | 8.4         | 7          |
| 5.3 Knowledge absorption .....  | 49.0        | 16         |
| 5.3.1 Intellectual property payments, % total trade .....                       | 2.6         | 6          |
| 5.3.2 High-tech imports less re-imports, % total trade .....                    | 2.5         | 125 ○      |
| 5.3.3 ICT services imports, % total trade .....                                 | 2.8         | 9          |
| 5.3.4 FDI net inflows, % GDP .....  | 28.7        | 4 ●        |
| 5.3.5 Research talent, % in business enterprise .....                           | 36.0        | 38         |
| <b>6 Knowledge &amp; technology outputs</b> .....                               | <b>45.0</b> | <b>15</b>  |
| 6.1 Knowledge creation .....  | 45.9        | 15         |
| 6.1.1 Patents by origin/bn PPP\$ GDP .....                                      | 9.7         | 13         |
| 6.1.2 PCT patent applications/bn PPP\$ GDP .....                                | 7.3         | 5          |
| 6.1.3 Utility models by origin/bn PPP\$ GDP .....                               | n/a         | n/a        |
| 6.1.4 Scientific & technical articles/bn PPP\$ GDP .....                        | 18.7        | 40         |
| 6.1.5 Citable documents H index .....   | 7.9         | 75         |
| 6.2 Knowledge impact .....  | 34.2        | 50         |
| 6.2.1 Growth rate of PPP\$ GDP/worker, % .....                                  | 2.3         | 34         |
| 6.2.2 New businesses/th pop. 15–64 <sup>Ⓢ</sup> .....                           | 6.1         | 20         |
| 6.2.3 Computer software spending, % GDP .....                                   | 0.2         | 73         |
| 6.2.4 ISO 9001 quality certificates/bn PPP\$ GDP .....                          | 4.5         | 66         |
| 6.2.5 High- & medium-high-tech manufactures, % .....                            | 0.2         | 62         |
| 6.3 Knowledge diffusion .....   | 54.9        | 9          |
| 6.3.1 Intellectual property receipts, % total trade .....                       | 1.0         | 15         |
| 6.3.2 High-tech exports less re-exports, % total trade .....                    | 0.7         | 72         |
| 6.3.3 ICT services exports, % total trade .....                                 | 3.9         | 20         |
| 6.3.4 FDI net outflows, % GDP .....   | 48.4        | 1 ●        |
| <b>7 Creative outputs</b> .....   | <b>65.8</b> | <b>1 ●</b> |
| 7.1 Intangible assets .....   | 74.8        | 1 ●        |
| 7.1.1 Trademarks by origin/bn PPP\$ GDP .....                                   | 131.6       | 5 ●        |
| 7.1.2 Industrial designs by origin/bn PPP\$ GDP .....                           | 13.8        | 7          |
| 7.1.3 ICTs & business model creation <sup>†</sup> .....                         | 82.7        | 6          |
| 7.1.4 ICTs & organizational model creation <sup>†</sup> .....                   | 74.2        | 14         |
| 7.2 Creative goods & services .....   | 39.9        | 10         |
| 7.2.1 Cultural & creative services exports, % of total trade <sup>Ⓢ</sup> ..... | 5.0         | 1 ●        |
| 7.2.2 National feature films/mn pop. 15–69 <sup>Ⓢ</sup> .....                   | 42.4        | 1 ●        |
| 7.2.3 Global ent. & media market/th pop. 15–69 .....                            | n/a         | n/a        |
| 7.2.4 Printing & publishing manufactures, % .....                               | 1.2         | 54         |
| 7.2.5 Creative goods exports, % total trade .....                               | 0.1         | 89 ○       |
| 7.3 Online creativity .....   | 74.0        | 3 ●        |
| 7.3.1 Generic top-level domains (TLDs)/th pop. 15–69 .....                      | 92.5        | 4 ●        |
| 7.3.2 Country-code TLDs/th pop. 15–69 .....                                     | 63.9        | 8          |
| 7.3.3 Wikipedia edits/mn pop. 15–69 <sup>Ⓢ</sup> .....                          | 6.8         | 17         |
| 7.3.4 Video uploads on YouTube/pop. 15–69 .....                                 | n/a         | n/a        |

NOTES: ● indicates a strength; ○ a weakness; \* an index; † a survey question.

Ⓢ indicates that the country's data are older than the base year; see Appendix II for details, including the year of the data, at <http://globalinnovationindex.org>.

Square brackets indicate that the data minimum coverage (DMC) requirements were not met at the sub-pillar or pillar level; see page 181 of this appendix for details.

# Madagascar

## Key indicators

|                            |                    |
|----------------------------|--------------------|
| Population (millions)..... | 24.9               |
| GDP (US\$ billions).....   | 9.7                |
| GDP per capita, PPP\$..... | 1,462.2            |
| Income group.....          | Low income         |
| Region.....                | Sub-Saharan Africa |

|  | Score 0–100<br>or value (hard data) | Rank       |
|--|-------------------------------------|------------|
| <b>Global Innovation Index (out of 127).....</b> | <b>24.2</b>                         | <b>111</b> |
| Innovation Output Sub-Index.....                 | 19.5                                | 95         |
| Innovation Input Sub-Index.....                  | 28.8                                | 120        |
| Innovation Efficiency Ratio.....                 | 0.7                                 | 45 ●       |
| Global Innovation Index 2016 (out of 128).....   | 24.8                                | 111        |

|   |             |           |
|---|-------------|-----------|
| <b>1 Institutions.....</b>                            | <b>48.7</b> | <b>99</b> |
| 1.1 Political environment.....                        | 31.5        | 113       |
| 1.1.1 Political stability & safety*.....              | 54.1        | 83        |
| 1.1.2 Government effectiveness*.....                  | 9.0         | 126 ○     |
| 1.2 Regulatory environment.....                       | 53.9        | 91        |
| 1.2.1 Regulatory quality*.....                        | 22.8        | 109       |
| 1.2.2 Rule of law*.....                               | 19.1        | 100       |
| 1.2.3 Cost of redundancy dismissal, salary weeks..... | 14.7        | 58 ●      |
| 1.3 Business environment.....                         | 60.8        | 96        |
| 1.3.1 Ease of starting a business*.....               | 83.5        | 87        |
| 1.3.2 Ease of resolving insolvency*.....              | 34.2        | 107       |
| 1.3.3 Ease of paying taxes*.....                      | 64.8        | 86        |

|  |             |            |
|--|-------------|------------|
| <b>2 Human capital &amp; research.....</b>                             | <b>14.8</b> | <b>116</b> |
| 2.1 Education.....   | 22.0        | 122        |
| 2.1.1 Expenditure on education, % GDP.....                             | 2.1         | 112        |
| 2.1.2 Gov't expenditure/pupil, secondary, % GDP/cap <sup>Ⓐ</sup> ..... | 8.4         | 101        |
| 2.1.3 School life expectancy, years.....                               | 10.5        | 100        |
| 2.1.4 PISA scales in reading, maths, & science.....                    | n/a         | n/a        |
| 2.1.5 Pupil-teacher ratio, secondary <sup>Ⓐ</sup> .....                | 23.1        | 90         |
| 2.2 Tertiary education.....  | 22.3        | 100        |
| 2.2.1 Tertiary enrolment, % gross <sup>Ⓐ</sup> .....                   | 4.8         | 115        |
| 2.2.2 Graduates in science & engineering, %.....                       | 20.3        | 54         |
| 2.2.3 Tertiary inbound mobility, % <sup>Ⓐ</sup> .....                  | 1.8         | 73         |
| 2.3 Research & development (R&D).....                                  | 0.1         | 114        |
| 2.3.1 Researchers, FTE/mn pop. <sup>Ⓐ</sup> .....                      | 51.0        | 88         |
| 2.3.2 Gross expenditure on R&D, % GDP <sup>Ⓐ</sup> .....               | 0.0         | 110 ○      |
| 2.3.3 Global R&D companies, avg. expend. top 3, mn \$US.....           | 0.0         | 43 ○       |
| 2.3.4 QS university ranking, average score top 3*.....                 | 0.0         | 75 ○       |

|  |             |            |
|--|-------------|------------|
| <b>3 Infrastructure.....</b>                                 | <b>20.8</b> | <b>125</b> |
| 3.1 Information & communication technologies (ICTs).....     | 17.8        | 120        |
| 3.1.1 ICT access*.....                                       | 23.9        | 121        |
| 3.1.2 ICT use*.....  | 4.4         | 122        |
| 3.1.3 Government's online service*.....                      | 22.5        | 112        |
| 3.1.4 E-participation*.....                                  | 20.3        | 113        |
| 3.2 General infrastructure.....                              | 19.5        | 119        |
| 3.2.1 Electricity output, kWh/cap.....                       | n/a         | n/a        |
| 3.2.2 Logistics performance*.....                            | 4.2         | 124 ○      |
| 3.2.3 Gross capital formation, % GDP.....                    | 15.3        | 110        |
| 3.3 Ecological sustainability.....                           | 25.2        | 120        |
| 3.3.1 GDP/unit of energy use.....                            | n/a         | n/a        |
| 3.3.2 Environmental performance*.....                        | 37.1        | 123 ○      |
| 3.3.3 ISO 14001 environmental certificates/bn PPP\$ GDP..... | 0.2         | 107        |

|   |             |            |
|---|-------------|------------|
| <b>4 Market sophistication.....</b>                 | <b>36.9</b> | <b>106</b> |
| 4.1 Credit.....                                     | 13.8        | 122        |
| 4.1.1 Ease of getting credit*.....                  | 15.0        | 121 ○      |
| 4.1.2 Domestic credit to private sector, % GDP..... | 13.3        | 123 ○      |
| 4.1.3 Microfinance gross loans, % GDP.....          | 1.2         | 24 ●       |

|  |      |      |
|--|------|------|
| 4.2 Investment.....  | 48.3 | [31] |
| 4.2.1 Ease of protecting minority investors*.....              | 48.3 | 92   |
| 4.2.2 Market capitalization, % GDP.....                        | n/a  | n/a  |
| 4.2.3 Venture capital deals/bn PPP\$ GDP.....                  | n/a  | n/a  |
| 4.3 Trade, competition, & market scale.....                    | 48.5 | 106  |
| 4.3.1 Applied tariff rate, weighted mean, % <sup>Ⓐ</sup> ..... | 6.0  | 98   |
| 4.3.2 Intensity of local competition <sup>†</sup> .....        | 60.0 | 101  |
| 4.3.3 Domestic market scale, bn PPP\$.....                     | 37.5 | 100  |

|  |             |            |
|--|-------------|------------|
| <b>5 Business sophistication.....</b>                                  | <b>22.7</b> | <b>116</b> |
| 5.1 Knowledge workers.....   | 8.3         | 125 ○      |
| 5.1.1 Knowledge-intensive employment, %.....                           | 3.7         | 106 ○      |
| 5.1.2 Firms offering formal training, % firms.....                     | 12.7        | 87         |
| 5.1.3 GERD performed by business, % of GDP.....                        | n/a         | n/a        |
| 5.1.4 GERD financed by business, %.....                                | n/a         | n/a        |
| 5.1.5 Females employed w/advanced degrees, % total <sup>Ⓐ</sup> .....  | 2.3         | 83         |
| 5.2 Innovation linkages.....   | 21.6        | 90         |
| 5.2.1 University/industry research collaboration <sup>†</sup> .....    | 40.0        | 70         |
| 5.2.2 State of cluster development <sup>†</sup> .....                  | 35.6        | 101        |
| 5.2.3 GERD financed by abroad, % <sup>Ⓐ</sup> .....                    | 10.6        | 45 ●       |
| 5.2.4 JV-strategic alliance deals/bn PPP\$ GDP.....                    | 0.0         | 82         |
| 5.2.5 Patent families 2+ offices/bn PPP\$ GDP <sup>Ⓐ</sup> .....       | 0.0         | 88         |
| 5.3 Knowledge absorption.....  | 38.2        | 41 ●       |
| 5.3.1 Intellectual property payments, % total trade <sup>Ⓐ</sup> ..... | 0.5         | 59         |
| 5.3.2 High-tech imports less re-imports, % total trade.....            | 5.9         | 98         |
| 5.3.3 ICT services imports, % total trade <sup>Ⓐ</sup> .....           | 2.9         | 8 ●        |
| 5.3.4 FDI net inflows, % GDP.....                                      | 4.6         | 30 ●       |
| 5.3.5 Research talent, % in business enterprise.....                   | n/a         | n/a        |

|  |             |            |
|--|-------------|------------|
| <b>6 Knowledge &amp; technology outputs.....</b>                       | <b>13.6</b> | <b>113</b> |
| 6.1 Knowledge creation.....  | 3.2         | 110        |
| 6.1.1 Patents by origin/bn PPP\$ GDP.....                              | 0.1         | 108        |
| 6.1.2 PCT patent applications/bn PPP\$ GDP <sup>Ⓐ</sup> .....          | 0.1         | 73         |
| 6.1.3 Utility models by origin/bn PPP\$ GDP.....                       | n/a         | n/a        |
| 6.1.4 Scientific & technical articles/bn PPP\$ GDP.....                | 5.8         | 92         |
| 6.1.5 Citable documents H index.....                                   | 4.2         | 101        |
| 6.2 Knowledge impact.....  | 18.7        | 107        |
| 6.2.1 Growth rate of PPP\$ GDP/worker, %.....                          | 1.1         | 51 ●       |
| 6.2.2 New businesses/th pop. 15–64.....                                | 0.7         | 81         |
| 6.2.3 Computer software spending, % GDP.....                           | 0.0         | 115        |
| 6.2.4 ISO 9001 quality certificates/bn PPP\$ GDP.....                  | 2.7         | 82         |
| 6.2.5 High- & medium-high-tech manufactures, %.....                    | 0.0         | 101 ○      |
| 6.3 Knowledge diffusion.....   | 19.0        | 88         |
| 6.3.1 Intellectual property receipts, % total trade <sup>Ⓐ</sup> ..... | 0.5         | 24 ●       |
| 6.3.2 High-tech exports less re-exports, % total trade.....            | 0.0         | 119        |
| 6.3.3 ICT services exports, % total trade <sup>Ⓐ</sup> .....           | 1.7         | 62         |
| 6.3.4 FDI net outflows, % GDP.....                                     | 0.1         | 96         |

|   |             |           |
|---|-------------|-----------|
| <b>7 Creative outputs.....</b>                                    | <b>25.4</b> | <b>88</b> |
| 7.1 Intangible assets.....  | 41.6        | 66        |
| 7.1.1 Trademarks by origin/bn PPP\$ GDP.....                      | 57.0        | 38 ●      |
| 7.1.2 Industrial designs by origin/bn PPP\$ GDP.....              | 5.8         | 20 ●      |
| 7.1.3 ICTs & business model creation <sup>†</sup> .....           | 53.4        | 88        |
| 7.1.4 ICTs & organizational model creation <sup>†</sup> .....     | 47.6        | 82        |
| 7.2 Creative goods & services.....                                | 13.4        | 77        |
| 7.2.1 Cultural & creative services exports, % of total trade..... | 0.0         | 73        |
| 7.2.2 National feature films/mn pop. 15–69.....                   | 2.6         | 57        |
| 7.2.3 Global ent. & media market/th pop. 15–69.....               | n/a         | n/a       |
| 7.2.4 Printing & publishing manufactures, %.....                  | 2.1         | 21 ●      |
| 7.2.5 Creative goods exports, % total trade.....                  | 0.1         | 87        |
| 7.3 Online creativity.....  | 5.2         | 111       |
| 7.3.1 Generic top-level domains (TLDs)/th pop. 15–69.....         | 0.1         | 120       |
| 7.3.2 Country-code TLDs/th pop. 15–69.....                        | 0.0         | 118       |
| 7.3.3 Wikipedia edits/mn pop. 15–69 <sup>Ⓐ</sup> .....            | 1.6         | 109       |
| 7.3.4 Video uploads on YouTube/pop. 15–69.....                    | n/a         | n/a       |

NOTES: ● indicates a strength; ○ a weakness; \* an index; † a survey question.

<sup>Ⓐ</sup> indicates that the country's data are older than the base year; see Appendix II for details, including the year of the data, at <http://globalinnovationindex.org>.

Square brackets indicate that the data minimum coverage (DMC) requirements were not met at the sub-pillar or pillar level; see page 181 of this appendix for details.

Key indicators

|                       |                    |
|-----------------------|--------------------|
| Population (millions) | 17.7               |
| GDP (US\$ billions)   | 5.5                |
| GDP per capita, PPP\$ | 1,124.2            |
| Income group          | Low income         |
| Region                | Sub-Saharan Africa |

|   | Score 0–100<br>or value (hard data) | Rank       |
|---|-------------------------------------|------------|
| <b>Global Innovation Index (out of 127)</b> | <b>23.5</b>                         | <b>115</b> |
| Innovation Output Sub-Index                 | 16.2                                | 112        |
| Innovation Input Sub-Index                  | 30.8                                | 112        |
| Innovation Efficiency Ratio                 | 0.5                                 | 98         |
| Global Innovation Index 2016 (out of 128)   | 27.3                                | 98         |

**1 Institutions** ..... 51.3 93

|  |      |       |
|--|------|-------|
| 1.1 Political environment                        | 43.5 | 85    |
| 1.1.1 Political stability & safety*              | 62.3 | 65 ●  |
| 1.1.2 Government effectiveness*                  | 24.8 | 108   |
| 1.2 Regulatory environment                       | 54.1 | 89    |
| 1.2.1 Regulatory quality*                        | 21.2 | 112   |
| 1.2.2 Rule of law*                               | 29.7 | 77    |
| 1.2.3 Cost of redundancy dismissal, salary weeks | 16.7 | 69    |
| 1.3 Business environment                         | 56.2 | 111   |
| 1.3.1 Ease of starting a business*               | 76.7 | 111   |
| 1.3.2 Ease of resolving insolvency*              | 22.3 | 126 ○ |
| 1.3.3 Ease of paying taxes*                      | 69.6 | 76    |

**2 Human capital & research** ..... 12.3 122

|   |      |       |
|---|------|-------|
| 2.1 Education   | 33.9 | 101   |
| 2.1.1 Expenditure on education, % GDP                   | 5.6  | 27 ●  |
| 2.1.2 Gov't expenditure/pupil, secondary, % GDP/cap     | 25.1 | 30 ●  |
| 2.1.3 School life expectancy, years <sup>Ⓐ</sup>        | 10.7 | 96    |
| 2.1.4 PISA scales in reading, maths, & science          | n/a  | n/a   |
| 2.1.5 Pupil-teacher ratio, secondary                    | 40.9 | 110 ○ |
| 2.2 Tertiary education                                  | 2.9  | 121 ○ |
| 2.2.1 Tertiary enrolment, % gross <sup>Ⓐ</sup>          | 0.8  | 121 ○ |
| 2.2.2 Graduates in science & engineering, %             | n/a  | n/a   |
| 2.2.3 Tertiary inbound mobility, % <sup>Ⓐ</sup>         | 1.1  | 79    |
| 2.3 Research & development (R&D)                        | 0.2  | 113   |
| 2.3.1 Researchers, FTE/mn pop. <sup>Ⓐ</sup>             | 49.6 | 89    |
| 2.3.2 Gross expenditure on R&D, % GDP                   | n/a  | n/a   |
| 2.3.3 Global R&D companies, avg. expend. top 3, mn \$US | 0.0  | 43 ○  |
| 2.3.4 QS university ranking, average score top 3*       | 0.0  | 75 ○  |

**3 Infrastructure** ..... 26.2 117

|   |      |       |
|---|------|-------|
| 3.1 Information & communication technologies (ICTs)     | 19.9 | 116   |
| 3.1.1 ICT access*                                       | 20.3 | 126 ○ |
| 3.1.2 ICT use*  | 8.6  | 116   |
| 3.1.3 Government's online service*                      | 21.7 | 113   |
| 3.1.4 E-participation*                                  | 28.8 | 107   |
| 3.2 General infrastructure                              | 25.5 | 107   |
| 3.2.1 Electricity output, kWh/cap                       | n/a  | n/a   |
| 3.2.2 Logistics performance <sup>Ⓐ</sup>                | 34.7 | 71    |
| 3.2.3 Gross capital formation, % GDP                    | 12.6 | 120   |
| 3.3 Ecological sustainability                           | 33.3 | 110   |
| 3.3.1 GDP/unit of energy use                            | n/a  | n/a   |
| 3.3.2 Environmental performance*                        | 49.7 | 113   |
| 3.3.3 ISO 14001 environmental certificates/bn PPP\$ GDP | 0.1  | 116   |

**4 Market sophistication** ..... 32.0 118

|  |      |       |
|--|------|-------|
| 4.1 Credit                                     | 18.0 | 117   |
| 4.1.1 Ease of getting credit*                  | 45.0 | 84    |
| 4.1.2 Domestic credit to private sector, % GDP | 12.2 | 124 ○ |
| 4.1.3 Microfinance gross loans, % GDP          | 0.3  | 42    |

|   |      |     |
|---|------|-----|
| 4.2 Investment                                    | 30.7 | 106 |
| 4.2.1 Ease of protecting minority investors*      | 43.3 | 101 |
| 4.2.2 Market capitalization, % GDP <sup>Ⓐ</sup>   | 12.6 | 73  |
| 4.2.3 Venture capital deals/bn PPP\$ GDP          | n/a  | n/a |
| 4.3 Trade, competition, & market scale            | 47.1 | 112 |
| 4.3.1 Applied tariff rate, weighted mean, %       | 4.2  | 83  |
| 4.3.2 Intensity of local competition <sup>†</sup> | 59.7 | 104 |
| 4.3.3 Domestic market scale, bn PPP\$             | 21.2 | 118 |

**5 Business sophistication** ..... 32.0 [66]

|  |      |      |
|--|------|------|
| 5.1 Knowledge workers  | 38.9 | [57] |
| 5.1.1 Knowledge-intensive employment, %                          | n/a  | n/a  |
| 5.1.2 Firms offering formal training, % firms                    | 32.9 | 42 ● |
| 5.1.3 GERD performed by business, % of GDP                       | n/a  | n/a  |
| 5.1.4 GERD financed by business, %                               | n/a  | n/a  |
| 5.1.5 Females employed w/advanced degrees, % total               | n/a  | n/a  |
| 5.2 Innovation linkages  | 30.3 | [56] |
| 5.2.1 University/industry research collaboration <sup>†</sup>    | 28.5 | 110  |
| 5.2.2 State of cluster development <sup>†</sup>                  | 31.2 | 118  |
| 5.2.3 GERD financed by abroad, %                                 | n/a  | n/a  |
| 5.2.4 JV-strategic alliance deals/bn PPP\$ GDP                   | n/a  | n/a  |
| 5.2.5 Patent families 2+ offices/bn PPP\$ GDP                    | n/a  | n/a  |
| 5.3 Knowledge absorption   | 26.7 | 92   |
| 5.3.1 Intellectual property payments, % total trade <sup>Ⓐ</sup> | 0.1  | 92   |
| 5.3.2 High-tech imports less re-imports, % total trade           | 8.6  | 57 ● |
| 5.3.3 ICT services imports, % total trade <sup>Ⓐ</sup>           | 1.2  | 59 ● |
| 5.3.4 FDI net inflows, % GDP                                     | 8.7  | 15 ● |
| 5.3.5 Research talent, % in business enterprise <sup>Ⓐ</sup>     | 1.7  | 76   |

**6 Knowledge & technology outputs** ..... 15.8 98

|   |       |       |
|---|-------|-------|
| 6.1 Knowledge creation                                      | 9.4   | 68    |
| 6.1.1 Patents by origin/bn PPP\$ GDP                        | 0.3   | 87    |
| 6.1.2 PCT patent applications/bn PPP\$ GDP                  | 0.0   | 82    |
| 6.1.3 Utility models by origin/bn PPP\$ GDP                 | n/a   | n/a   |
| 6.1.4 Scientific & technical articles/bn PPP\$ GDP          | 20.7  | 37 ●  |
| 6.1.5 Citable documents H index                             | 7.0   | 102   |
| 6.2 Knowledge impact  | 21.3  | 102   |
| 6.2.1 Growth rate of PPP\$ GDP/worker, %                    | 1.8   | 40 ●  |
| 6.2.2 New businesses/th pop. 15–64 <sup>Ⓐ</sup>             | 0.1   | 102 ○ |
| 6.2.3 Computer software spending, % GDP                     | 0.1   | 102   |
| 6.2.4 ISO 9001 quality certificates/bn PPP\$ GDP            | 0.8   | 111   |
| 6.2.5 High- & medium-high-tech manufactures, % <sup>Ⓐ</sup> | 0.1   | 86    |
| 6.3 Knowledge diffusion                                     | 16.6  | 104   |
| 6.3.1 Intellectual property receipts, % total trade         | n/a   | n/a   |
| 6.3.2 High-tech exports less re-exports, % total trade      | 0.2   | 99    |
| 6.3.3 ICT services exports, % total trade <sup>Ⓐ</sup>      | 0.9   | 87    |
| 6.3.4 FDI net outflows, % GDP                               | (0.1) | 116   |

**7 Creative outputs** ..... 16.5 118

|  |      |       |
|--|------|-------|
| 7.1 Intangible assets  | 26.7 | 116   |
| 7.1.1 Trademarks by origin/bn PPP\$ GDP                      | 21.0 | 82    |
| 7.1.2 Industrial designs by origin/bn PPP\$ GDP              | n/a  | n/a   |
| 7.1.3 ICTs & business model creation <sup>†</sup>            | 39.4 | 120 ○ |
| 7.1.4 ICTs & organizational model creation <sup>†</sup>      | 30.5 | 119   |
| 7.2 Creative goods & services                                | 11.7 | 83    |
| 7.2.1 Cultural & creative services exports, % of total trade | 0.0  | 68    |
| 7.2.2 National feature films/mn pop. 15–69                   | n/a  | n/a   |
| 7.2.3 Global ent. & media market/th pop. 15–69               | n/a  | n/a   |
| 7.2.4 Printing & publishing manufactures, % <sup>Ⓐ</sup>     | 1.7  | 30 ●  |
| 7.2.5 Creative goods exports, % total trade                  | 0.1  | 92    |
| 7.3 Online creativity  | 0.9  | 124 ○ |
| 7.3.1 Generic top-level domains (TLDs)/th pop. 15–69         | 0.2  | 115   |
| 7.3.2 Country-code TLDs/th pop. 15–69                        | 0.3  | 96    |
| 7.3.3 Wikipedia edits/mn pop. 15–69 <sup>Ⓐ</sup>             | 0.2  | 124 ○ |
| 7.3.4 Video uploads on YouTube/pop. 15–69                    | n/a  | n/a   |

NOTES: ● indicates a strength; ○ a weakness; \* an index; † a survey question.

Ⓐ indicates that the country's data are older than the base year; see Appendix II for details, including the year of the data, at <http://globalinnovationindex.org>.

Square brackets indicate that the data minimum coverage (DMC) requirements were not met at the sub-pillar or pillar level; see page 181 of this appendix for details.



## Malaysia

## Key indicators

|                            |   |
|----------------------------|---|
| Population (millions)..... | 30.8                                    |
| GDP (US\$ billions).....   | 302.7                                   |
| GDP per capita, PPP\$..... | 26,314.8                                |
| Income group.....          | Upper-middle income                     |
| Region.....                | South East Asia, East Asia, and Oceania |

|  | Score 0–100<br>or value (hard data) | Rank      |
|--|-------------------------------------|-----------|
| <b>Global Innovation Index (out of 127).....</b> | <b>42.7</b>                         | <b>37</b> |
| Innovation Output Sub-Index.....                 | 34.5                                | 39        |
| Innovation Input Sub-Index.....                  | 50.9                                | 36        |
| Innovation Efficiency Ratio.....                 | 0.7                                 | 46        |
| Global Innovation Index 2016 (out of 128).....   | 43.4                                | 35        |

|   |             |           |
|---|-------------|-----------|
| <b>1 Institutions.....</b>                            | <b>67.0</b> | <b>53</b> |
| 1.1 Political environment.....                        | 67.7        | 41        |
| 1.1.1 Political stability & safety*.....              | 68.5        | 52        |
| 1.1.2 Government effectiveness*.....                  | 66.9        | 37        |
| 1.2 Regulatory environment.....                       | 58.3        | 75        |
| 1.2.1 Regulatory quality*.....                        | 61.9        | 40        |
| 1.2.2 Rule of law*.....                               | 56.2        | 40        |
| 1.2.3 Cost of redundancy dismissal, salary weeks..... | 29.4        | 115 ○     |
| 1.3 Business environment.....                         | 75.1        | 50        |
| 1.3.1 Ease of starting a business*.....               | 83.7        | 86        |
| 1.3.2 Ease of resolving insolvency*.....              | 62.5        | 43        |
| 1.3.3 Ease of paying taxes*.....                      | 79.2        | 52        |

|   |             |           |
|---|-------------|-----------|
| <b>2 Human capital &amp; research.....</b>                        | <b>41.9</b> | <b>35</b> |
| 2.1 Education.....  | 43.9        | 77        |
| 2.1.1 Expenditure on education, % GDP.....                        | 5.0         | 49        |
| 2.1.2 Gov't expenditure/pupil, secondary, % GDP/cap.....          | 18.4        | 58        |
| 2.1.3 School life expectancy, years.....                          | 12.9        | 74        |
| 2.1.4 PISA scales in reading, maths, & science <sup>Ⓓ</sup> ..... | 412.7       | 58 ○      |
| 2.1.5 Pupil-teacher ratio, secondary.....                         | 12.0        | 40        |
| 2.2 Tertiary education.....                                       | 48.4        | 24        |
| 2.2.1 Tertiary enrolment, % gross.....                            | 26.1        | 87 ○      |
| 2.2.2 Graduates in science & engineering, %.....                  | 33.3        | 7 ●       |
| 2.2.3 Tertiary inbound mobility, %.....                           | 7.4         | 26        |
| 2.3 Research & development (R&D).....                             | 33.3        | 35        |
| 2.3.1 Researchers, FTE/mn pop. <sup>Ⓓ</sup> .....                 | 2,017.4     | 37        |
| 2.3.2 Gross expenditure on R&D, % GDP <sup>Ⓓ</sup> .....          | 1.3         | 29        |
| 2.3.3 Global R&D companies, avg. expend. top 3, mn \$US.....      | 35.5        | 42        |
| 2.3.4 QS university ranking, average score top 3*.....            | 44.4        | 29        |

|  |             |           |
|--|-------------|-----------|
| <b>3 Infrastructure.....</b>                                 | <b>52.4</b> | <b>45</b> |
| 3.1 Information & communication technologies (ICTs).....     | 66.4        | 44        |
| 3.1.1 ICT access*.....                                       | 67.5        | 59        |
| 3.1.2 ICT use*.....  | 58.6        | 41        |
| 3.1.3 Government's online service*.....                      | 71.7        | 40        |
| 3.1.4 E-participation*.....                                  | 67.8        | 47        |
| 3.2 General infrastructure.....                              | 45.9        | 37        |
| 3.2.1 Electricity output, kWh/cap.....                       | 4,932.1     | 42        |
| 3.2.2 Logistics performance*.....                            | 63.0        | 31        |
| 3.2.3 Gross capital formation, % GDP.....                    | 26.1        | 35        |
| 3.3 Ecological sustainability.....                           | 45.0        | 62        |
| 3.3.1 GDP/unit of energy use.....                            | 8.0         | 71        |
| 3.3.2 Environmental performance*.....                        | 74.2        | 59        |
| 3.3.3 ISO 14001 environmental certificates/bn PPP\$ GDP..... | 2.9         | 35        |

|  |             |           |
|--|-------------|-----------|
| <b>4 Market sophistication.....</b>                      | <b>57.6</b> | <b>20</b> |
| 4.1 Credit.....  | 42.4        | 46        |
| 4.1.1 Ease of getting credit*.....                       | 75.0        | 19        |
| 4.1.2 Domestic credit to private sector, % GDP.....      | 125.2       | 17 ●      |
| 4.1.3 Microfinance gross loans, % GDP <sup>Ⓓ</sup> ..... | 0.1         | 54        |

|  |       |      |
|--|-------|------|
| 4.2 Investment.....  | 55.1  | 22   |
| 4.2.1 Ease of protecting minority investors*.....              | 80.0  | 3 ●  |
| 4.2.2 Market capitalization, % GDP.....                        | 129.3 | 6 ●  |
| 4.2.3 Venture capital deals/bn PPP\$ GDP.....                  | 0.0   | 55   |
| 4.3 Trade, competition, & market scale.....                    | 75.3  | 21   |
| 4.3.1 Applied tariff rate, weighted mean, % <sup>Ⓓ</sup> ..... | 1.3   | 17 ● |
| 4.3.2 Intensity of local competition <sup>†</sup> .....        | 73.1  | 39   |
| 4.3.3 Domestic market scale, bn PPP\$.....                     | 863.8 | 27   |

**5 Business sophistication.....35.7 48**

|   |      |      |
|---|------|------|
| 5.1 Knowledge workers.....  | 26.9 | 93 ○ |
| 5.1.1 Knowledge-intensive employment, %.....                        | 25.5 | 53   |
| 5.1.2 Firms offering formal training, % firms.....                  | 18.5 | 79 ○ |
| 5.1.3 GERD performed by business, % of GDP <sup>Ⓓ</sup> .....       | 0.6  | 32   |
| 5.1.4 GERD financed by business, % <sup>Ⓓ</sup> .....               | 6.9  | 75 ○ |
| 5.1.5 Females employed w/advanced degrees, % total.....             | 12.2 | 57   |
| 5.2 Innovation linkages.....  | 34.5 | 47   |
| 5.2.1 University/industry research collaboration <sup>†</sup> ..... | 70.0 | 11 ● |
| 5.2.2 State of cluster development <sup>†</sup> .....               | 69.5 | 12 ● |
| 5.2.3 GERD financed by abroad, % <sup>Ⓓ</sup> .....                 | 0.2  | 96 ○ |
| 5.2.4 JV-strategic alliance deals/bn PPP\$ GDP.....                 | 0.1  | 18   |
| 5.2.5 Patent families 2+ offices/bn PPP\$ GDP.....                  | 0.3  | 45   |
| 5.3 Knowledge absorption.....                                       | 45.6 | 20   |
| 5.3.1 Intellectual property payments, % total trade.....            | 0.6  | 52   |
| 5.3.2 High-tech imports less re-imports, % total trade.....         | 24.7 | 1 ●  |
| 5.3.3 ICT services imports, % total trade.....                      | 1.6  | 38   |
| 5.3.4 FDI net inflows, % GDP.....                                   | 3.4  | 47   |
| 5.3.5 Research talent, % in business enterprise <sup>Ⓓ</sup> .....  | 10.3 | 66 ○ |

**6 Knowledge & technology outputs.....31.7 36**

|   |      |      |
|---|------|------|
| 6.1 Knowledge creation.....                                       | 8.0  | 74   |
| 6.1.1 Patents by origin/bn PPP\$ GDP.....                         | 1.6  | 54   |
| 6.1.2 PCT patent applications/bn PPP\$ GDP.....                   | 0.2  | 50   |
| 6.1.3 Utility models by origin/bn PPP\$ GDP.....                  | 0.1  | 51 ○ |
| 6.1.4 Scientific & technical articles/bn PPP\$ GDP.....           | 12.3 | 58   |
| 6.1.5 Citable documents H index.....                              | 15.0 | 45   |
| 6.2 Knowledge impact.....   | 37.1 | 43   |
| 6.2.1 Growth rate of PPP\$ GDP/worker, %.....                     | 0.9  | 58   |
| 6.2.2 New businesses/th pop. 15–64.....                           | 2.4  | 43   |
| 6.2.3 Computer software spending, % GDP.....                      | 0.4  | 29   |
| 6.2.4 ISO 9001 quality certificates/bn PPP\$ GDP.....             | 14.6 | 26   |
| 6.2.5 High- & medium-high-tech manufactures, % <sup>Ⓓ</sup> ..... | 0.4  | 28   |
| 6.3 Knowledge diffusion.....                                      | 50.1 | 11 ● |
| 6.3.1 Intellectual property receipts, % total trade.....          | 0.0  | 73   |
| 6.3.2 High-tech exports less re-exports, % total trade.....       | 32.3 | 1 ●  |
| 6.3.3 ICT services exports, % total trade.....                    | 1.3  | 71   |
| 6.3.4 FDI net outflows, % GDP.....                                | 4.1  | 12 ● |

**7 Creative outputs.....37.3 45**

|   |      |      |
|---|------|------|
| 7.1 Intangible assets.....  | 46.1 | 53   |
| 7.1.1 Trademarks by origin/bn PPP\$ GDP.....                      | 19.5 | 84 ○ |
| 7.1.2 Industrial designs by origin/bn PPP\$ GDP.....              | 0.8  | 70   |
| 7.1.3 ICTs & business model creation <sup>†</sup> .....           | 76.2 | 20   |
| 7.1.4 ICTs & organizational model creation <sup>†</sup> .....     | 73.7 | 18   |
| 7.2 Creative goods & services.....                                | 38.4 | 13 ● |
| 7.2.1 Cultural & creative services exports, % of total trade..... | n/a  | n/a  |
| 7.2.2 National feature films/mn pop. 15–69.....                   | 3.7  | 51   |
| 7.2.3 Global ent. & media market/th pop. 15–69.....               | 11.2 | 32   |
| 7.2.4 Printing & publishing manufactures, % <sup>Ⓓ</sup> .....    | 0.9  | 70   |
| 7.2.5 Creative goods exports, % total trade.....                  | 10.3 | 2 ●  |
| 7.3 Online creativity.....  | 18.5 | 69   |
| 7.3.1 Generic top-level domains (TLDs)/th pop. 15–69.....         | 6.3  | 52   |
| 7.3.2 Country-code TLDs/th pop. 15–69.....                        | 4.3  | 54   |
| 7.3.3 Wikipedia edits/mn pop. 15–69.....                          | 4.6  | 69   |
| 7.3.4 Video uploads on YouTube/pop. 15–69.....                    | 19.0 | 58 ○ |

NOTES: ● indicates a strength; ○ a weakness; \* an index; † a survey question.

Ⓓ indicates that the country's data are older than the base year; see Appendix II for details, including the year of the data, at <http://globalinnovationindex.org>.

Square brackets indicate that the data minimum coverage (DMC) requirements were not met at the sub-pillar or pillar level; see page 181 of this appendix for details.



**Key indicators**

|                            |                    |
|----------------------------|--------------------|
| Population (millions)..... | 18.1               |
| GDP (US\$ billions).....   | 14.1               |
| GDP per capita, PPP\$..... | 2,199.0            |
| Income group.....          | Low income         |
| Region.....                | Sub-Saharan Africa |

|  | Score 0–100<br>or value (hard data) | Rank       |
|--|-------------------------------------|------------|
| <b>Global Innovation Index (out of 127).....</b> | <b>22.5</b>                         | <b>118</b> |
| Innovation Output Sub-Index.....                 | 16.8                                | 107        |
| Innovation Input Sub-Index.....                  | 28.1                                | 123 ○      |
| Innovation Efficiency Ratio.....                 | 0.6                                 | 78         |
| Global Innovation Index 2016 (out of 128).....   | 24.8                                | 112        |

**1 Institutions.....45.9 110**

|   |      |       |
|---|------|-------|
| 1.1 Political environment.....                        | 21.2 | 123 ○ |
| 1.1.1 Political stability & safety*.....              | 23.6 | 121   |
| 1.1.2 Government effectiveness*.....                  | 18.7 | 118   |
| 1.2 Regulatory environment.....                       | 55.6 | 85    |
| 1.2.1 Regulatory quality*.....                        | 27.6 | 104   |
| 1.2.2 Rule of law*.....                               | 17.3 | 105   |
| 1.2.3 Cost of redundancy dismissal, salary weeks..... | 13.7 | 53 ●  |
| 1.3 Business environment.....                         | 61.0 | 93    |
| 1.3.1 Ease of starting a business*.....               | 84.1 | 83    |
| 1.3.2 Ease of resolving insolvency*.....              | 41.5 | 88    |
| 1.3.3 Ease of paying taxes*.....                      | 57.5 | 100   |

**2 Human capital & research.....12.2 123 ○**

|  |      |       |
|--|------|-------|
| 2.1 Education.....   | 29.4 | 109   |
| 2.1.1 Expenditure on education, % GDP.....                   | 3.6  | 89    |
| 2.1.2 Gov't expenditure/pupil, secondary, % GDP/cap.....     | 22.1 | 46 ●  |
| 2.1.3 School life expectancy, years <sup>Ⓐ</sup> .....       | 7.7  | 113 ○ |
| 2.1.4 PISA scales in reading, maths, & science.....          | n/a  | n/a   |
| 2.1.5 Pupil-teacher ratio, secondary.....                    | 19.2 | 78    |
| 2.2 Tertiary education.....                                  | 4.0  | 120 ○ |
| 2.2.1 Tertiary enrolment, % gross <sup>Ⓐ</sup> .....         | 6.9  | 112   |
| 2.2.2 Graduates in science & engineering, %.....             | n/a  | n/a   |
| 2.2.3 Tertiary inbound mobility, % <sup>Ⓐ</sup> .....        | 0.5  | 90    |
| 2.3 Research & development (R&D).....                        | 3.4  | 85    |
| 2.3.1 Researchers, FTE/mn pop. <sup>Ⓐ</sup> .....            | 29.2 | 98 ○  |
| 2.3.2 Gross expenditure on R&D, % GDP <sup>Ⓐ</sup> .....     | 0.6  | 58    |
| 2.3.3 Global R&D companies, avg. expend. top 3, mn \$US..... | 0.0  | 43 ○  |
| 2.3.4 QS university ranking, average score top 3*.....       | 0.0  | 75 ○  |

**3 Infrastructure.....24.5 122**

|  |      |       |
|--|------|-------|
| 3.1 Information & communication technologies (ICTs).....     | 14.7 | 124 ○ |
| 3.1.1 ICT access*.....                                       | 33.0 | 107   |
| 3.1.2 ICT use*.....  | 9.7  | 114   |
| 3.1.3 Government's online service*.....                      | 9.4  | 122 ○ |
| 3.1.4 E-participation*.....                                  | 6.8  | 125 ○ |
| 3.2 General infrastructure.....                              | 31.0 | 90    |
| 3.2.1 Electricity output, kWh/cap.....                       | n/a  | n/a   |
| 3.2.2 Logistics performance*.....                            | 20.4 | 103   |
| 3.2.3 Gross capital formation, % GDP.....                    | 19.4 | 90    |
| 3.3 Ecological sustainability.....                           | 27.8 | 118   |
| 3.3.1 GDP/unit of energy use.....                            | n/a  | n/a   |
| 3.3.2 Environmental performance*.....                        | 41.5 | 121 ○ |
| 3.3.3 ISO 14001 environmental certificates/bn PPP\$ GDP..... | 0.1  | 120   |

**4 Market sophistication.....28.6 124 ○**

|   |      |     |
|---|------|-----|
| 4.1 Credit.....                                     | 14.5 | 120 |
| 4.1.1 Ease of getting credit*.....                  | 30.0 | 108 |
| 4.1.2 Domestic credit to private sector, % GDP..... | 24.4 | 105 |
| 4.1.3 Microfinance gross loans, % GDP.....          | 0.3  | 44  |

|   |      |      |
|---|------|------|
| 4.2 Investment.....   | 30.2 | 110  |
| 4.2.1 Ease of protecting minority investors*.....           | 40.0 | 111  |
| 4.2.2 Market capitalization, % GDP.....                     | n/a  | n/a  |
| 4.2.3 Venture capital deals/bn PPP\$ GDP <sup>Ⓐ</sup> ..... | 0.0  | 37 ● |
| 4.3 Trade, competition, & market scale.....                 | 41.1 | 120  |
| 4.3.1 Applied tariff rate, weighted mean, %.....            | 10.6 | 116  |
| 4.3.2 Intensity of local competition <sup>†</sup> .....     | 57.2 | 111  |
| 4.3.3 Domestic market scale, bn PPP\$.....                  | 38.1 | 99   |

**5 Business sophistication.....29.4 74**

|   |      |      |
|---|------|------|
| 5.1 Knowledge workers.....  | 22.2 | 105  |
| 5.1.1 Knowledge-intensive employment, %.....                              | n/a  | n/a  |
| 5.1.2 Firms offering formal training, % firms <sup>Ⓐ</sup> .....          | 32.1 | 44 ● |
| 5.1.3 GERD performed by business, % of GDP <sup>Ⓐ</sup> .....             | 0.0  | 83   |
| 5.1.4 GERD financed by business, % <sup>Ⓐ</sup> .....                     | 10.1 | 73   |
| 5.1.5 Females employed w/advanced degrees, % total.....                   | n/a  | n/a  |
| 5.2 Innovation linkages.....  | 26.7 | 69   |
| 5.2.1 University/industry research collaboration <sup>†</sup> .....       | 35.8 | 90   |
| 5.2.2 State of cluster development <sup>†</sup> .....                     | 40.8 | 83   |
| 5.2.3 GERD financed by abroad, % <sup>Ⓐ</sup> .....                       | 8.8  | 50   |
| 5.2.4 JV-strategic alliance deals/bn PPP\$ GDP.....                       | 0.0  | 35 ● |
| 5.2.5 Patent families 2+ offices/bn PPP\$ GDP.....                        | n/a  | n/a  |
| 5.3 Knowledge absorption.....   | 39.3 | 35 ● |
| 5.3.1 Intellectual property payments, % total trade <sup>Ⓐ</sup> .....    | 0.1  | 105  |
| 5.3.2 High-tech imports less re-imports, % total trade <sup>Ⓐ</sup> ..... | 5.1  | 107  |
| 5.3.3 ICT services imports, % total trade <sup>Ⓐ</sup> .....              | 3.1  | 7 ●  |
| 5.3.4 FDI net inflows, % GDP.....   | 1.5  | 95   |
| 5.3.5 Research talent, % in business enterprise <sup>Ⓐ</sup> .....        | 49.0 | 26 ● |

**6 Knowledge & technology outputs.....19.1 80**

|   |      |       |
|---|------|-------|
| 6.1 Knowledge creation.....   | 3.8  | 100   |
| 6.1.1 Patents by origin/bn PPP\$ GDP <sup>Ⓐ</sup> .....                   | 0.3  | 90    |
| 6.1.2 PCT patent applications/bn PPP\$ GDP.....                           | n/a  | n/a   |
| 6.1.3 Utility models by origin/bn PPP\$ GDP.....                          | n/a  | n/a   |
| 6.1.4 Scientific & technical articles/bn PPP\$ GDP.....                   | 4.6  | 101   |
| 6.1.5 Citable documents H index.....                                      | 4.3  | 99    |
| 6.2 Knowledge impact.....   | 32.9 | 58 ●  |
| 6.2.1 Growth rate of PPP\$ GDP/worker, %.....                             | 2.7  | 24 ●  |
| 6.2.2 New businesses/th pop. 15–64.....                                   | n/a  | n/a   |
| 6.2.3 Computer software spending, % GDP.....                              | 0.0  | 111   |
| 6.2.4 ISO 9001 quality certificates/bn PPP\$ GDP.....                     | 0.2  | 123 ○ |
| 6.2.5 High- & medium-high-tech manufactures, %.....                       | n/a  | n/a   |
| 6.3 Knowledge diffusion.....  | 20.7 | 70    |
| 6.3.1 Intellectual property receipts, % total trade <sup>Ⓐ</sup> .....    | 0.0  | 94    |
| 6.3.2 High-tech exports less re-exports, % total trade <sup>Ⓐ</sup> ..... | 0.1  | 111   |
| 6.3.3 ICT services exports, % total trade <sup>Ⓐ</sup> .....              | 4.7  | 14 ●  |
| 6.3.4 FDI net outflows, % GDP.....  | 0.0  | 104   |

**7 Creative outputs.....14.5 121**

|   |      |       |
|---|------|-------|
| 7.1 Intangible assets.....  | 26.1 | 119   |
| 7.1.1 Trademarks by origin/bn PPP\$ GDP.....                      | 5.4  | 111   |
| 7.1.2 Industrial designs by origin/bn PPP\$ GDP.....              | 0.5  | 77    |
| 7.1.3 ICTs & business model creation <sup>†</sup> .....           | 48.8 | 107   |
| 7.1.4 ICTs & organizational model creation <sup>†</sup> .....     | 38.9 | 109   |
| 7.2 Creative goods & services.....                                | 0.5  | 127   |
| 7.2.1 Cultural & creative services exports, % of total trade..... | 0.0  | 74    |
| 7.2.2 National feature films/mn pop. 15–69 <sup>Ⓐ</sup> .....     | 0.1  | 101 ○ |
| 7.2.3 Global ent. & media market/th pop. 15–69.....               | n/a  | n/a   |
| 7.2.4 Printing & publishing manufactures, %.....                  | n/a  | n/a   |
| 7.2.5 Creative goods exports, % total trade <sup>Ⓐ</sup> .....    | 0.0  | 122 ○ |
| 7.3 Online creativity.....  | 5.2  | 110   |
| 7.3.1 Generic top-level domains (TLDs)/th pop. 15–69.....         | 0.2  | 119   |
| 7.3.2 Country-code TLDs/th pop. 15–69.....                        | 11.1 | 38 ●  |
| 7.3.3 Wikipedia edits/mn pop. 15–69 <sup>Ⓐ</sup> .....            | 0.5  | 121   |
| 7.3.4 Video uploads on YouTube/pop. 15–69.....                    | n/a  | n/a   |

**NOTES:** ● indicates a strength; ○ a weakness; \* an index; † a survey question.

Ⓐ indicates that the country's data are older than the base year; see Appendix II for details, including the year of the data, at <http://globalinnovationindex.org>.

Square brackets indicate that the data minimum coverage (DMC) requirements were not met at the sub-pillar or pillar level; see page 181 of this appendix for details.

## Key indicators

|                            |             |
|----------------------------|-------------|
| Population (millions)..... | 0.4         |
| GDP (US\$ billions).....   | 10.5        |
| GDP per capita, PPP\$..... | 35,825.6    |
| Income group.....          | High income |
| Region.....                | Europe      |

|  | Score 0–100<br>or value (hard data) | Rank      |
|--|-------------------------------------|-----------|
| <b>Global Innovation Index (out of 127).....</b> | <b>50.6</b>                         | <b>26</b> |
| Innovation Output Sub-Index.....                 | 46.3                                | 15        |
| Innovation Input Sub-Index.....                  | 54.9                                | 28        |
| Innovation Efficiency Ratio.....                 | 0.8                                 | 8         |
| Global Innovation Index 2016 (out of 128).....   | 50.4                                | 26        |

**1 Institutions.....77.6 29**

|   |      |      |
|---|------|------|
| 1.1 Political environment.....                        | 76.5 | 29   |
| 1.1.1 Political stability & safety*.....              | 89.1 | 10   |
| 1.1.2 Government effectiveness*.....                  | 64.0 | 38   |
| 1.2 Regulatory environment.....                       | 86.3 | 17   |
| 1.2.1 Regulatory quality*.....                        | 72.2 | 25   |
| 1.2.2 Rule of law*.....                               | 73.1 | 25   |
| 1.2.3 Cost of redundancy dismissal, salary weeks..... | 8.0  | 1 ●  |
| 1.3 Business environment.....                         | 70.1 | 66   |
| 1.3.1 Ease of starting a business*.....               | 80.2 | 99 ○ |
| 1.3.2 Ease of resolving insolvency*.....              | 45.4 | 76   |
| 1.3.3 Ease of paying taxes*.....                      | 84.6 | 29   |

**2 Human capital & research.....41.9 37**

|  |         |      |
|--|---------|------|
| 2.1 Education.....   | 69.8    | 7    |
| 2.1.1 Expenditure on education, % GDP.....                     | 8.3     | 5 ●  |
| 2.1.2 Gov't expenditure/pupil, secondary, % GDP/cap.....       | 40.6    | 4 ●  |
| 2.1.3 School life expectancy, years.....                       | 15.0    | 46   |
| 2.1.4 PISA scales in reading, maths, & science.....            | 463.4   | 40   |
| 2.1.5 Pupil-teacher ratio, secondary <sup>Ⓐ</sup> .....        | 7.8     | 6    |
| 2.2 Tertiary education.....                                    | 36.2    | 61   |
| 2.2.1 Tertiary enrolment, % gross.....                         | 47.0    | 56   |
| 2.2.2 Graduates in science & engineering, % <sup>Ⓐ</sup> ..... | 19.1    | 63 ○ |
| 2.2.3 Tertiary inbound mobility, %.....                        | 6.2     | 31   |
| 2.3 Research & development (R&D).....                          | 19.6    | 44   |
| 2.3.1 Researchers, FTE/mn pop.....                             | 1,951.4 | 40   |
| 2.3.2 Gross expenditure on R&D, % GDP <sup>Ⓐ</sup> .....       | 0.8     | 46   |
| 2.3.3 Global R&D companies, avg. expend. top 3, mn \$US.....   | 37.4    | 41   |
| 2.3.4 QS university ranking, average score top 3*.....         | 0.0     | 75 ○ |

**3 Infrastructure.....60.6 23**

|  |         |     |
|--|---------|-----|
| 3.1 Information & communication technologies (ICTs).....     | 78.9    | 22  |
| 3.1.1 ICT access*.....                                       | 90.4    | 6 ● |
| 3.1.2 ICT use*.....  | 67.5    | 26  |
| 3.1.3 Government's online service*.....                      | 79.7    | 26  |
| 3.1.4 E-participation*.....                                  | 78.0    | 25  |
| 3.2 General infrastructure.....                              | 41.4    | 48  |
| 3.2.1 Electricity output, kWh/cap.....                       | 5,220.9 | 37  |
| 3.2.2 Logistics performance*.....                            | 46.5    | 55  |
| 3.2.3 Gross capital formation, % GDP.....                    | 25.6    | 42  |
| 3.3 Ecological sustainability.....                           | 61.5    | 15  |
| 3.3.1 GDP/unit of energy use.....                            | 15.2    | 9   |
| 3.3.2 Environmental performance*.....                        | 88.5    | 9   |
| 3.3.3 ISO 14001 environmental certificates/bn PPP\$ GDP..... | 2.6     | 42  |

**4 Market sophistication.....45.4 69**

|   |      |       |
|---|------|-------|
| 4.1 Credit.....                                     | 34.4 | 67    |
| 4.1.1 Ease of getting credit*.....                  | 30.0 | 108 ○ |
| 4.1.2 Domestic credit to private sector, % GDP..... | 98.0 | 28    |
| 4.1.3 Microfinance gross loans, % GDP.....          | n/a  | n/a   |

|   |      |       |
|---|------|-------|
| 4.2 Investment.....                                     | 47.0 | 35    |
| 4.2.1 Ease of protecting minority investors*.....       | 65.0 | 31    |
| 4.2.2 Market capitalization, % GDP.....                 | 45.2 | 34    |
| 4.2.3 Venture capital deals/bn PPP\$ GDP.....           | 0.1  | 15    |
| 4.3 Trade, competition, & market scale.....             | 54.8 | 94 ○  |
| 4.3.1 Applied tariff rate, weighted mean, %.....        | 1.6  | 23    |
| 4.3.2 Intensity of local competition <sup>†</sup> ..... | 83.2 | 4 ●   |
| 4.3.3 Domestic market scale, bn PPP\$.....              | 16.3 | 122 ○ |

**5 Business sophistication.....49.0 21**

|   |      |      |
|---|------|------|
| 5.1 Knowledge workers.....  | 48.7 | 34   |
| 5.1.1 Knowledge-intensive employment, %.....                        | 39.8 | 26   |
| 5.1.2 Firms offering formal training, % firms.....                  | n/a  | n/a  |
| 5.1.3 GERD performed by business, % of GDP <sup>Ⓐ</sup> .....       | 0.4  | 38   |
| 5.1.4 GERD financed by business, %.....                             | 44.1 | 28   |
| 5.1.5 Females employed w/advanced degrees, % total.....             | 12.3 | 55 ○ |
| 5.2 Innovation linkages.....  | 49.0 | 9    |
| 5.2.1 University/industry research collaboration <sup>†</sup> ..... | 50.0 | 36   |
| 5.2.2 State of cluster development <sup>†</sup> .....               | 53.6 | 35   |
| 5.2.3 GERD financed by abroad, %.....                               | 21.3 | 19   |
| 5.2.4 JV-strategic alliance deals/bn PPP\$ GDP.....                 | 0.1  | 24   |
| 5.2.5 Patent families 2+ offices/bn PPP\$ GDP.....                  | 8.8  | 6    |
| 5.3 Knowledge absorption.....                                       | 49.4 | 15   |
| 5.3.1 Intellectual property payments, % total trade.....            | 3.2  | 5 ●  |
| 5.3.2 High-tech imports less re-imports, % total trade.....         | 7.4  | 73   |
| 5.3.3 ICT services imports, % total trade.....                      | 1.0  | 67   |
| 5.3.4 FDI net inflows, % GDP.....                                   | 9.5  | 10   |
| 5.3.5 Research talent, % in business enterprise.....                | 58.0 | 14   |

**6 Knowledge & technology outputs.....36.6 23**

|   |        |       |
|---|--------|-------|
| 6.1 Knowledge creation.....                                       | 33.3   | 28    |
| 6.1.1 Patents by origin/bn PPP\$ GDP.....                         | 6.0    | 21    |
| 6.1.2 PCT patent applications/bn PPP\$ GDP.....                   | 5.3    | 9     |
| 6.1.3 Utility models by origin/bn PPP\$ GDP.....                  | n/a    | n/a   |
| 6.1.4 Scientific & technical articles/bn PPP\$ GDP.....           | 17.9   | 42    |
| 6.1.5 Citable documents H index.....                              | 5.0    | 93 ○  |
| 6.2 Knowledge impact.....   | 59.0   | 3 ●   |
| 6.2.1 Growth rate of PPP\$ GDP/worker, %.....                     | 2.7    | 25    |
| 6.2.2 New businesses/th pop. 15–64.....                           | 17.3   | 1 ●   |
| 6.2.3 Computer software spending, % GDP.....                      | 0.4    | 25    |
| 6.2.4 ISO 9001 quality certificates/bn PPP\$ GDP.....             | 32.8   | 5 ●   |
| 6.2.5 High- & medium-high-tech manufactures, % <sup>Ⓐ</sup> ..... | 0.2    | 50    |
| 6.3 Knowledge diffusion.....                                      | 17.4   | 99 ○  |
| 6.3.1 Intellectual property receipts, % total trade.....          | 2.1    | 9     |
| 6.3.2 High-tech exports less re-exports, % total trade.....       | 4.7    | 36    |
| 6.3.3 ICT services exports, % total trade.....                    | 1.0    | 82 ○  |
| 6.3.4 FDI net outflows, % GDP.....                                | (81.5) | 124 ○ |

**7 Creative outputs.....56.0 6 ●**

|   |       |      |
|---|-------|------|
| 7.1 Intangible assets.....  | 62.8  | 10   |
| 7.1.1 Trademarks by origin/bn PPP\$ GDP.....                                    | 104.6 | 13   |
| 7.1.2 Industrial designs by origin/bn PPP\$ GDP <sup>Ⓐ</sup> .....              | 13.0  | 9    |
| 7.1.3 ICTs & business model creation <sup>†</sup> .....                         | 69.9  | 32   |
| 7.1.4 ICTs & organizational model creation <sup>†</sup> .....                   | 61.2  | 36   |
| 7.2 Creative goods & services.....  | 45.1  | 7    |
| 7.2.1 Cultural & creative services exports, % of total trade <sup>Ⓐ</sup> ..... | 0.0   | 90 ○ |
| 7.2.2 National feature films/mn pop. 15–69.....                                 | 22.8  | 4 ●  |
| 7.2.3 Global ent. & media market/th pop. 15–69.....                             | 8.8   | 36   |
| 7.2.4 Printing & publishing manufactures, % <sup>Ⓐ</sup> .....                  | 36.2  | 1 ●  |
| 7.2.5 Creative goods exports, % total trade.....                                | 0.4   | 64   |
| 7.3 Online creativity.....  | 53.5  | 14   |
| 7.3.1 Generic top-level domains (TLDs)/th pop. 15–69.....                       | 94.5  | 3 ●  |
| 7.3.2 Country-code TLDs/th pop. 15–69.....                                      | 7.3   | 44   |
| 7.3.3 Wikipedia edits/mn pop. 15–69 <sup>Ⓐ</sup> .....                          | 6.1   | 42   |
| 7.3.4 Video uploads on YouTube/pop. 15–69.....                                  | n/a   | n/a  |

NOTES: ● indicates a strength; ○ a weakness; \* an index; † a survey question.

<sup>Ⓐ</sup> indicates that the country's data are older than the base year; see Appendix II for details, including the year of the data, at <http://globalinnovationindex.org>.

Square brackets indicate that the data minimum coverage (DMC) requirements were not met at the sub-pillar or pillar level; see page 181 of this appendix for details.

## Key indicators

|                            |                     |
|----------------------------|---------------------|
| Population (millions)..... | 1.3                 |
| GDP (US\$ billions).....   | 11.7                |
| GDP per capita, PPP\$..... | 19,509.2            |
| Income group.....          | Upper-middle income |
| Region.....                | Sub-Saharan Africa  |

|  | Score 0–100<br>or value (hard data) | Rank      |
|--|-------------------------------------|-----------|
| <b>Global Innovation Index (out of 127).....</b> | <b>34.8</b>                         | <b>64</b> |
| Innovation Output Sub-Index.....                 | 22.5                                | 82        |
| Innovation Input Sub-Index.....                  | 47.1                                | 47        |
| Innovation Efficiency Ratio.....                 | 0.5                                 | 109 ○     |
| Global Innovation Index 2016 (out of 128).....   | 35.9                                | 53        |

|   |             |             |
|---|-------------|-------------|
| <b>1 Institutions.....</b>                            | <b>80.0</b> | <b>27 ●</b> |
| 1.1 Political environment.....                        | 77.8        | 25 ●        |
| 1.1.1 Political stability & safety*.....              | 86.9        | 20 ●        |
| 1.1.2 Government effectiveness*.....                  | 68.8        | 33 ●        |
| 1.2 Regulatory environment.....                       | 81.0        | 24 ●        |
| 1.2.1 Regulatory quality*.....                        | 70.0        | 29 ●        |
| 1.2.2 Rule of law*.....                               | 64.4        | 34          |
| 1.2.3 Cost of redundancy dismissal, salary weeks..... | 10.6        | 36          |
| 1.3 Business environment.....                         | 81.2        | 29 ●        |
| 1.3.1 Ease of starting a business*.....               | 91.7        | 41          |
| 1.3.2 Ease of resolving insolvency*.....              | 69.1        | 36          |
| 1.3.3 Ease of paying taxes*.....                      | 83.0        | 38          |

|  |             |           |
|--|-------------|-----------|
| <b>2 Human capital &amp; research.....</b>                   | <b>30.2</b> | <b>76</b> |
| 2.1 Education.....   | 53.8        | 45        |
| 2.1.1 Expenditure on education, % GDP.....                   | 5.0         | 50        |
| 2.1.2 Gov't expenditure/pupil, secondary, % GDP/cap.....     | 31.2        | 12 ●      |
| 2.1.3 School life expectancy, years.....                     | 14.9        | 54        |
| 2.1.4 PISA scales in reading, maths, & science.....          | n/a         | n/a       |
| 2.1.5 Pupil-teacher ratio, secondary.....                    | 12.9        | 49        |
| 2.2 Tertiary education.....                                  | 35.2        | 65        |
| 2.2.1 Tertiary enrolment, % gross.....                       | 36.7        | 71        |
| 2.2.2 Graduates in science & engineering, %.....             | 22.9        | 37        |
| 2.2.3 Tertiary inbound mobility, %.....                      | 4.0         | 50        |
| 2.3 Research & development (R&D).....                        | 1.5         | 98        |
| 2.3.1 Researchers, FTE/mn pop. <sup>Ⓔ</sup> .....            | 181.1       | 77        |
| 2.3.2 Gross expenditure on R&D, % GDP <sup>Ⓔ</sup> .....     | 0.2         | 91 ○      |
| 2.3.3 Global R&D companies, avg. expend. top 3, mn \$US..... | 0.0         | 43 ○      |
| 2.3.4 QS university ranking, average score top 3*.....       | 0.0         | 75 ○      |

|  |             |           |
|--|-------------|-----------|
| <b>3 Infrastructure.....</b>                                 | <b>47.2</b> | <b>64</b> |
| 3.1 Information & communication technologies (ICTs).....     | 60.7        | 58        |
| 3.1.1 ICT access*.....                                       | 68.6        | 53        |
| 3.1.2 ICT use*.....  | 37.8        | 74        |
| 3.1.3 Government's online service*.....                      | 70.3        | 45        |
| 3.1.4 E-participation*.....                                  | 66.1        | 49        |
| 3.2 General infrastructure.....                              | 28.0        | 97        |
| 3.2.1 Electricity output, kWh/cap.....                       | 2,328.6     | 73        |
| 3.2.2 Logistics performance* <sup>Ⓔ</sup> .....              | 20.9        | 99        |
| 3.2.3 Gross capital formation, % GDP.....                    | 21.7        | 68        |
| 3.3 Ecological sustainability.....                           | 52.8        | 37        |
| 3.3.1 GDP/unit of energy use.....                            | 15.6        | 8 ●       |
| 3.3.2 Environmental performance*.....                        | 70.9        | 70        |
| 3.3.3 ISO 14001 environmental certificates/bn PPP\$ GDP..... | 0.9         | 67        |

|   |             |           |
|---|-------------|-----------|
| <b>4 Market sophistication.....</b>                 | <b>50.6</b> | <b>44</b> |
| 4.1 Credit.....                                     | 52.9        | 23 ●      |
| 4.1.1 Ease of getting credit*.....                  | 65.0        | 40        |
| 4.1.2 Domestic credit to private sector, % GDP..... | 102.8       | 26 ●      |
| 4.1.3 Microfinance gross loans, % GDP.....          | n/a         | n/a       |

|   |      |       |
|---|------|-------|
| 4.2 Investment.....                                     | 42.2 | 54    |
| 4.2.1 Ease of protecting minority investors*.....       | 65.0 | 31    |
| 4.2.2 Market capitalization, % GDP.....                 | 62.0 | 27    |
| 4.2.3 Venture capital deals/bn PPP\$ GDP.....           | 0.0  | 35    |
| 4.3 Trade, competition, & market scale.....             | 56.8 | 84    |
| 4.3.1 Applied tariff rate, weighted mean, %.....        | 0.6  | 7 ●   |
| 4.3.2 Intensity of local competition <sup>†</sup> ..... | 71.7 | 47    |
| 4.3.3 Domestic market scale, bn PPP\$.....              | 25.8 | 113 ○ |

|  |             |           |
|--|-------------|-----------|
| <b>5 Business sophistication.....</b>                                  | <b>27.7</b> | <b>86</b> |
| 5.1 Knowledge workers.....   | 27.7        | 92        |
| 5.1.1 Knowledge-intensive employment, %.....                           | 24.7        | 56        |
| 5.1.2 Firms offering formal training, % firms <sup>Ⓔ</sup> .....       | 25.6        | 61        |
| 5.1.3 GERD performed by business, % of GDP.....                        | n/a         | n/a       |
| 5.1.4 GERD financed by business, % <sup>Ⓔ</sup> .....                  | 0.3         | 91 ○      |
| 5.1.5 Females employed w/advanced degrees, % total <sup>Ⓔ</sup> .....  | 7.4         | 73 ○      |
| 5.2 Innovation linkages.....   | 24.4        | 78        |
| 5.2.1 University/industry research collaboration <sup>†</sup> .....    | 36.5        | 87        |
| 5.2.2 State of cluster development <sup>†</sup> .....                  | 52.3        | 39        |
| 5.2.3 GERD financed by abroad, % <sup>Ⓔ</sup> .....                    | 6.4         | 60        |
| 5.2.4 JV-strategic alliance deals/bn PPP\$ GDP <sup>Ⓔ</sup> .....      | 0.0         | 64        |
| 5.2.5 Patent families 2+ offices/bn PPP\$ GDP.....                     | 0.2         | 53        |
| 5.3 Knowledge absorption.....  | 31.0        | 75        |
| 5.3.1 Intellectual property payments, % total trade <sup>Ⓔ</sup> ..... | 0.3         | 77        |
| 5.3.2 High-tech imports less re-imports, % total trade.....            | 8.9         | 55        |
| 5.3.3 ICT services imports, % total trade <sup>Ⓔ</sup> .....           | 1.3         | 54        |
| 5.3.4 FDI net inflows, % GDP.....                                      | 2.5         | 72        |
| 5.3.5 Research talent, % in business enterprise.....                   | n/a         | n/a       |

|  |             |              |
|--|-------------|--------------|
| <b>6 Knowledge &amp; technology outputs.....</b>                       | <b>13.6</b> | <b>115 ○</b> |
| 6.1 Knowledge creation.....  | 2.8         | 116 ○        |
| 6.1.1 Patents by origin/bn PPP\$ GDP.....                              | 0.0         | 117 ○        |
| 6.1.2 PCT patent applications/bn PPP\$ GDP.....                        | n/a         | n/a          |
| 6.1.3 Utility models by origin/bn PPP\$ GDP.....                       | n/a         | n/a          |
| 6.1.4 Scientific & technical articles/bn PPP\$ GDP.....                | 4.6         | 100          |
| 6.1.5 Citable documents H index.....                                   | 2.3         | 114 ○        |
| 6.2 Knowledge impact.....  | 17.7        | 108 ○        |
| 6.2.1 Growth rate of PPP\$ GDP/worker, %.....                          | n/a         | n/a          |
| 6.2.2 New businesses/th pop. 15–64.....                                | 5.1         | 24 ●         |
| 6.2.3 Computer software spending, % GDP.....                           | 0.2         | 75           |
| 6.2.4 ISO 9001 quality certificates/bn PPP\$ GDP.....                  | 9.7         | 38           |
| 6.2.5 High- & medium-high-tech manufactures, % <sup>Ⓔ</sup> .....      | 0.1         | 87 ○         |
| 6.3 Knowledge diffusion.....   | 20.3        | 74           |
| 6.3.1 Intellectual property receipts, % total trade <sup>Ⓔ</sup> ..... | 0.0         | 72           |
| 6.3.2 High-tech exports less re-exports, % total trade.....            | 0.0         | 122 ○        |
| 6.3.3 ICT services exports, % total trade <sup>Ⓔ</sup> .....           | 2.6         | 41           |
| 6.3.4 FDI net outflows, % GDP.....                                     | 0.9         | 55           |

|  |             |           |
|--|-------------|-----------|
| <b>7 Creative outputs.....</b>                                     | <b>31.4</b> | <b>61</b> |
| 7.1 Intangible assets.....   | 37.8        | 83        |
| 7.1.1 Trademarks by origin/bn PPP\$ GDP.....                       | 40.2        | 59        |
| 7.1.2 Industrial designs by origin/bn PPP\$ GDP <sup>Ⓔ</sup> ..... | 0.4         | 81        |
| 7.1.3 ICTs & business model creation <sup>†</sup> .....            | 60.0        | 64        |
| 7.1.4 ICTs & organizational model creation <sup>†</sup> .....      | 50.9        | 71        |
| 7.2 Creative goods & services.....                                 | 32.0        | 27 ●      |
| 7.2.1 Cultural & creative services exports, % of total trade.....  | 0.0         | 69        |
| 7.2.2 National feature films/mn pop. 15–69.....                    | 9.4         | 16 ●      |
| 7.2.3 Global ent. & media market/th pop. 15–69.....                | n/a         | n/a       |
| 7.2.4 Printing & publishing manufactures, % <sup>Ⓔ</sup> .....     | 3.2         | 5 ●       |
| 7.2.5 Creative goods exports, % total trade.....                   | 1.1         | 41        |
| 7.3 Online creativity.....   | 18.1        | 70        |
| 7.3.1 Generic top-level domains (TLDs)/th pop. 15–69.....          | 12.7        | 34        |
| 7.3.2 Country-code TLDs/th pop. 15–69.....                         | 2.3         | 62        |
| 7.3.3 Wikipedia edits/mn pop. 15–69 <sup>Ⓔ</sup> .....             | 4.1         | 79        |
| 7.3.4 Video uploads on YouTube/pop. 15–69.....                     | n/a         | n/a       |

NOTES: ● indicates a strength; ○ a weakness; \* an index; † a survey question.

Ⓔ indicates that the country's data are older than the base year; see Appendix II for details, including the year of the data, at <http://globalinnovationindex.org>.

Square brackets indicate that the data minimum coverage (DMC) requirements were not met at the sub-pillar or pillar level; see page 181 of this appendix for details.

## Mexico

## Key indicators

|                            |                                 |
|----------------------------|---------------------------------|
| Population (millions)..... | 128.6                           |
| GDP (US\$ billions).....   | 1,063.6                         |
| GDP per capita, PPP\$..... | 17,534.4                        |
| Income group.....          | Upper-middle income             |
| Region.....                | Latin America and the Caribbean |

|  | Score 0–100<br>or value (hard data) | Rank      |
|--|-------------------------------------|-----------|
| <b>Global Innovation Index (out of 127).....</b> | <b>35.8</b>                         | <b>58</b> |
| Innovation Output Sub-Index.....                 | 27.1                                | 60        |
| Innovation Input Sub-Index.....                  | 44.5                                | 54        |
| Innovation Efficiency Ratio.....                 | 0.6                                 | 74        |
| Global Innovation Index 2016 (out of 128).....   | 34.6                                | 61        |

|  |             |           |
|--|-------------|-----------|
| <b>1 Institutions.....</b>                                     | <b>58.5</b> | <b>68</b> |
| 1.1 Political environment.....                                 | 45.1        | 82        |
| 1.1.1 Political stability & safety*.....                       | 42.7        | 104 ○     |
| 1.1.2 Government effectiveness*.....                           | 47.6        | 59        |
| 1.2 Regulatory environment.....                                | 55.6        | 84        |
| 1.2.1 Regulatory quality*.....                                 | 52.4        | 54        |
| 1.2.2 Rule of law*.....  | 25.7        | 90        |
| 1.2.3 Cost of redundancy dismissal, salary weeks.....          | 22.0        | 94        |
| 1.3 Business environment.....                                  | 74.9        | 51        |
| 1.3.1 Ease of starting a business*.....                        | 85.7        | 75        |
| 1.3.2 Ease of resolving insolvency*.....                       | 73.1        | 28        |
| 1.3.3 Ease of paying taxes*.....                               | 65.8        | 83        |
| <b>2 Human capital &amp; research.....</b>                     | <b>33.7</b> | <b>55</b> |
| 2.1 Education.....   | 43.1        | 80        |
| 2.1.1 Expenditure on education, % GDP <sup>Ⓐ</sup> .....       | 5.2         | 44        |
| 2.1.2 Gov't expenditure/pupil, secondary, % GDP/cap.....       | 16.6        | 69        |
| 2.1.3 School life expectancy, years.....                       | 13.3        | 66        |
| 2.1.4 PISA scales in reading, maths, & science.....            | 415.7       | 55 ○      |
| 2.1.5 Pupil-teacher ratio, secondary <sup>Ⓐ</sup> .....        | 16.1        | 71        |
| 2.2 Tertiary education.....                                    | 33.0        | 72        |
| 2.2.1 Tertiary enrolment, % gross <sup>Ⓐ</sup> .....           | 29.9        | 79        |
| 2.2.2 Graduates in science & engineering, % <sup>Ⓐ</sup> ..... | 26.9        | 19 ●      |
| 2.2.3 Tertiary inbound mobility, % <sup>Ⓐ</sup> .....          | 0.2         | 99 ○      |
| 2.3 Research & development (R&D).....                          | 24.8        | 41        |
| 2.3.1 Researchers, FTE/mn pop. <sup>Ⓐ</sup> .....              | 241.8       | 72        |
| 2.3.2 Gross expenditure on R&D, % GDP.....                     | 0.6         | 59        |
| 2.3.3 Global R&D companies, avg. expend. top 3, mn \$US.....   | 42.5        | 37        |
| 2.3.4 QS university ranking, average score top 3*.....         | 41.6        | 32        |
| <b>3 Infrastructure.....</b>                                   | <b>49.7</b> | <b>53</b> |
| 3.1 Information & communication technologies (ICTs).....       | 66.5        | 42        |
| 3.1.1 ICT access*.....   | 50.8        | 81        |
| 3.1.2 ICT use*.....  | 42.4        | 65        |
| 3.1.3 Government's online service*.....                        | 84.8        | 19 ●      |
| 3.1.4 E-participation*.....                                    | 88.1        | 14 ●      |
| 3.2 General infrastructure.....                                | 36.7        | 67        |
| 3.2.1 Electricity output, kWh/cap.....                         | 2,538.6     | 70        |
| 3.2.2 Logistics performance*.....                              | 48.6        | 53        |
| 3.2.3 Gross capital formation, % GDP.....                      | 23.1        | 54        |
| 3.3 Ecological sustainability.....                             | 45.8        | 58        |
| 3.3.1 GDP/unit of energy use.....                              | 10.6        | 41        |
| 3.3.2 Environmental performance*.....                          | 73.6        | 63        |
| 3.3.3 ISO 14001 environmental certificates/bn PPP\$ GDP.....   | 0.6         | 78        |
| <b>4 Market sophistication.....</b>                            | <b>50.0</b> | <b>49</b> |
| 4.1 Credit.....  | 35.5        | 63        |
| 4.1.1 Ease of getting credit*.....                             | 90.0        | 5 ●       |
| 4.1.2 Domestic credit to private sector, % GDP.....            | 32.7        | 97        |
| 4.1.3 Microfinance gross loans, % GDP.....                     | 0.2         | 47        |

|   |             |           |
|---|-------------|-----------|
| 4.2 Investment.....   | 34.5        | 86        |
| 4.2.1 Ease of protecting minority investors*.....                     | 60.0        | 52        |
| 4.2.2 Market capitalization, % GDP.....                               | 35.2        | 42        |
| 4.2.3 Venture capital deals/bn PPP\$ GDP.....                         | 0.0         | 70        |
| 4.3 Trade, competition, & market scale.....                           | 79.9        | 7 ●       |
| 4.3.1 Applied tariff rate, weighted mean, % <sup>Ⓐ</sup> .....        | 1.0         | 12 ●      |
| 4.3.2 Intensity of local competition <sup>†</sup> .....               | 70.3        | 56        |
| 4.3.3 Domestic market scale, bn PPP\$.....                            | 2,306.7     | 11 ●      |
| <b>5 Business sophistication.....</b>                                 | <b>30.8</b> | <b>71</b> |
| 5.1 Knowledge workers.....  | 34.9        | 75        |
| 5.1.1 Knowledge-intensive employment, %.....                          | 18.8        | 77        |
| 5.1.2 Firms offering formal training, % firms <sup>Ⓐ</sup> .....      | 50.8        | 22        |
| 5.1.3 GERD performed by business, % of GDP.....                       | 0.2         | 54        |
| 5.1.4 GERD financed by business, %.....                               | 20.6        | 62        |
| 5.1.5 Females employed w/advanced degrees, % total <sup>Ⓐ</sup> ..... | 8.2         | 69 ○      |
| 5.2 Innovation linkages.....  | 22.3        | 84        |
| 5.2.1 University/industry research collaboration <sup>†</sup> .....   | 43.8        | 50        |
| 5.2.2 State of cluster development <sup>†</sup> .....                 | 53.8        | 34        |
| 5.2.3 GERD financed by abroad, %.....                                 | 0.4         | 93 ○      |
| 5.2.4 JV-strategic alliance deals/bn PPP\$ GDP.....                   | 0.0         | 87 ○      |
| 5.2.5 Patent families 2+ offices/bn PPP\$ GDP.....                    | 0.1         | 73        |
| 5.3 Knowledge absorption.....   | 35.0        | 54        |
| 5.3.1 Intellectual property payments, % total trade.....              | 0.2         | 82        |
| 5.3.2 High-tech imports less re-imports, % total trade.....           | 18.4        | 9 ●       |
| 5.3.3 ICT services imports, % total trade.....                        | 0.0         | 125 ○     |
| 5.3.4 FDI net inflows, % GDP.....                                     | 2.9         | 61        |
| 5.3.5 Research talent, % in business enterprise <sup>Ⓐ</sup> .....    | 24.5        | 50        |
| <b>6 Knowledge &amp; technology outputs.....</b>                      | <b>21.5</b> | <b>64</b> |
| 6.1 Knowledge creation.....   | 8.3         | 70        |
| 6.1.1 Patents by origin/bn PPP\$ GDP.....                             | 0.6         | 72        |
| 6.1.2 PCT patent applications/bn PPP\$ GDP.....                       | 0.1         | 61        |
| 6.1.3 Utility models by origin/bn PPP\$ GDP.....                      | 0.3         | 40        |
| 6.1.4 Scientific & technical articles/bn PPP\$ GDP.....               | 5.8         | 93        |
| 6.1.5 Citable documents H index.....                                  | 26.8        | 34        |
| 6.2 Knowledge impact.....   | 30.3        | 70        |
| 6.2.1 Growth rate of PPP\$ GDP/worker, %.....                         | 0.1         | 83        |
| 6.2.2 New businesses/th pop. 15–64.....                               | 0.9         | 73        |
| 6.2.3 Computer software spending, % GDP.....                          | 0.3         | 57        |
| 6.2.4 ISO 9001 quality certificates/bn PPP\$ GDP.....                 | 3.3         | 74        |
| 6.2.5 High- & medium-high-tech manufactures, % <sup>Ⓐ</sup> .....     | 0.4         | 16 ●      |
| 6.3 Knowledge diffusion.....  | 25.9        | 49        |
| 6.3.1 Intellectual property receipts, % total trade.....              | 0.1         | 58        |
| 6.3.2 High-tech exports less re-exports, % total trade.....           | 14.8        | 10 ●      |
| 6.3.3 ICT services exports, % total trade.....                        | 0.0         | 126 ○     |
| 6.3.4 FDI net outflows, % GDP.....                                    | 0.9         | 53        |
| <b>7 Creative outputs.....</b>  | <b>32.6</b> | <b>58</b> |
| 7.1 Intangible assets.....  | 41.7        | 64        |
| 7.1.1 Trademarks by origin/bn PPP\$ GDP.....                          | 40.7        | 58        |
| 7.1.2 Industrial designs by origin/bn PPP\$ GDP.....                  | 0.8         | 69        |
| 7.1.3 ICTs & business model creation <sup>†</sup> .....               | 66.6        | 43        |
| 7.1.4 ICTs & organizational model creation <sup>†</sup> .....         | 57.0        | 49        |
| 7.2 Creative goods & services.....                                    | 29.9        | 31        |
| 7.2.1 Cultural & creative services exports, % of total trade.....     | 0.0         | 75 ○      |
| 7.2.2 National feature films/mn pop. 15–69.....                       | 1.6         | 67        |
| 7.2.3 Global ent. & media market/th pop. 15–69.....                   | 8.3         | 38        |
| 7.2.4 Printing & publishing manufactures, % <sup>Ⓐ</sup> .....        | 0.6         | 87 ○      |
| 7.2.5 Creative goods exports, % total trade.....                      | 10.0        | 3 ●       |
| 7.3 Online creativity.....  | 17.1        | 73        |
| 7.3.1 Generic top-level domains (TLDs)/th pop. 15–69.....             | 2.6         | 71        |
| 7.3.2 Country-code TLDs/th pop. 15–69.....                            | 2.8         | 59        |
| 7.3.3 Wikipedia edits/mn pop. 15–69.....                              | 4.0         | 85        |
| 7.3.4 Video uploads on YouTube/pop. 15–69.....                        | 24.9        | 51        |

NOTES: ● indicates a strength; ○ a weakness; \* an index; † a survey question.

Ⓐ indicates that the country's data are older than the base year; see Appendix II for details, including the year of the data, at <http://globalinnovationindex.org>.

Square brackets indicate that the data minimum coverage (DMC) requirements were not met at the sub-pillar or pillar level; see page 181 of this appendix for details.

## Key indicators

|                            |                     |
|----------------------------|---------------------|
| Population (millions)..... | 4.1                 |
| GDP (US\$ billions).....   | 6.7                 |
| GDP per capita, PPP\$..... | 5,006.2             |
| Income group.....          | Lower-middle income |
| Region.....                | Europe              |

|  | Score 0–100<br>or value (hard data) | Rank      |
|--|-------------------------------------|-----------|
| <b>Global Innovation Index (out of 127).....</b> | <b>36.8</b>                         | <b>54</b> |
| Innovation Output Sub-Index.....                 | 32.3                                | 42        |
| Innovation Input Sub-Index.....                  | 41.4                                | 73        |
| Innovation Efficiency Ratio.....                 | 0.8                                 | 22 ●      |
| Global Innovation Index 2016 (out of 128).....   | 38.4                                | 46        |

|  |             |           |
|--|-------------|-----------|
| <b>1 Institutions.....</b>                                   | <b>56.4</b> | <b>72</b> |
| 1.1 Political environment.....                               | 40.1        | 96        |
| 1.1.1 Political stability & safety*.....                     | 54.3        | 81        |
| 1.1.2 Government effectiveness*.....                         | 25.9        | 103       |
| 1.2 Regulatory environment.....                              | 52.7        | 92        |
| 1.2.1 Regulatory quality*.....                               | 40.8        | 75        |
| 1.2.2 Rule of law*.....                                      | 27.7        | 85        |
| 1.2.3 Cost of redundancy dismissal, salary weeks.....        | 22.6        | 95        |
| 1.3 Business environment.....                                | 76.4        | 41        |
| 1.3.1 Ease of starting a business*.....                      | 92.0        | 37        |
| 1.3.2 Ease of resolving insolvency*.....                     | 52.6        | 56        |
| 1.3.3 Ease of paying taxes*.....                             | 84.8        | 28 ●      |
| <b>2 Human capital &amp; research.....</b>                   | <b>33.2</b> | <b>59</b> |
| 2.1 Education.....   | 58.3        | 31        |
| 2.1.1 Expenditure on education, % GDP.....                   | 7.5         | 9 ●       |
| 2.1.2 Gov't expenditure/pupil, secondary, % GDP/cap.....     | 39.3        | 5 ●       |
| 2.1.3 School life expectancy, years.....                     | 11.6        | 90        |
| 2.1.4 PISA scales in reading, maths, & science.....          | 421.3       | 51        |
| 2.1.5 Pupil-teacher ratio, secondary.....                    | 9.3         | 18 ●      |
| 2.2 Tertiary education.....                                  | 37.2        | 58        |
| 2.2.1 Tertiary enrolment, % gross.....                       | 41.2        | 63        |
| 2.2.2 Graduates in science & engineering, %.....             | 25.7        | 24 ●      |
| 2.2.3 Tertiary inbound mobility, %.....                      | 2.5         | 63        |
| 2.3 Research & development (R&D).....                        | 4.0         | 81        |
| 2.3.1 Researchers, FTE/mn pop.....                           | 662.1       | 59        |
| 2.3.2 Gross expenditure on R&D, % GDP.....                   | 0.4         | 74        |
| 2.3.3 Global R&D companies, avg. expend. top 3, mn \$US..... | 0.0         | 43 ○      |
| 2.3.4 QS university ranking, average score top 3*.....       | 0.0         | 75 ○      |
| <b>3 Infrastructure.....</b>                                 | <b>41.7</b> | <b>82</b> |
| 3.1 Information & communication technologies (ICTs).....     | 58.6        | 62        |
| 3.1.1 ICT access*.....                                       | 66.4        | 61        |
| 3.1.2 ICT use*.....  | 42.6        | 64        |
| 3.1.3 Government's online service*.....                      | 59.4        | 67        |
| 3.1.4 E-participation*.....                                  | 66.1        | 49        |
| 3.2 General infrastructure.....                              | 27.7        | 98        |
| 3.2.1 Electricity output, kWh/cap.....                       | 1,503.1     | 87        |
| 3.2.2 Logistics performance*.....                            | 25.5        | 91        |
| 3.2.3 Gross capital formation, % GDP.....                    | 21.1        | 73        |
| 3.3 Ecological sustainability.....                           | 38.7        | 87        |
| 3.3.1 GDP/unit of energy use.....                            | 5.0         | 103 ○     |
| 3.3.2 Environmental performance*.....                        | 76.7        | 54        |
| 3.3.3 ISO 14001 environmental certificates/bn PPP\$ GDP..... | 1.0         | 62        |
| <b>4 Market sophistication.....</b>                          | <b>46.8</b> | <b>62</b> |
| 4.1 Credit.....  | 29.8        | 79        |
| 4.1.1 Ease of getting credit*.....                           | 70.0        | 29        |
| 4.1.2 Domestic credit to private sector, % GDP.....          | 34.8        | 93        |
| 4.1.3 Microfinance gross loans, % GDP.....                   | 0.4         | 38        |

|   |      |       |
|---|------|-------|
| 4.2 Investment.....                                     | 63.3 | [15]  |
| 4.2.1 Ease of protecting minority investors*.....       | 63.3 | 41    |
| 4.2.2 Market capitalization, % GDP.....                 | n/a  | n/a   |
| 4.2.3 Venture capital deals/bn PPP\$ GDP.....           | n/a  | n/a   |
| 4.3 Trade, competition, & market scale.....             | 47.2 | 111 ○ |
| 4.3.1 Applied tariff rate, weighted mean, %.....        | 3.4  | 72    |
| 4.3.2 Intensity of local competition <sup>†</sup> ..... | 59.1 | 105 ○ |
| 4.3.3 Domestic market scale, bn PPP\$.....              | 18.5 | 121 ○ |

|   |             |           |
|---|-------------|-----------|
| <b>5 Business sophistication.....</b>                                 | <b>28.7</b> | <b>81</b> |
| 5.1 Knowledge workers.....  | 36.2        | 71        |
| 5.1.1 Knowledge-intensive employment, %.....                          | 28.1        | 50        |
| 5.1.2 Firms offering formal training, % firms.....                    | 32.4        | 43        |
| 5.1.3 GERD performed by business, % of GDP.....                       | 0.1         | 64        |
| 5.1.4 GERD financed by business, %.....                               | n/a         | n/a       |
| 5.1.5 Females employed w/advanced degrees, % total <sup>Ⓓ</sup> ..... | 14.0        | 43        |
| 5.2 Innovation linkages.....  | 18.5        | 117 ○     |
| 5.2.1 University/industry research collaboration <sup>†</sup> .....   | 25.3        | 117 ○     |
| 5.2.2 State of cluster development <sup>†</sup> .....                 | 22.2        | 123 ○     |
| 5.2.3 GERD financed by abroad, %.....                                 | 11.6        | 44        |
| 5.2.4 JV-strategic alliance deals/bn PPP\$ GDP.....                   | 0.1         | 27        |
| 5.2.5 Patent families 2+ offices/bn PPP\$ GDP.....                    | 0.2         | 47        |
| 5.3 Knowledge absorption.....   | 31.3        | 73        |
| 5.3.1 Intellectual property payments, % total trade.....              | 0.5         | 61        |
| 5.3.2 High-tech imports less re-imports, % total trade.....           | 7.8         | 67        |
| 5.3.3 ICT services imports, % total trade.....                        | 2.5         | 12 ●      |
| 5.3.4 FDI net inflows, % GDP.....                                     | 3.9         | 39        |
| 5.3.5 Research talent, % in business enterprise.....                  | 7.6         | 68        |

|   |             |           |
|---|-------------|-----------|
| <b>6 Knowledge &amp; technology outputs.....</b>                  | <b>25.4</b> | <b>52</b> |
| 6.1 Knowledge creation.....                                       | 41.5        | 19 ●      |
| 6.1.1 Patents by origin/bn PPP\$ GDP.....                         | 3.6         | 30        |
| 6.1.2 PCT patent applications/bn PPP\$ GDP.....                   | 0.5         | 36        |
| 6.1.3 Utility models by origin/bn PPP\$ GDP.....                  | 9.3         | 1 ●       |
| 6.1.4 Scientific & technical articles/bn PPP\$ GDP.....           | 13.2        | 57        |
| 6.1.5 Citable documents H index.....                              | 4.8         | 96        |
| 6.2 Knowledge impact.....   | 11.0        | 115 ○     |
| 6.2.1 Growth rate of PPP\$ GDP/worker, %.....                     | (3.5)       | 108 ○     |
| 6.2.2 New businesses/th pop. 15–64 <sup>Ⓓ</sup> .....             | 1.6         | 52        |
| 6.2.3 Computer software spending, % GDP.....                      | 0.1         | 83        |
| 6.2.4 ISO 9001 quality certificates/bn PPP\$ GDP.....             | 7.2         | 49        |
| 6.2.5 High- & medium-high-tech manufactures, % <sup>Ⓓ</sup> ..... | 0.1         | 80        |
| 6.3 Knowledge diffusion.....                                      | 23.7        | 59        |
| 6.3.1 Intellectual property receipts, % total trade.....          | 0.1         | 46        |
| 6.3.2 High-tech exports less re-exports, % total trade.....       | 0.6         | 74        |
| 6.3.3 ICT services exports, % total trade.....                    | 4.7         | 13 ●      |
| 6.3.4 FDI net outflows, % GDP.....                                | 0.4         | 75        |

|   |             |           |
|---|-------------|-----------|
| <b>7 Creative outputs.....</b>                                    | <b>39.3</b> | <b>39</b> |
| 7.1 Intangible assets.....  | 63.3        | 9 ●       |
| 7.1.1 Trademarks by origin/bn PPP\$ GDP.....                      | 149.8       | 3 ●       |
| 7.1.2 Industrial designs by origin/bn PPP\$ GDP.....              | 67.3        | 1 ●       |
| 7.1.3 ICTs & business model creation <sup>†</sup> .....           | 49.5        | 104 ○     |
| 7.1.4 ICTs & organizational model creation <sup>†</sup> .....     | 45.1        | 92        |
| 7.2 Creative goods & services.....                                | 12.5        | 80        |
| 7.2.1 Cultural & creative services exports, % of total trade..... | 0.4         | 32        |
| 7.2.2 National feature films/mn pop. 15–69.....                   | 0.3         | 96 ○      |
| 7.2.3 Global ent. & media market/th pop. 15–69.....               | n/a         | n/a       |
| 7.2.4 Printing & publishing manufactures, % <sup>Ⓓ</sup> .....    | 1.7         | 29        |
| 7.2.5 Creative goods exports, % total trade.....                  | 0.1         | 102       |
| 7.3 Online creativity.....  | 18.0        | 71        |
| 7.3.1 Generic top-level domains (TLDs)/th pop. 15–69.....         | 2.1         | 77        |
| 7.3.2 Country-code TLDs/th pop. 15–69.....                        | 2.3         | 61        |
| 7.3.3 Wikipedia edits/mn pop. 15–69 <sup>Ⓓ</sup> .....            | 5.1         | 57        |
| 7.3.4 Video uploads on YouTube/pop. 15–69.....                    | n/a         | n/a       |

NOTES: ● indicates a strength; ○ a weakness; \* an index; † a survey question.

Ⓓ indicates that the country's data are older than the base year; see Appendix II for details, including the year of the data, at <http://globalinnovationindex.org>.

Square brackets indicate that the data minimum coverage (DMC) requirements were not met at the sub-pillar or pillar level; see page 181 of this appendix for details.



## Mongolia

## Key indicators

|                            |   |
|----------------------------|---|
| Population (millions)..... | 3.0                                     |
| GDP (US\$ billions).....   | 11.2                                    |
| GDP per capita, PPP\$..... | 12,146.6                                |
| Income group.....          | Lower-middle income                     |
| Region.....                | South East Asia, East Asia, and Oceania |

|  | Score 0–100<br>or value (hard data) | Rank      |
|--|-------------------------------------|-----------|
| <b>Global Innovation Index (out of 127).....</b> | <b>37.1</b>                         | <b>52</b> |
| Innovation Output Sub-Index.....                 | 31.6                                | 48        |
| Innovation Input Sub-Index.....                  | 42.7                                | 67        |
| Innovation Efficiency Ratio.....                 | 0.7                                 | 27        |
| Global Innovation Index 2016 (out of 128).....   | 35.7                                | 55        |

|   |             |           |
|---|-------------|-----------|
| <b>1 Institutions.....</b>                            | <b>64.6</b> | <b>60</b> |
| 1.1 Political environment.....                        | 55.7        | 56        |
| 1.1.1 Political stability & safety*.....              | 79.6        | 34        |
| 1.1.2 Government effectiveness*.....                  | 31.8        | 89        |
| 1.2 Regulatory environment.....                       | 64.7        | 64        |
| 1.2.1 Regulatory quality*.....                        | 33.6        | 90        |
| 1.2.2 Rule of law*.....                               | 28.0        | 84        |
| 1.2.3 Cost of redundancy dismissal, salary weeks..... | 8.7         | 22 ●      |
| 1.3 Business environment.....                         | 73.4        | 56        |
| 1.3.1 Ease of starting a business*.....               | 92.6        | 32        |
| 1.3.2 Ease of resolving insolvency*.....              | 43.6        | 82        |
| 1.3.3 Ease of paying taxes*.....                      | 84.2        | 31        |

|  |             |           |
|--|-------------|-----------|
| <b>2 Human capital &amp; research.....</b>                             | <b>26.9</b> | <b>81</b> |
| 2.1 Education.....   | 45.5        | 71        |
| 2.1.1 Expenditure on education, % GDP <sup>Ⓔ</sup> .....               | 4.6         | 64        |
| 2.1.2 Gov't expenditure/pupil, secondary, % GDP/cap <sup>Ⓔ</sup> ..... | 15.4        | 78        |
| 2.1.3 School life expectancy, years.....                               | 15.0        | 47        |
| 2.1.4 PISA scales in reading, maths, & science.....                    | n/a         | n/a       |
| 2.1.5 Pupil-teacher ratio, secondary <sup>Ⓔ</sup> .....                | 14.5        | 61        |
| 2.2 Tertiary education.....  | 34.1        | 70        |
| 2.2.1 Tertiary enrolment, % gross.....                                 | 68.6        | 28        |
| 2.2.2 Graduates in science & engineering, %.....                       | 19.5        | 61        |
| 2.2.3 Tertiary inbound mobility, %.....                                | 0.7         | 86        |
| 2.3 Research & development (R&D).....                                  | 1.1         | 104       |
| 2.3.1 Researchers, FTE/mn pop.....                                     | n/a         | n/a       |
| 2.3.2 Gross expenditure on R&D, % GDP.....                             | 0.2         | 94        |
| 2.3.3 Global R&D companies, avg. expend. top 3, mn \$US.....           | 0.0         | 43 ○      |
| 2.3.4 QS university ranking, average score top 3*.....                 | 0.0         | 75 ○      |

|  |             |           |
|--|-------------|-----------|
| <b>3 Infrastructure.....</b>                                 | <b>40.1</b> | <b>86</b> |
| 3.1 Information & communication technologies (ICTs).....     | 52.6        | 73        |
| 3.1.1 ICT access*.....                                       | 51.2        | 80        |
| 3.1.2 ICT use*.....  | 36.4        | 75        |
| 3.1.3 Government's online service*.....                      | 51.4        | 81        |
| 3.1.4 E-participation*.....                                  | 71.2        | 39        |
| 3.2 General infrastructure.....                              | 33.5        | 80        |
| 3.2.1 Electricity output, kWh/cap.....                       | 1,847.4     | 79        |
| 3.2.2 Logistics performance*.....                            | 20.5        | 102       |
| 3.2.3 Gross capital formation, % GDP.....                    | 27.0        | 31        |
| 3.3 Ecological sustainability.....                           | 34.3        | 106       |
| 3.3.1 GDP/unit of energy use.....                            | 6.1         | 93        |
| 3.3.2 Environmental performance*.....                        | 64.4        | 96        |
| 3.3.3 ISO 14001 environmental certificates/bn PPP\$ GDP..... | 0.2         | 113       |

|   |             |           |
|---|-------------|-----------|
| <b>4 Market sophistication.....</b>                 | <b>52.6</b> | <b>35</b> |
| 4.1 Credit.....                                     | 60.4        | 14 ●      |
| 4.1.1 Ease of getting credit*.....                  | 60.0        | 55        |
| 4.1.2 Domestic credit to private sector, % GDP..... | 54.8        | 60        |
| 4.1.3 Microfinance gross loans, % GDP.....          | 18.4        | 1 ●       |

|   |      |      |
|---|------|------|
| 4.2 Investment.....                                     | 47.1 | 34   |
| 4.2.1 Ease of protecting minority investors*.....       | 68.3 | 25 ● |
| 4.2.2 Market capitalization, % GDP <sup>Ⓔ</sup> .....   | 10.5 | 75   |
| 4.2.3 Venture capital deals/bn PPP\$ GDP.....           | n/a  | n/a  |
| 4.3 Trade, competition, & market scale.....             | 50.4 | 103  |
| 4.3.1 Applied tariff rate, weighted mean, %.....        | 4.6  | 85   |
| 4.3.2 Intensity of local competition <sup>†</sup> ..... | 60.1 | 100  |
| 4.3.3 Domestic market scale, bn PPP\$.....              | 36.7 | 102  |

**5 Business sophistication.....29.3 76**

|   |      |       |
|---|------|-------|
| 5.1 Knowledge workers.....  | 42.3 | 50    |
| 5.1.1 Knowledge-intensive employment, %.....                          | 24.7 | 57    |
| 5.1.2 Firms offering formal training, % firms.....                    | 60.9 | 7 ●   |
| 5.1.3 GERD performed by business, % of GDP.....                       | 0.0  | 81 ○  |
| 5.1.4 GERD financed by business, %.....                               | 7.3  | 74    |
| 5.1.5 Females employed w/advanced degrees, % total <sup>Ⓔ</sup> ..... | 16.7 | 32    |
| 5.2 Innovation linkages.....  | 14.5 | 123 ○ |
| 5.2.1 University/industry research collaboration <sup>†</sup> .....   | 26.6 | 114 ○ |
| 5.2.2 State of cluster development <sup>†</sup> .....                 | 28.8 | 121 ○ |
| 5.2.3 GERD financed by abroad, % <sup>Ⓔ</sup> .....                   | 2.8  | 68    |
| 5.2.4 JV-strategic alliance deals/bn PPP\$ GDP.....                   | 0.0  | 59    |
| 5.2.5 Patent families 2+ offices/bn PPP\$ GDP <sup>Ⓔ</sup> .....      | 0.0  | 87    |
| 5.3 Knowledge absorption.....   | 31.1 | 74    |
| 5.3.1 Intellectual property payments, % total trade.....              | 0.3  | 76    |
| 5.3.2 High-tech imports less re-imports, % total trade.....           | 5.5  | 103   |
| 5.3.3 ICT services imports, % total trade.....                        | 1.6  | 40    |
| 5.3.4 FDI net inflows, % GDP.....                                     | 6.6  | 19 ●  |
| 5.3.5 Research talent, % in business enterprise.....                  | n/a  | n/a   |

**6 Knowledge & technology outputs.....21.1 67**

|   |      |       |
|---|------|-------|
| 6.1 Knowledge creation.....                                       | 35.5 | 23 ●  |
| 6.1.1 Patents by origin/bn PPP\$ GDP.....                         | 3.0  | 34    |
| 6.1.2 PCT patent applications/bn PPP\$ GDP.....                   | 0.0  | 92    |
| 6.1.3 Utility models by origin/bn PPP\$ GDP.....                  | 4.1  | 5 ●   |
| 6.1.4 Scientific & technical articles/bn PPP\$ GDP.....           | 6.5  | 83    |
| 6.1.5 Citable documents H index.....                              | 4.0  | 103   |
| 6.2 Knowledge impact.....   | 13.5 | 113   |
| 6.2.1 Growth rate of PPP\$ GDP/worker, %.....                     | n/a  | n/a   |
| 6.2.2 New businesses/th pop. 15–64.....                           | 6.3  | 19 ●  |
| 6.2.3 Computer software spending, % GDP.....                      | 0.1  | 82    |
| 6.2.4 ISO 9001 quality certificates/bn PPP\$ GDP.....             | 0.5  | 118 ○ |
| 6.2.5 High- & medium-high-tech manufactures, % <sup>Ⓔ</sup> ..... | 0.1  | 93 ○  |
| 6.3 Knowledge diffusion.....                                      | 14.3 | 113   |
| 6.3.1 Intellectual property receipts, % total trade.....          | 0.0  | 68    |
| 6.3.2 High-tech exports less re-exports, % total trade.....       | 0.1  | 116 ○ |
| 6.3.3 ICT services exports, % total trade.....                    | 0.2  | 113   |
| 6.3.4 FDI net outflows, % GDP.....                                | 0.4  | 70    |

**7 Creative outputs.....42.0 34**

|   |       |       |
|---|-------|-------|
| 7.1 Intangible assets.....  | 62.0  | 13 ●  |
| 7.1.1 Trademarks by origin/bn PPP\$ GDP.....                                    | 194.5 | 1 ●   |
| 7.1.2 Industrial designs by origin/bn PPP\$ GDP <sup>Ⓔ</sup> .....              | 7.4   | 18 ●  |
| 7.1.3 ICTs & business model creation <sup>†</sup> .....                         | 55.8  | 82    |
| 7.1.4 ICTs & organizational model creation <sup>†</sup> .....                   | 41.2  | 108   |
| 7.2 Creative goods & services.....  | 27.2  | 39    |
| 7.2.1 Cultural & creative services exports, % of total trade <sup>Ⓔ</sup> ..... | 0.0   | 91 ○  |
| 7.2.2 National feature films/mn pop. 15–69.....                                 | 20.0  | 5 ●   |
| 7.2.3 Global ent. & media market/th pop. 15–69.....                             | n/a   | n/a   |
| 7.2.4 Printing & publishing manufactures, % <sup>Ⓔ</sup> .....                  | 2.9   | 9 ●   |
| 7.2.5 Creative goods exports, % total trade.....                                | 0.0   | 120 ○ |
| 7.3 Online creativity.....  | 17.0  | 75    |
| 7.3.1 Generic top-level domains (TLDs)/th pop. 15–69.....                       | 0.6   | 102   |
| 7.3.2 Country-code TLDs/th pop. 15–69.....                                      | 1.4   | 70    |
| 7.3.3 Wikipedia edits/mn pop. 15–69 <sup>Ⓔ</sup> .....                          | 5.1   | 62    |
| 7.3.4 Video uploads on YouTube/pop. 15–69.....                                  | n/a   | n/a   |

NOTES: ● indicates a strength; ○ a weakness; \* an index; † a survey question.

Ⓔ indicates that the country's data are older than the base year; see Appendix II for details, including the year of the data, at <http://globalinnovationindex.org>.

Square brackets indicate that the data minimum coverage (DMC) requirements were not met at the sub-pillar or pillar level; see page 181 of this appendix for details.



## Key indicators

|                            |                     |
|----------------------------|---------------------|
| Population (millions)..... | 0.6                 |
| GDP (US\$ billions).....   | 4.2                 |
| GDP per capita, PPP\$..... | 16,123.1            |
| Income group.....          | Upper-middle income |
| Region.....                | Europe              |

|  | Score 0–100<br>or value (hard data) | Rank      |
|--|-------------------------------------|-----------|
| <b>Global Innovation Index (out of 127).....</b> | <b>38.1</b>                         | <b>48</b> |
| Innovation Output Sub-Index.....                 | 29.3                                | 52        |
| Innovation Input Sub-Index.....                  | 46.8                                | 50        |
| Innovation Efficiency Ratio.....                 | 0.6                                 | 62        |
| Global Innovation Index 2016 (out of 128).....   | 37.4                                | 51        |

**1 Institutions.....68.4 48**

|   |      |    |
|---|------|----|
| 1.1 Political environment.....                        | 56.6 | 54 |
| 1.1.1 Political stability & safety*.....              | 67.0 | 54 |
| 1.1.2 Government effectiveness*.....                  | 46.3 | 61 |
| 1.2 Regulatory environment.....                       | 68.9 | 47 |
| 1.2.1 Regulatory quality*.....                        | 47.9 | 63 |
| 1.2.2 Rule of law*.....                               | 40.4 | 59 |
| 1.2.3 Cost of redundancy dismissal, salary weeks..... | 11.2 | 39 |
| 1.3 Business environment.....                         | 79.6 | 34 |
| 1.3.1 Ease of starting a business*.....               | 90.1 | 49 |
| 1.3.2 Ease of resolving insolvency*.....              | 68.4 | 37 |
| 1.3.3 Ease of paying taxes*.....                      | 80.4 | 48 |

**2 Human capital & research.....36.3 [49]**

|  |       |      |
|--|-------|------|
| 2.1 Education.....   | 56.0  | [39] |
| 2.1.1 Expenditure on education, % GDP.....                   | n/a   | n/a  |
| 2.1.2 Gov't expenditure/pupil, secondary, % GDP/cap.....     | n/a   | n/a  |
| 2.1.3 School life expectancy, years <sup>Ⓐ</sup> .....       | 15.1  | 44   |
| 2.1.4 PISA scales in reading, maths, & science.....          | 418.7 | 52 ○ |
| 2.1.5 Pupil-teacher ratio, secondary.....                    | n/a   | n/a  |
| 2.2 Tertiary education.....                                  | 48.2  | [25] |
| 2.2.1 Tertiary enrolment, % gross <sup>Ⓐ</sup> .....         | 55.3  | 48   |
| 2.2.2 Graduates in science & engineering, %.....             | n/a   | n/a  |
| 2.2.3 Tertiary inbound mobility, %.....                      | n/a   | n/a  |
| 2.3 Research & development (R&D).....                        | 4.6   | 77   |
| 2.3.1 Researchers, FTE/mn pop.....                           | 835.8 | 53   |
| 2.3.2 Gross expenditure on R&D, % GDP.....                   | 0.4   | 72   |
| 2.3.3 Global R&D companies, avg. expend. top 3, mn \$US..... | 0.0   | 43 ○ |
| 2.3.4 QS university ranking, average score top 3*.....       | 0.0   | 75 ○ |

**3 Infrastructure.....49.5 54**

|  |         |       |
|--|---------|-------|
| 3.1 Information & communication technologies (ICTs).....     | 66.4    | 43    |
| 3.1.1 ICT access*.....                                       | 68.5    | 55    |
| 3.1.2 ICT use*.....  | 46.1    | 60    |
| 3.1.3 Government's online service*.....                      | 68.1    | 47    |
| 3.1.4 E-participation*.....                                  | 83.1    | 17 ●  |
| 3.2 General infrastructure.....                              | 35.0    | 74    |
| 3.2.1 Electricity output, kWh/cap.....                       | 5,119.4 | 39    |
| 3.2.2 Logistics performance*.....                            | 14.7    | 114 ○ |
| 3.2.3 Gross capital formation, % GDP.....                    | 27.1    | 30    |
| 3.3 Ecological sustainability.....                           | 47.1    | 55    |
| 3.3.1 GDP/unit of energy use.....                            | 9.2     | 58    |
| 3.3.2 Environmental performance*.....                        | 78.9    | 46    |
| 3.3.3 ISO 14001 environmental certificates/bn PPP\$ GDP..... | 1.7     | 52    |

**4 Market sophistication.....45.9 65**

|   |      |     |
|---|------|-----|
| 4.1 Credit.....                                     | 40.8 | 47  |
| 4.1.1 Ease of getting credit*.....                  | 85.0 | 7 ● |
| 4.1.2 Domestic credit to private sector, % GDP..... | 50.6 | 69  |
| 4.1.3 Microfinance gross loans, % GDP.....          | 1.0  | 26  |

|  |      |       |
|--|------|-------|
| 4.2 Investment.....  | 55.4 | 21 ●  |
| 4.2.1 Ease of protecting minority investors*.....              | 63.3 | 41    |
| 4.2.2 Market capitalization, % GDP <sup>Ⓐ</sup> .....          | 92.6 | 10 ●  |
| 4.2.3 Venture capital deals/bn PPP\$ GDP.....                  | n/a  | n/a   |
| 4.3 Trade, competition, & market scale.....                    | 41.4 | 119 ○ |
| 4.3.1 Applied tariff rate, weighted mean, % <sup>Ⓐ</sup> ..... | 2.6  | 60    |
| 4.3.2 Intensity of local competition <sup>†</sup> .....        | 54.6 | 114 ○ |
| 4.3.3 Domestic market scale, bn PPP\$.....                     | 10.6 | 126 ○ |

**5 Business sophistication.....34.1 58**

|   |      |       |
|---|------|-------|
| 5.1 Knowledge workers.....  | 37.4 | 62    |
| 5.1.1 Knowledge-intensive employment, %.....                        | 37.4 | 32    |
| 5.1.2 Firms offering formal training, % firms.....                  | 23.7 | 67    |
| 5.1.3 GERD performed by business, % of GDP <sup>Ⓐ</sup> .....       | 0.1  | 57    |
| 5.1.4 GERD financed by business, % <sup>Ⓐ</sup> .....               | 28.5 | 53    |
| 5.1.5 Females employed w/advanced degrees, % total.....             | n/a  | n/a   |
| 5.2 Innovation linkages.....  | 29.6 | 57    |
| 5.2.1 University/industry research collaboration <sup>†</sup> ..... | 36.4 | 88    |
| 5.2.2 State of cluster development <sup>†</sup> .....               | 34.8 | 103 ○ |
| 5.2.3 GERD financed by abroad, % <sup>Ⓐ</sup> .....                 | 20.7 | 20 ●  |
| 5.2.4 JV-strategic alliance deals/bn PPP\$ GDP.....                 | n/a  | n/a   |
| 5.2.5 Patent families 2+ offices/bn PPP\$ GDP <sup>Ⓐ</sup> .....    | 0.2  | 48    |
| 5.3 Knowledge absorption.....                                       | 35.3 | 53    |
| 5.3.1 Intellectual property payments, % total trade.....            | 0.2  | 86 ○  |
| 5.3.2 High-tech imports less re-imports, % total trade.....         | 6.4  | 90    |
| 5.3.3 ICT services imports, % total trade.....                      | 2.3  | 15 ●  |
| 5.3.4 FDI net inflows, % GDP.....                                   | 12.8 | 7 ●   |
| 5.3.5 Research talent, % in business enterprise <sup>Ⓐ</sup> .....  | 19.0 | 57    |

**6 Knowledge & technology outputs.....22.5 57**

|   |      |       |
|---|------|-------|
| 6.1 Knowledge creation.....                                 | 11.2 | 60    |
| 6.1.1 Patents by origin/bn PPP\$ GDP.....                   | 2.3  | 42    |
| 6.1.2 PCT patent applications/bn PPP\$ GDP.....             | 0.2  | 51    |
| 6.1.3 Utility models by origin/bn PPP\$ GDP.....            | n/a  | n/a   |
| 6.1.4 Scientific & technical articles/bn PPP\$ GDP.....     | 21.5 | 36    |
| 6.1.5 Citable documents H index.....                        | 0.3  | 125 ○ |
| 6.2 Knowledge impact.....                                   | 36.1 | 45    |
| 6.2.1 Growth rate of PPP\$ GDP/worker, %.....               | 0.4  | 73    |
| 6.2.2 New businesses/th pop. 15–64.....                     | 6.9  | 17 ●  |
| 6.2.3 Computer software spending, % GDP.....                | 0.4  | 22 ●  |
| 6.2.4 ISO 9001 quality certificates/bn PPP\$ GDP.....       | 8.4  | 41    |
| 6.2.5 High- & medium-high-tech manufactures, %.....         | n/a  | n/a   |
| 6.3 Knowledge diffusion.....                                | 20.1 | 78    |
| 6.3.1 Intellectual property receipts, % total trade.....    | 0.0  | 74    |
| 6.3.2 High-tech exports less re-exports, % total trade..... | 0.6  | 77    |
| 6.3.3 ICT services exports, % total trade.....              | 3.2  | 26    |
| 6.3.4 FDI net outflows, % GDP.....                          | 0.4  | 72    |

**7 Creative outputs.....36.1 48**

|   |       |      |
|---|-------|------|
| 7.1 Intangible assets.....  | 41.7  | 65   |
| 7.1.1 Trademarks by origin/bn PPP\$ GDP.....                      | n/a   | n/a  |
| 7.1.2 Industrial designs by origin/bn PPP\$ GDP.....              | 0.8   | 68   |
| 7.1.3 ICTs & business model creation <sup>†</sup> .....           | 56.7  | 79   |
| 7.1.4 ICTs & organizational model creation <sup>†</sup> .....     | 45.5  | 90 ○ |
| 7.2 Creative goods & services.....                                | 16.5  | 70   |
| 7.2.1 Cultural & creative services exports, % of total trade..... | 0.1   | 57   |
| 7.2.2 National feature films/mn pop. 15–69.....                   | 13.3  | 10 ● |
| 7.2.3 Global ent. & media market/th pop. 15–69.....               | n/a   | n/a  |
| 7.2.4 Printing & publishing manufactures, %.....                  | n/a   | n/a  |
| 7.2.5 Creative goods exports, % total trade.....                  | 0.2   | 75   |
| 7.3 Online creativity.....  | 44.6  | 22 ● |
| 7.3.1 Generic top-level domains (TLDs)/th pop. 15–69.....         | 1.4   | 89   |
| 7.3.2 Country-code TLDs/th pop. 15–69.....                        | 100.0 | 1 ●  |
| 7.3.3 Wikipedia edits/mn pop. 15–69 <sup>Ⓐ</sup> .....            | 5.5   | 51   |
| 7.3.4 Video uploads on YouTube/pop. 15–69.....                    | 23.8  | 53   |

NOTES: ● indicates a strength; ○ a weakness; \* an index; † a survey question.

Ⓐ indicates that the country's data are older than the base year; see Appendix II for details, including the year of the data, at <http://globalinnovationindex.org>.

Square brackets indicate that the data minimum coverage (DMC) requirements were not met at the sub-pillar or pillar level; see page 181 of this appendix for details.

## Key indicators

|                       |                                  |
|-----------------------|----------------------------------|
| Population (millions) | 34.8                             |
| GDP (US\$ billions)   | 104.9                            |
| GDP per capita, PPP\$ | 8,164.4                          |
| Income group          | Lower-middle income              |
| Region                | Northern Africa and Western Asia |

|   | Score 0–100<br>or value (hard data) | Rank      |
|---|-------------------------------------|-----------|
| <b>Global Innovation Index (out of 127)</b> | <b>32.7</b>                         | <b>72</b> |
| Innovation Output Sub-Index                 | 24.8                                | 68        |
| Innovation Input Sub-Index                  | 40.6                                | 79        |
| Innovation Efficiency Ratio                 | 0.6                                 | 71        |
| Global Innovation Index 2016 (out of 128)   | 32.3                                | 72        |

|          |  |             |           |
|----------|--|-------------|-----------|
| <b>1</b> | <b>Institutions</b>  | <b>58.1</b> | <b>70</b> |
| 1.1      | Political environment                                      | 48.1        | 72        |
| 1.1.1    | Political stability & safety*                              | 55.7        | 79        |
| 1.1.2    | Government effectiveness*                                  | 40.6        | 76        |
| 1.2      | Regulatory environment                                     | 56.2        | 81        |
| 1.2.1    | Regulatory quality*  | 37.7        | 78        |
| 1.2.2    | Rule of law*   | 37.2        | 63        |
| 1.2.3    | Cost of redundancy dismissal, salary weeks                 | 20.7        | 85        |
| 1.3      | Business environment                                       | 69.9        | 67        |
| 1.3.1    | Ease of starting a business*                               | 92.3        | 34 ●      |
| 1.3.2    | Ease of resolving insolvency*                              | 33.9        | 109 ○     |
| 1.3.3    | Ease of paying taxes*                                      | 83.5        | 36 ●      |
| <b>2</b> | <b>Human capital &amp; research</b>                        | <b>32.3</b> | <b>63</b> |
| 2.1      | Education  | 46.4        | 66        |
| 2.1.1    | Expenditure on education, % GDP <sup>Ⓔ</sup>               | 5.3         | 42        |
| 2.1.2    | Gov't expenditure/pupil, secondary, % GDP/cap <sup>Ⓔ</sup> | 36.1        | 9 ●       |
| 2.1.3    | School life expectancy, years <sup>Ⓔ</sup>                 | 12.1        | 86        |
| 2.1.4    | PISA scales in reading, maths, & science                   | n/a         | n/a       |
| 2.1.5    | Pupil-teacher ratio, secondary                             | n/a         | n/a       |
| 2.2      | Tertiary education   | 43.4        | 39        |
| 2.2.1    | Tertiary enrolment, % gross                                | 28.1        | 83        |
| 2.2.2    | Graduates in science & engineering, % <sup>Ⓔ</sup>         | 34.9        | 4 ●       |
| 2.2.3    | Tertiary inbound mobility, % <sup>Ⓔ</sup>                  | 1.8         | 71        |
| 2.3      | Research & development (R&D)                               | 7.2         | 65        |
| 2.3.1    | Researchers, FTE/mn pop. <sup>Ⓔ</sup>                      | 1,032.5     | 47        |
| 2.3.2    | Gross expenditure on R&D, % GDP <sup>Ⓔ</sup>               | 0.7         | 50        |
| 2.3.3    | Global R&D companies, avg. expend. top 3, mn \$US          | 0.0         | 43 ○      |
| 2.3.4    | QS university ranking, average score top 3*                | 0.0         | 75 ○      |
| <b>3</b> | <b>Infrastructure</b>                                      | <b>50.0</b> | <b>51</b> |
| 3.1      | Information & communication technologies (ICTs)            | 62.9        | 53        |
| 3.1.1    | ICT access*  | 60.7        | 71        |
| 3.1.2    | ICT use*   | 34.0        | 79        |
| 3.1.3    | Government's online service*                               | 73.9        | 36        |
| 3.1.4    | E-participation*   | 83.1        | 17 ●      |
| 3.2      | General infrastructure                                     | 38.0        | 61        |
| 3.2.1    | Electricity output, kWh/cap                                | 847.5       | 97 ○      |
| 3.2.2    | Logistics performance*                                     | 27.9        | 85        |
| 3.2.3    | Gross capital formation, % GDP                             | 30.2        | 18 ●      |
| 3.3      | Ecological sustainability                                  | 49.2        | 49        |
| 3.3.1    | GDP/unit of energy use                                     | 12.7        | 21 ●      |
| 3.3.2    | Environmental performance*                                 | 74.2        | 60        |
| 3.3.3    | ISO 14001 environmental certificates/bn PPP\$ GDP          | 0.6         | 79        |
| <b>4</b> | <b>Market sophistication</b>                               | <b>42.1</b> | <b>89</b> |
| 4.1      | Credit   | 26.7        | 93        |
| 4.1.1    | Ease of getting credit*                                    | 45.0        | 84        |
| 4.1.2    | Domestic credit to private sector, % GDP                   | 64.3        | 49        |
| 4.1.3    | Microfinance gross loans, % GDP                            | 0.6         | 33        |

|       |   |       |    |
|-------|---|-------|----|
| 4.2   | Investment                                  | 33.2  | 97 |
| 4.2.1 | Ease of protecting minority investors*      | 53.3  | 80 |
| 4.2.2 | Market capitalization, % GDP                | 45.7  | 33 |
| 4.2.3 | Venture capital deals/bn PPP\$ GDP          | 0.0   | 50 |
| 4.3   | Trade, competition, & market scale          | 66.3  | 49 |
| 4.3.1 | Applied tariff rate, weighted mean, %       | 2.8   | 64 |
| 4.3.2 | Intensity of local competition <sup>†</sup> | 68.7  | 68 |
| 4.3.3 | Domestic market scale, bn PPP\$             | 282.8 | 54 |

**5 Business sophistication** 20.5 122 ○

|       |  |      |       |
|-------|--|------|-------|
| 5.1   | Knowledge workers  | 21.0 | 109 ○ |
| 5.1.1 | Knowledge-intensive employment, % <sup>Ⓔ</sup>             | 6.8  | 99 ○  |
| 5.1.2 | Firms offering formal training, % firms                    | 26.3 | 59    |
| 5.1.3 | GERD performed by business, % of GDP <sup>Ⓔ</sup>          | 0.2  | 50    |
| 5.1.4 | GERD financed by business, % <sup>Ⓔ</sup>                  | 29.9 | 51    |
| 5.1.5 | Females employed w/advanced degrees, % total               | n/a  | n/a   |
| 5.2   | Innovation linkages  | 18.8 | 115 ○ |
| 5.2.1 | University/industry research collaboration <sup>†</sup>    | 35.4 | 93    |
| 5.2.2 | State of cluster development <sup>†</sup>                  | 43.6 | 74    |
| 5.2.3 | GERD financed by abroad, % <sup>Ⓔ</sup>                    | 1.7  | 78    |
| 5.2.4 | JV-strategic alliance deals/bn PPP\$ GDP                   | 0.0  | 89    |
| 5.2.5 | Patent families 2+ offices/bn PPP\$ GDP                    | 0.0  | 99 ○  |
| 5.3   | Knowledge absorption                                       | 21.6 | 118 ○ |
| 5.3.1 | Intellectual property payments, % total trade <sup>Ⓔ</sup> | 0.2  | 84    |
| 5.3.2 | High-tech imports less re-imports, % total trade           | 7.3  | 75    |
| 5.3.3 | ICT services imports, % total trade <sup>Ⓔ</sup>           | 0.5  | 96    |
| 5.3.4 | FDI net inflows, % GDP                                     | 3.2  | 50    |
| 5.3.5 | Research talent, % in business enterprise <sup>Ⓔ</sup>     | 7.5  | 69 ○  |

**6 Knowledge & technology outputs** 20.3 77

|       |  |      |      |
|-------|--|------|------|
| 6.1   | Knowledge creation   | 6.2  | 81   |
| 6.1.1 | Patents by origin/bn PPP\$ GDP                             | 0.8  | 67   |
| 6.1.2 | PCT patent applications/bn PPP\$ GDP                       | 0.1  | 59   |
| 6.1.3 | Utility models by origin/bn PPP\$ GDP                      | n/a  | n/a  |
| 6.1.4 | Scientific & technical articles/bn PPP\$ GDP               | 7.0  | 78   |
| 6.1.5 | Citable documents H index                                  | 9.3  | 68   |
| 6.2   | Knowledge impact   | 34.5 | 48   |
| 6.2.1 | Growth rate of PPP\$ GDP/worker, %                         | 2.7  | 26 ● |
| 6.2.2 | New businesses/th pop. 15–64                               | 1.5  | 54   |
| 6.2.3 | Computer software spending, % GDP                          | 0.3  | 62   |
| 6.2.4 | ISO 9001 quality certificates/bn PPP\$ GDP                 | 3.5  | 73   |
| 6.2.5 | High- & medium-high-tech manufactures, % <sup>Ⓔ</sup>      | 0.3  | 42   |
| 6.3   | Knowledge diffusion  | 20.1 | 79   |
| 6.3.1 | Intellectual property receipts, % total trade <sup>Ⓔ</sup> | 0.0  | 95 ○ |
| 6.3.2 | High-tech exports less re-exports, % total trade           | 1.5  | 59   |
| 6.3.3 | ICT services exports, % total trade <sup>Ⓔ</sup>           | 2.9  | 31 ● |
| 6.3.4 | FDI net outflows, % GDP                                    | 0.5  | 68   |

**7 Creative outputs** 29.4 68

|       |  |      |       |
|-------|--|------|-------|
| 7.1   | Intangible assets                                      | 49.4 | 39    |
| 7.1.1 | Trademarks by origin/bn PPP\$ GDP                      | 49.4 | 52    |
| 7.1.2 | Industrial designs by origin/bn PPP\$ GDP              | 13.6 | 8 ●   |
| 7.1.3 | ICTs & business model creation <sup>†</sup>            | 62.3 | 53    |
| 7.1.4 | ICTs & organizational model creation <sup>†</sup>      | 48.8 | 78    |
| 7.2   | Creative goods & services                              | 5.6  | 106 ○ |
| 7.2.1 | Cultural & creative services exports, % of total trade | 0.1  | 58    |
| 7.2.2 | National feature films/mn pop. 15–69                   | 0.8  | 85    |
| 7.2.3 | Global ent. & media market/th pop. 15–69               | 0.6  | 60 ○  |
| 7.2.4 | Printing & publishing manufactures, % <sup>Ⓔ</sup>     | 0.8  | 74    |
| 7.2.5 | Creative goods exports, % total trade                  | 0.2  | 77    |
| 7.3   | Online creativity                                      | 13.3 | 89    |
| 7.3.1 | Generic top-level domains (TLDs)/th pop. 15–69         | 1.6  | 85    |
| 7.3.2 | Country-code TLDs/th pop. 15–69                        | 0.8  | 84    |
| 7.3.3 | Wikipedia edits/mn pop. 15–69                          | 4.0  | 84    |
| 7.3.4 | Video uploads on YouTube/pop. 15–69                    | 12.6 | 62 ○  |

NOTES: ● indicates a strength; ○ a weakness; \* an index; † a survey question.

Ⓔ indicates that the country's data are older than the base year; see Appendix II for details, including the year of the data, at <http://globalinnovationindex.org>.

Square brackets indicate that the data minimum coverage (DMC) requirements were not met at the sub-pillar or pillar level; see page 181 of this appendix for details.

## Key indicators

|                             |                    |
|-----------------------------|--------------------|
| Population (millions) ..... | 28.8               |
| GDP (US\$ billions) .....   | 12.0               |
| GDP per capita, PPP\$ ..... | 1,186.2            |
| Income group .....          | Low income         |
| Region .....                | Sub-Saharan Africa |

|   | Score 0–100<br>or value (hard data) | Rank       |
|---|-------------------------------------|------------|
| <b>Global Innovation Index (out of 127)</b> ..... | <b>24.5</b>                         | <b>107</b> |
| Innovation Output Sub-Index .....                 | 18.6                                | 100        |
| Innovation Input Sub-Index .....                  | 30.5                                | 114        |
| Innovation Efficiency Ratio .....                 | 0.6                                 | 70 ●       |
| Global Innovation Index 2016 (out of 128) .....   | 29.8                                | 84         |

**1 Institutions.....44.6 113**

|  |      |       |
|--|------|-------|
| 1.1 Political environment .....                        | 36.5 | 102   |
| 1.1.1 Political stability & safety* .....              | 49.9 | 92    |
| 1.1.2 Government effectiveness* .....                  | 23.1 | 112   |
| 1.2 Regulatory environment .....                       | 31.7 | 123 ○ |
| 1.2.1 Regulatory quality* .....                        | 29.5 | 99    |
| 1.2.2 Rule of law* .....                               | 14.1 | 113   |
| 1.2.3 Cost of redundancy dismissal, salary weeks ..... | 37.5 | 123 ○ |
| 1.3 Business environment .....                         | 65.5 | 76    |
| 1.3.1 Ease of starting a business* .....               | 79.9 | 101   |
| 1.3.2 Ease of resolving insolvency* .....              | 49.6 | 60 ●  |
| 1.3.3 Ease of paying taxes* .....                      | 67.1 | 81    |

**2 Human capital & research.....18.7 104**

|   |      |       |
|---|------|-------|
| 2.1 Education .....   | 46.5 | 64 ●  |
| 2.1.1 Expenditure on education, % GDP .....                   | 6.5  | 15 ●  |
| 2.1.2 Gov't expenditure/pupil, secondary, % GDP/cap .....     | 52.0 | 2 ●   |
| 2.1.3 School life expectancy, years .....                     | 9.6  | 104   |
| 2.1.4 PISA scales in reading, maths, & science .....          | n/a  | n/a   |
| 2.1.5 Pupil-teacher ratio, secondary .....                    | 39.7 | 108 ○ |
| 2.2 Tertiary education .....                                  | 7.6  | 117   |
| 2.2.1 Tertiary enrolment, % gross <sup>Ⓐ</sup> .....          | 6.0  | 113   |
| 2.2.2 Graduates in science & engineering, % .....             | 8.1  | 99 ○  |
| 2.2.3 Tertiary inbound mobility, % <sup>Ⓐ</sup> .....         | 0.4  | 94    |
| 2.3 Research & development (R&D) .....                        | 2.0  | 94    |
| 2.3.1 Researchers, FTE/mn pop. .....                          | 41.5 | 92    |
| 2.3.2 Gross expenditure on R&D, % GDP .....                   | 0.3  | 75    |
| 2.3.3 Global R&D companies, avg. expend. top 3, mn \$US ..... | 0.0  | 43 ○  |
| 2.3.4 QS university ranking, average score top 3* .....       | 0.0  | 75 ○  |

**3 Infrastructure.....28.8 110**

|   |       |       |
|---|-------|-------|
| 3.1 Information & communication technologies (ICTs) .....     | 19.0  | 117   |
| 3.1.1 ICT access* .....                                       | 29.0  | 111   |
| 3.1.2 ICT use* .....  | 6.2   | 119   |
| 3.1.3 Government's online service* .....                      | 20.3  | 115   |
| 3.1.4 E-participation* .....                                  | 20.3  | 113   |
| 3.2 General infrastructure .....                              | 47.4  | 33 ●  |
| 3.2.1 Electricity output, kWh/cap .....                       | 651.9 | 102   |
| 3.2.2 Logistics performance* .....                            | 28.7  | 84    |
| 3.2.3 Gross capital formation, % GDP .....                    | 38.5  | 7 ●   |
| 3.3 Ecological sustainability .....                           | 20.0  | 125 ○ |
| 3.3.1 GDP/unit of energy use .....                            | 2.5   | 115   |
| 3.3.2 Environmental performance* .....                        | 41.8  | 119 ○ |
| 3.3.3 ISO 14001 environmental certificates/bn PPP\$ GDP ..... | 0.4   | 87    |

**4 Market sophistication.....35.8 111**

|  |      |     |
|--|------|-----|
| 4.1 Credit .....                                     | 13.9 | 121 |
| 4.1.1 Ease of getting credit* .....                  | 25.0 | 119 |
| 4.1.2 Domestic credit to private sector, % GDP ..... | 35.1 | 91  |
| 4.1.3 Microfinance gross loans, % GDP .....          | 0.2  | 51  |

|  |      |      |
|--|------|------|
| 4.2 Investment .....   | 43.3 | [47] |
| 4.2.1 Ease of protecting minority investors* .....             | 43.3 | 101  |
| 4.2.2 Market capitalization, % GDP .....                       | n/a  | n/a  |
| 4.2.3 Venture capital deals/bn PPP\$ GDP .....                 | n/a  | n/a  |
| 4.3 Trade, competition, & market scale .....                   | 50.2 | 104  |
| 4.3.1 Applied tariff rate, weighted mean, % <sup>Ⓐ</sup> ..... | 4.2  | 80   |
| 4.3.2 Intensity of local competition <sup>†</sup> .....        | 58.0 | 108  |
| 4.3.3 Domestic market scale, bn PPP\$ .....                    | 35.3 | 104  |

**5 Business sophistication.....24.4 106**

|  |      |       |
|--|------|-------|
| 5.1 Knowledge workers .....  | 10.2 | 122   |
| 5.1.1 Knowledge-intensive employment, % .....                          | n/a  | n/a   |
| 5.1.2 Firms offering formal training, % firms <sup>Ⓐ</sup> .....       | 22.1 | 71    |
| 5.1.3 GERD performed by business, % of GDP .....                       | 0.0  | 86    |
| 5.1.4 GERD financed by business, % .....                               | 0.5  | 89    |
| 5.1.5 Females employed w/advanced degrees, % total <sup>Ⓐ</sup> .....  | 0.5  | 87 ○  |
| 5.2 Innovation linkages .....  | 34.5 | 46 ●  |
| 5.2.1 University/industry research collaboration <sup>†</sup> .....    | 37.8 | 82    |
| 5.2.2 State of cluster development <sup>†</sup> .....                  | 34.5 | 104   |
| 5.2.3 GERD financed by abroad, % .....                                 | 39.9 | 11 ●  |
| 5.2.4 JV-strategic alliance deals/bn PPP\$ GDP .....                   | 0.0  | 102   |
| 5.2.5 Patent families 2+ offices/bn PPP\$ GDP .....                    | 0.0  | 118 ○ |
| 5.3 Knowledge absorption .....   | 28.5 | 85    |
| 5.3.1 Intellectual property payments, % total trade <sup>Ⓐ</sup> ..... | 0.2  | 78    |
| 5.3.2 High-tech imports less re-imports, % total trade .....           | 5.7  | 100   |
| 5.3.3 ICT services imports, % total trade .....                        | 0.9  | 72    |
| 5.3.4 FDI net inflows, % GDP .....                                     | 32.5 | 3 ●   |
| 5.3.5 Research talent, % in business enterprise .....                  | 0.3  | 84 ○  |

**6 Knowledge & technology outputs.....20.8 72 ●**

|  |      |      |
|--|------|------|
| 6.1 Knowledge creation .....   | 4.5  | 93   |
| 6.1.1 Patents by origin/bn PPP\$ GDP .....                             | 0.7  | 70 ● |
| 6.1.2 PCT patent applications/bn PPP\$ GDP .....                       | 0.0  | 90   |
| 6.1.3 Utility models by origin/bn PPP\$ GDP .....                      | n/a  | n/a  |
| 6.1.4 Scientific & technical articles/bn PPP\$ GDP .....               | 7.4  | 76   |
| 6.1.5 Citable documents H index .....                                  | 4.1  | 102  |
| 6.2 Knowledge impact .....   | 40.6 | 29 ● |
| 6.2.1 Growth rate of PPP\$ GDP/worker, % .....                         | 4.4  | 10 ● |
| 6.2.2 New businesses/th pop. 15–64 .....                               | n/a  | n/a  |
| 6.2.3 Computer software spending, % GDP .....                          | 0.0  | 113  |
| 6.2.4 ISO 9001 quality certificates/bn PPP\$ GDP .....                 | 1.7  | 98   |
| 6.2.5 High- & medium-high-tech manufactures, % .....                   | n/a  | n/a  |
| 6.3 Knowledge diffusion .....  | 17.3 | 100  |
| 6.3.1 Intellectual property receipts, % total trade <sup>Ⓐ</sup> ..... | 0.0  | 102  |
| 6.3.2 High-tech exports less re-exports, % total trade .....           | 0.4  | 90   |
| 6.3.3 ICT services exports, % total trade .....                        | 0.2  | 114  |
| 6.3.4 FDI net outflows, % GDP .....                                    | 1.3  | 42 ● |

**7 Creative outputs.....16.5 119**

|   |      |       |
|---|------|-------|
| 7.1 Intangible assets .....   | 30.3 | 102   |
| 7.1.1 Trademarks by origin/bn PPP\$ GDP .....                                   | 34.7 | 66 ●  |
| 7.1.2 Industrial designs by origin/bn PPP\$ GDP .....                           | 0.9  | 65    |
| 7.1.3 ICTs & business model creation <sup>†</sup> .....                         | 49.3 | 105   |
| 7.1.4 ICTs & organizational model creation <sup>†</sup> .....                   | 37.0 | 113   |
| 7.2 Creative goods & services .....   | 2.0  | 119   |
| 7.2.1 Cultural & creative services exports, % of total trade <sup>Ⓐ</sup> ..... | 0.0  | 71    |
| 7.2.2 National feature films/mn pop. 15–69 .....                                | 1.7  | 65    |
| 7.2.3 Global ent. & media market/th pop. 15–69 .....                            | n/a  | n/a   |
| 7.2.4 Printing & publishing manufactures, % .....                               | n/a  | n/a   |
| 7.2.5 Creative goods exports, % total trade .....                               | 0.0  | 121 ○ |
| 7.3 Online creativity .....   | 3.3  | 117   |
| 7.3.1 Generic top-level domains (TLDs)/th pop. 15–69 .....                      | 0.0  | 126 ○ |
| 7.3.2 Country-code TLDs/th pop. 15–69 .....                                     | 0.1  | 111   |
| 7.3.3 Wikipedia edits/mn pop. 15–69 <sup>Ⓐ</sup> .....                          | 1.0  | 116   |
| 7.3.4 Video uploads on YouTube/pop. 15–69 .....                                 | n/a  | n/a   |

NOTES: ● indicates a strength; ○ a weakness; \* an index; † a survey question.

Ⓐ indicates that the country's data are older than the base year; see Appendix II for details, including the year of the data, at <http://globalinnovationindex.org>.

Square brackets indicate that the data minimum coverage (DMC) requirements were not met at the sub-pillar or pillar level; see page 181 of this appendix for details.

## Namibia

## Key indicators

|                            |                     |
|----------------------------|---------------------|
| Population (millions)..... | 2.5                 |
| GDP (US\$ billions).....   | 10.2                |
| GDP per capita, PPP\$..... | 11,408.2            |
| Income group.....          | Upper-middle income |
| Region.....                | Sub-Saharan Africa  |

|  | Score 0–100<br>or value (hard data) | Rank      |
|--|-------------------------------------|-----------|
| <b>Global Innovation Index (out of 127).....</b> | <b>27.9</b>                         | <b>97</b> |
| Innovation Output Sub-Index.....                 | 18.1                                | 102       |
| Innovation Input Sub-Index.....                  | 37.8                                | 89        |
| Innovation Efficiency Ratio.....                 | 0.5                                 | 108       |
| Global Innovation Index 2016 (out of 128).....   | 28.2                                | 93        |

**1 Institutions.....65.2 58**

|   |      |       |
|---|------|-------|
| 1.1 Political environment.....                        | 64.2 | 45    |
| 1.1.1 Political stability & safety*.....              | 79.6 | 35 ●  |
| 1.1.2 Government effectiveness*.....                  | 48.8 | 53    |
| 1.2 Regulatory environment.....                       | 69.6 | 44    |
| 1.2.1 Regulatory quality*.....                        | 40.0 | 76    |
| 1.2.2 Rule of law*.....                               | 44.9 | 53    |
| 1.2.3 Cost of redundancy dismissal, salary weeks..... | 9.7  | 30 ●  |
| 1.3 Business environment.....                         | 61.9 | 87    |
| 1.3.1 Ease of starting a business*.....               | 68.9 | 119 ○ |
| 1.3.2 Ease of resolving insolvency*.....              | 42.0 | 86    |
| 1.3.3 Ease of paying taxes*.....                      | 75.0 | 60    |

**2 Human capital & research.....22.5 94**

|  |       |       |
|--|-------|-------|
| 2.1 Education.....   | 50.1  | 53    |
| 2.1.1 Expenditure on education, % GDP <sup>Ⓐ</sup> .....               | 8.3   | 4 ●   |
| 2.1.2 Gov't expenditure/pupil, secondary, % GDP/cap <sup>Ⓐ</sup> ..... | 16.0  | 76    |
| 2.1.3 School life expectancy, years.....                               | n/a   | n/a   |
| 2.1.4 PISA scales in reading, maths, & science.....                    | n/a   | n/a   |
| 2.1.5 Pupil-teacher ratio, secondary <sup>Ⓐ</sup> .....                | 24.6  | 92    |
| 2.2 Tertiary education.....  | 15.1  | 108   |
| 2.2.1 Tertiary enrolment, % gross <sup>Ⓐ</sup> .....                   | 9.3   | 107   |
| 2.2.2 Graduates in science & engineering, % <sup>Ⓐ</sup> .....         | 2.6   | 102 ○ |
| 2.2.3 Tertiary inbound mobility, % <sup>Ⓐ</sup> .....                  | 10.2  | 17 ●  |
| 2.3 Research & development (R&D).....                                  | 2.3   | 89    |
| 2.3.1 Researchers, FTE/mn pop. <sup>Ⓐ</sup> .....                      | 141.4 | 82    |
| 2.3.2 Gross expenditure on R&D, % GDP <sup>Ⓐ</sup> .....               | 0.3   | 76    |
| 2.3.3 Global R&D companies, avg. expend. top 3, mn \$US.....           | 0.0   | 43 ○  |
| 2.3.4 QS university ranking, average score top 3*.....                 | 0.0   | 75 ○  |

**3 Infrastructure.....38.6 92**

|  |       |      |
|--|-------|------|
| 3.1 Information & communication technologies (ICTs).....     | 30.9  | 108  |
| 3.1.1 ICT access*.....                                       | 42.5  | 97   |
| 3.1.2 ICT use*.....  | 29.1  | 90   |
| 3.1.3 Government's online service*.....                      | 28.3  | 109  |
| 3.1.4 E-participation*.....                                  | 23.7  | 111  |
| 3.2 General infrastructure.....                              | 37.6  | 62   |
| 3.2.1 Electricity output, kWh/cap.....                       | 624.2 | 103  |
| 3.2.2 Logistics performance*.....                            | 31.5  | 78   |
| 3.2.3 Gross capital formation, % GDP.....                    | 29.2  | 21 ● |
| 3.3 Ecological sustainability.....                           | 47.4  | 53   |
| 3.3.1 GDP/unit of energy use.....                            | 12.3  | 27 ● |
| 3.3.2 Environmental performance*.....                        | 70.8  | 71   |
| 3.3.3 ISO 14001 environmental certificates/bn PPP\$ GDP..... | 0.7   | 76   |

**4 Market sophistication.....39.3 97**

|  |      |    |
|--|------|----|
| 4.1 Credit.....  | 27.1 | 91 |
| 4.1.1 Ease of getting credit*.....                       | 60.0 | 55 |
| 4.1.2 Domestic credit to private sector, % GDP.....      | 53.8 | 63 |
| 4.1.3 Microfinance gross loans, % GDP <sup>Ⓐ</sup> ..... | 0.0  | 65 |

|   |      |      |
|---|------|------|
| 4.2 Investment.....                                     | 36.7 | 80   |
| 4.2.1 Ease of protecting minority investors*.....       | 55.0 | 75   |
| 4.2.2 Market capitalization, % GDP <sup>Ⓐ</sup> .....   | 0.0  | 86 ○ |
| 4.2.3 Venture capital deals/bn PPP\$ GDP.....           | n/a  | n/a  |
| 4.3 Trade, competition, & market scale.....             | 54.1 | 97   |
| 4.3.1 Applied tariff rate, weighted mean, %.....        | 0.9  | 10 ● |
| 4.3.2 Intensity of local competition <sup>†</sup> ..... | 61.1 | 95   |
| 4.3.3 Domestic market scale, bn PPP\$.....              | 27.0 | 111  |

**5 Business sophistication.....23.2 113**

|   |      |       |
|---|------|-------|
| 5.1 Knowledge workers.....  | 20.5 | 111   |
| 5.1.1 Knowledge-intensive employment, % <sup>Ⓐ</sup> .....                | 14.6 | 89    |
| 5.1.2 Firms offering formal training, % firms.....                        | 25.4 | 63    |
| 5.1.3 GERD performed by business, % of GDP <sup>Ⓐ</sup> .....             | 0.0  | 74    |
| 5.1.4 GERD financed by business, % <sup>Ⓐ</sup> .....                     | 11.1 | 71    |
| 5.1.5 Females employed w/advanced degrees, % total.....                   | n/a  | n/a   |
| 5.2 Innovation linkages.....  | 27.7 | 65    |
| 5.2.1 University/industry research collaboration <sup>†</sup> .....       | 37.7 | 83    |
| 5.2.2 State of cluster development <sup>†</sup> .....                     | 44.5 | 68    |
| 5.2.3 GERD financed by abroad, % <sup>Ⓐ</sup> .....                       | 15.8 | 29 ●  |
| 5.2.4 JV-strategic alliance deals/bn PPP\$ GDP.....                       | 0.0  | 40    |
| 5.2.5 Patent families 2+ offices/bn PPP\$ GDP.....                        | 0.1  | 59    |
| 5.3 Knowledge absorption.....   | 21.3 | 119 ○ |
| 5.3.1 Intellectual property payments, % total trade.....                  | 0.1  | 93    |
| 5.3.2 High-tech imports less re-imports, % total trade <sup>Ⓐ</sup> ..... | 6.0  | 95    |
| 5.3.3 ICT services imports, % total trade.....                            | 0.5  | 103   |
| 5.3.4 FDI net inflows, % GDP.....   | 6.4  | 20 ●  |
| 5.3.5 Research talent, % in business enterprise <sup>Ⓐ</sup> .....        | 6.9  | 70    |

**6 Knowledge & technology outputs.....7.9 123 ○**

|   |      |       |
|---|------|-------|
| 6.1 Knowledge creation.....   | 4.5  | 92    |
| 6.1.1 Patents by origin/bn PPP\$ GDP.....                                 | n/a  | n/a   |
| 6.1.2 PCT patent applications/bn PPP\$ GDP.....                           | 0.1  | 68    |
| 6.1.3 Utility models by origin/bn PPP\$ GDP.....                          | n/a  | n/a   |
| 6.1.4 Scientific & technical articles/bn PPP\$ GDP.....                   | 6.7  | 81    |
| 6.1.5 Citable documents H index.....                                      | 4.0  | 103   |
| 6.2 Knowledge impact.....   | 5.5  | 118 ○ |
| 6.2.1 Growth rate of PPP\$ GDP/worker, %.....                             | n/a  | n/a   |
| 6.2.2 New businesses/th pop. 15–64 <sup>Ⓐ</sup> .....                     | 0.9  | 76    |
| 6.2.3 Computer software spending, % GDP.....                              | 0.1  | 84    |
| 6.2.4 ISO 9001 quality certificates/bn PPP\$ GDP.....                     | 1.8  | 97    |
| 6.2.5 High- & medium-high-tech manufactures, % <sup>Ⓐ</sup> .....         | 0.0  | 94 ○  |
| 6.3 Knowledge diffusion.....  | 13.5 | 118 ○ |
| 6.3.1 Intellectual property receipts, % total trade <sup>Ⓐ</sup> .....    | 0.0  | 100 ○ |
| 6.3.2 High-tech exports less re-exports, % total trade <sup>Ⓐ</sup> ..... | 1.6  | 58    |
| 6.3.3 ICT services exports, % total trade <sup>Ⓐ</sup> .....              | 0.0  | 124 ○ |
| 6.3.4 FDI net outflows, % GDP.....  | 0.2  | 89    |

**7 Creative outputs.....28.3 75**

|   |      |       |
|---|------|-------|
| 7.1 Intangible assets.....  | 40.1 | 73    |
| 7.1.1 Trademarks by origin/bn PPP\$ GDP.....                      | 62.9 | 32 ●  |
| 7.1.2 Industrial designs by origin/bn PPP\$ GDP.....              | 0.0  | 112 ○ |
| 7.1.3 ICTs & business model creation <sup>†</sup> .....           | 58.0 | 72    |
| 7.1.4 ICTs & organizational model creation <sup>†</sup> .....     | 50.1 | 76    |
| 7.2 Creative goods & services.....                                | 18.9 | [62]  |
| 7.2.1 Cultural & creative services exports, % of total trade..... | n/a  | n/a   |
| 7.2.2 National feature films/mn pop. 15–69.....                   | n/a  | n/a   |
| 7.2.3 Global ent. & media market/th pop. 15–69.....               | n/a  | n/a   |
| 7.2.4 Printing & publishing manufactures, %.....                  | n/a  | n/a   |
| 7.2.5 Creative goods exports, % total trade <sup>Ⓐ</sup> .....    | 0.7  | 51    |
| 7.3 Online creativity.....  | 14.4 | 80    |
| 7.3.1 Generic top-level domains (TLDs)/th pop. 15–69.....         | 8.7  | 42    |
| 7.3.2 Country-code TLDs/th pop. 15–69.....                        | 0.0  | 117 ○ |
| 7.3.3 Wikipedia edits/mn pop. 15–69 <sup>Ⓐ</sup> .....            | 3.6  | 92    |
| 7.3.4 Video uploads on YouTube/pop. 15–69.....                    | n/a  | n/a   |

NOTES: ● indicates a strength; ○ a weakness; \* an index; † a survey question.

<sup>Ⓐ</sup> indicates that the country's data are older than the base year; see Appendix II for details, including the year of the data, at <http://globalinnovationindex.org>.

Square brackets indicate that the data minimum coverage (DMC) requirements were not met at the sub-pillar or pillar level; see page 181 of this appendix for details.

## Key indicators

|                             |                           |
|-----------------------------|---------------------------|
| Population (millions) ..... | 28.9                      |
| GDP (US\$ billions) .....   | 21.2                      |
| GDP per capita, PPP\$ ..... | 2,465.2                   |
| Income group .....          | Low income                |
| Region .....                | Central and Southern Asia |

|  | Score 0–100<br>or value (hard data) | Rank       |
|--|-------------------------------------|------------|
| <b>Global Innovation Index (out of 127).....</b> | <b>24.2</b>                         | <b>109</b> |
| Innovation Output Sub-Index .....                | 15.9                                | 114        |
| Innovation Input Sub-Index .....                 | 32.5                                | 108        |
| Innovation Efficiency Ratio .....                | 0.5                                 | 105        |
| Global Innovation Index 2016 (out of 128) .....  | 23.1                                | 115        |

|   |             |            |
|---|-------------|------------|
| <b>1 Institutions.....</b>                                    | <b>43.9</b> | <b>115</b> |
| 1.1 Political environment .....                               | 28.4        | 118        |
| 1.1.1 Political stability & safety* .....                     | 41.4        | 107        |
| 1.1.2 Government effectiveness* .....                         | 15.3        | 121 ○      |
| 1.2 Regulatory environment .....                              | 41.2        | 114        |
| 1.2.1 Regulatory quality* .....                               | 22.0        | 110        |
| 1.2.2 Rule of law* .....                                      | 18.9        | 103        |
| 1.2.3 Cost of redundancy dismissal, salary weeks .....        | 27.2        | 105        |
| 1.3 Business environment .....                                | 62.2        | 86         |
| 1.3.1 Ease of starting a business* .....                      | 83.8        | 84         |
| 1.3.2 Ease of resolving insolvency* .....                     | 44.6        | 81         |
| 1.3.3 Ease of paying taxes* .....                             | 58.1        | 99         |
| <b>2 Human capital &amp; research.....</b>                    | <b>15.0</b> | <b>113</b> |
| 2.1 Education .....   | 29.5        | 108        |
| 2.1.1 Expenditure on education, % GDP .....                   | 3.7         | 87         |
| 2.1.2 Gov't expenditure/pupil, secondary, % GDP/cap .....     | 11.1        | 93         |
| 2.1.3 School life expectancy, years .....                     | 12.2        | 83         |
| 2.1.4 PISA scales in reading, maths, & science .....          | n/a         | n/a        |
| 2.1.5 Pupil-teacher ratio, secondary .....                    | 28.9        | 102        |
| 2.2 Tertiary education .....                                  | 13.4        | 111        |
| 2.2.1 Tertiary enrolment, % gross .....                       | 14.9        | 98         |
| 2.2.2 Graduates in science & engineering, % .....             | 12.1        | 95         |
| 2.2.3 Tertiary inbound mobility, % <sup>ⓐ</sup> .....         | 0.0         | 107 ○      |
| 2.3 Research & development (R&D) .....                        | 2.2         | 90         |
| 2.3.1 Researchers, FTE/mn pop. .....                          | n/a         | n/a        |
| 2.3.2 Gross expenditure on R&D, % GDP <sup>ⓐ</sup> .....      | 0.3         | 79         |
| 2.3.3 Global R&D companies, avg. expend. top 3, mn \$US ..... | 0.0         | 43 ○       |
| 2.3.4 QS university ranking, average score top 3* .....       | 0.0         | 75 ○       |
| <b>3 Infrastructure.....</b>                                  | <b>33.3</b> | <b>105</b> |
| 3.1 Information & communication technologies (ICTs) .....     | 34.0        | 101        |
| 3.1.1 ICT access* .....                                       | 31.6        | 108        |
| 3.1.2 ICT use* .....  | 13.5        | 107        |
| 3.1.3 Government's online service* .....                      | 39.9        | 99         |
| 3.1.4 E-participation* .....                                  | 50.8        | 87         |
| 3.2 General infrastructure .....                              | 38.2        | 58 ●       |
| 3.2.1 Electricity output, kWh/cap .....                       | 134.7       | 114 ○      |
| 3.2.2 Logistics performance* .....                            | 14.5        | 115        |
| 3.2.3 Gross capital formation, % GDP .....                    | 34.0        | 9 ●        |
| 3.3 Ecological sustainability .....                           | 27.7        | 119 ○      |
| 3.3.1 GDP/unit of energy use .....                            | 5.3         | 99         |
| 3.3.2 Environmental performance* .....                        | 50.2        | 112        |
| 3.3.3 ISO 14001 environmental certificates/bn PPP\$ GDP ..... | 0.3         | 97         |
| <b>4 Market sophistication .....</b>                          | <b>44.1</b> | <b>75</b>  |
| 4.1 Credit .....  | 28.7        | 83         |
| 4.1.1 Ease of getting credit* .....                           | 30.0        | 108        |
| 4.1.2 Domestic credit to private sector, % GDP .....          | 65.0        | 48 ●       |
| 4.1.3 Microfinance gross loans, % GDP .....                   | 1.7         | 18 ●       |

|   |      |       |
|---|------|-------|
| 4.2 Investment .....                                    | 58.3 | [19]  |
| 4.2.1 Ease of protecting minority investors* .....      | 58.3 | 62 ●  |
| 4.2.2 Market capitalization, % GDP .....                | n/a  | n/a   |
| 4.2.3 Venture capital deals/bn PPP\$ GDP .....          | n/a  | n/a   |
| 4.3 Trade, competition, & market scale .....            | 45.2 | 113   |
| 4.3.1 Applied tariff rate, weighted mean, % .....       | 11.7 | 119 ○ |
| 4.3.2 Intensity of local competition <sup>†</sup> ..... | 65.2 | 80    |
| 4.3.3 Domestic market scale, bn PPP\$ .....             | 71.5 | 85    |

**5 Business sophistication .....** **26.2** **95**

|   |      |       |
|---|------|-------|
| 5.1 Knowledge workers .....   | 21.9 | [106] |
| 5.1.1 Knowledge-intensive employment, % <sup>ⓐ</sup> .....          | 4.3  | 101   |
| 5.1.2 Firms offering formal training, % firms .....                 | 31.9 | 48 ●  |
| 5.1.3 GERD performed by business, % of GDP .....                    | n/a  | n/a   |
| 5.1.4 GERD financed by business, % .....                            | n/a  | n/a   |
| 5.1.5 Females employed w/advanced degrees, % total .....            | n/a  | n/a   |
| 5.2 Innovation linkages .....                                       | 25.3 | 73 ●  |
| 5.2.1 University/industry research collaboration <sup>†</sup> ..... | 25.9 | 115   |
| 5.2.2 State of cluster development <sup>†</sup> .....               | 35.7 | 100   |
| 5.2.3 GERD financed by abroad, % .....                              | n/a  | n/a   |
| 5.2.4 JV-strategic alliance deals/bn PPP\$ GDP .....                | 0.0  | 77    |
| 5.2.5 Patent families 2+ offices/bn PPP\$ GDP .....                 | n/a  | n/a   |
| 5.3 Knowledge absorption .....                                      | 31.4 | 72 ●  |
| 5.3.1 Intellectual property payments, % total trade .....           | n/a  | n/a   |
| 5.3.2 High-tech imports less re-imports, % total trade .....        | 11.4 | 30 ●  |
| 5.3.3 ICT services imports, % total trade <sup>ⓐ</sup> .....        | 0.6  | 94    |
| 5.3.4 FDI net inflows, % GDP .....                                  | 0.3  | 120 ○ |
| 5.3.5 Research talent, % in business enterprise .....               | n/a  | n/a   |

**6 Knowledge & technology outputs .....** **13.7** **112**

|   |      |       |
|---|------|-------|
| 6.1 Knowledge creation .....                                      | 6.1  | 83    |
| 6.1.1 Patents by origin/bn PPP\$ GDP .....                        | 0.2  | 99    |
| 6.1.2 PCT patent applications/bn PPP\$ GDP .....                  | n/a  | n/a   |
| 6.1.3 Utility models by origin/bn PPP\$ GDP .....                 | n/a  | n/a   |
| 6.1.4 Scientific & technical articles/bn PPP\$ GDP .....          | 8.5  | 72 ●  |
| 6.1.5 Citable documents H index .....                             | 6.1  | 86    |
| 6.2 Knowledge impact .....  | 3.8  | 123 ○ |
| 6.2.1 Growth rate of PPP\$ GDP/worker, % .....                    | n/a  | n/a   |
| 6.2.2 New businesses/th pop. 15–64 .....                          | 0.7  | 82    |
| 6.2.3 Computer software spending, % GDP .....                     | 0.0  | 116   |
| 6.2.4 ISO 9001 quality certificates/bn PPP\$ GDP .....            | 1.4  | 102   |
| 6.2.5 High- & medium-high-tech manufactures, % <sup>ⓐ</sup> ..... | 0.1  | 91    |
| 6.3 Knowledge diffusion .....                                     | 31.1 | 37 ●  |
| 6.3.1 Intellectual property receipts, % total trade .....         | n/a  | n/a   |
| 6.3.2 High-tech exports less re-exports, % total trade .....      | 0.1  | 117 ○ |
| 6.3.3 ICT services exports, % total trade <sup>ⓐ</sup> .....      | 6.6  | 9 ●   |
| 6.3.4 FDI net outflows, % GDP .....                               | n/a  | n/a   |

**7 Creative outputs .....** **18.1** **109**

|  |      |       |
|--|------|-------|
| 7.1 Intangible assets .....  | 26.7 | 117   |
| 7.1.1 Trademarks by origin/bn PPP\$ GDP .....                      | 35.1 | 64 ●  |
| 7.1.2 Industrial designs by origin/bn PPP\$ GDP .....              | 0.2  | 93    |
| 7.1.3 ICTs & business model creation <sup>†</sup> .....            | 41.1 | 119 ○ |
| 7.1.4 ICTs & organizational model creation <sup>†</sup> .....      | 34.0 | 116 ○ |
| 7.2 Creative goods & services .....                                | 5.6  | [108] |
| 7.2.1 Cultural & creative services exports, % of total trade ..... | n/a  | n/a   |
| 7.2.2 National feature films/mn pop. 15–69 .....                   | n/a  | n/a   |
| 7.2.3 Global ent. & media market/th pop. 15–69 .....               | n/a  | n/a   |
| 7.2.4 Printing & publishing manufactures, % <sup>ⓐ</sup> .....     | 0.4  | 92    |
| 7.2.5 Creative goods exports, % total trade .....                  | 0.2  | 73 ●  |
| 7.3 Online creativity .....  | 13.7 | 84    |
| 7.3.1 Generic top-level domains (TLDs)/th pop. 15–69 .....         | 0.5  | 108   |
| 7.3.2 Country-code TLDs/th pop. 15–69 .....                        | 0.8  | 83    |
| 7.3.3 Wikipedia edits/mn pop. 15–69 <sup>ⓐ</sup> .....             | 4.1  | 78    |
| 7.3.4 Video uploads on YouTube/pop. 15–69 .....                    | n/a  | n/a   |

NOTES: ● indicates a strength; ○ a weakness; \* an index; † a survey question.

ⓐ indicates that the country's data are older than the base year; see Appendix II for details, including the year of the data, at <http://globalinnovationindex.org>.

Square brackets indicate that the data minimum coverage (DMC) requirements were not met at the sub-pillar or pillar level; see page 181 of this appendix for details.



## Netherlands

## Key indicators

|                             |             |
|-----------------------------|-------------|
| Population (millions) ..... | 17.0        |
| GDP (US\$ billions) .....   | 769.9       |
| GDP per capita, PPP\$ ..... | 49,165.8    |
| Income group .....          | High income |
| Region .....                | Europe      |

|  | Score 0–100<br>or value (hard data) | Rank       |
|--|-------------------------------------|------------|
| <b>Global Innovation Index (out of 127).....</b>               | <b>63.4</b>                         | <b>3 ●</b> |
| Innovation Output Sub-Index .....                              | 60.9                                | 2 ●        |
| Innovation Input Sub-Index .....                               | 65.8                                | 9          |
| Innovation Efficiency Ratio .....                              | 0.9                                 | 4 ●        |
| Global Innovation Index 2016 (out of 128) .....                | 58.3                                | 9          |
| <b>1 Institutions.....</b>                                     | <b>88.2</b>                         | <b>11</b>  |
| 1.1 Political environment .....                                | 87.9                                | 10         |
| 1.1.1 Political stability & safety* .....                      | 86.4                                | 21         |
| 1.1.2 Government effectiveness* .....                          | 89.5                                | 7          |
| 1.2 Regulatory environment .....                               | 88.1                                | 16         |
| 1.2.1 Regulatory quality* .....                                | 87.4                                | 9          |
| 1.2.2 Rule of law* .....                                       | 95.9                                | 7          |
| 1.2.3 Cost of redundancy dismissal, salary weeks .....         | 15.8                                | 65 ○       |
| 1.3 Business environment .....                                 | 88.7                                | 9          |
| 1.3.1 Ease of starting a business* .....                       | 94.2                                | 20         |
| 1.3.2 Ease of resolving insolvency* .....                      | 84.0                                | 10         |
| 1.3.3 Ease of paying taxes* .....                              | 88.1                                | 18         |
| <b>2 Human capital &amp; research.....</b>                     | <b>54.7</b>                         | <b>19</b>  |
| 2.1 Education .....  | 61.1                                | 18         |
| 2.1.1 Expenditure on education, % GDP .....                    | 5.6                                 | 28         |
| 2.1.2 Gov't expenditure/pupil, secondary, % GDP/cap .....      | 24.4                                | 33         |
| 2.1.3 School life expectancy, years <sup>Ⓐ</sup> .....         | 18.1                                | 9          |
| 2.1.4 PISA scales in reading, maths, & science .....           | 507.9                               | 12         |
| 2.1.5 Pupil-teacher ratio, secondary <sup>Ⓐ</sup> .....        | 14.6                                | 62 ○       |
| 2.2 Tertiary education .....                                   | 39.4                                | 49 ○       |
| 2.2.1 Tertiary enrolment, % gross <sup>Ⓐ</sup> .....           | 78.5                                | 18         |
| 2.2.2 Graduates in science & engineering, % <sup>Ⓐ</sup> ..... | 14.4                                | 88 ○       |
| 2.2.3 Tertiary inbound mobility, % <sup>Ⓐ</sup> .....          | 7.2                                 | 27         |
| 2.3 Research & development (R&D) .....                         | 63.6                                | 14         |
| 2.3.1 Researchers, FTE/mn pop. .....                           | 4,548.1                             | 14         |
| 2.3.2 Gross expenditure on R&D, % GDP .....                    | 2.0                                 | 18         |
| 2.3.3 Global R&D companies, avg. expend. top 3, mn \$US .....  | 83.0                                | 10         |
| 2.3.4 QS university ranking, average score top 3* .....        | 69.7                                | 13         |
| <b>3 Infrastructure.....</b>                                   | <b>63.3</b>                         | <b>14</b>  |
| 3.1 Information & communication technologies (ICTs) .....      | 88.9                                | 3 ●        |
| 3.1.1 ICT access* .....  | 90.2                                | 7          |
| 3.1.2 ICT use* .....   | 77.7                                | 14         |
| 3.1.3 Government's online service* .....                       | 92.8                                | 9          |
| 3.1.4 E-participation* .....                                   | 94.9                                | 5 ●        |
| 3.2 General infrastructure .....                               | 48.6                                | 30         |
| 3.2.1 Electricity output, kWh/cap .....                        | 6,497.5                             | 31         |
| 3.2.2 Logistics performance* .....                             | 98.2                                | 4 ●        |
| 3.2.3 Gross capital formation, % GDP .....                     | 19.5                                | 87 ○       |
| 3.3 Ecological sustainability .....                            | 52.4                                | 39         |
| 3.3.1 GDP/unit of energy use .....                             | 10.8                                | 40 ○       |
| 3.3.2 Environmental performance* .....                         | 82.0                                | 36         |
| 3.3.3 ISO 14001 environmental certificates/bn PPP\$ GDP .....  | 2.9                                 | 38         |
| <b>4 Market sophistication .....</b>                           | <b>59.0</b>                         | <b>17</b>  |
| 4.1 Credit .....   | 47.2                                | 35         |
| 4.1.1 Ease of getting credit* .....                            | 50.0                                | 72 ○       |
| 4.1.2 Domestic credit to private sector, % GDP .....           | 111.5                               | 23         |
| 4.1.3 Microfinance gross loans, % GDP .....                    | n/a                                 | n/a        |

|   |             |            |
|---|-------------|------------|
| 4.2 Investment .....  | 52.8        | 26         |
| 4.2.1 Ease of protecting minority investors* .....                              | 56.7        | 67 ○       |
| 4.2.2 Market capitalization, % GDP .....  | 97.1        | 9          |
| 4.2.3 Venture capital deals/bn PPP\$ GDP .....                                  | 0.2         | 11         |
| 4.3 Trade, competition, & market scale .....                                    | 77.0        | 15         |
| 4.3.1 Applied tariff rate, weighted mean, % .....                               | 1.6         | 23 ○       |
| 4.3.2 Intensity of local competition <sup>†</sup> .....                         | 81.6        | 10         |
| 4.3.3 Domestic market scale, bn PPP\$ .....                                     | 865.9       | 26         |
| <b>5 Business sophistication .....</b>  | <b>63.7</b> | <b>1 ●</b> |
| 5.1 Knowledge workers .....   | 62.3        | 21         |
| 5.1.1 Knowledge-intensive employment, % .....                                   | 46.6        | 9          |
| 5.1.2 Firms offering formal training, % firms .....                             | n/a         | n/a        |
| 5.1.3 GERD performed by business, % of GDP .....                                | 1.1         | 19         |
| 5.1.4 GERD financed by business, % .....  | 48.7        | 21         |
| 5.1.5 Females employed w/advanced degrees, % total .....                        | 18.7        | 27         |
| 5.2 Innovation linkages .....   | 50.7        | 7          |
| 5.2.1 University/industry research collaboration <sup>†</sup> .....             | 75.0        | 5 ●        |
| 5.2.2 State of cluster development <sup>†</sup> .....                           | 71.2        | 6          |
| 5.2.3 GERD financed by abroad, % .....  | 15.1        | 30         |
| 5.2.4 JV-strategic alliance deals/bn PPP\$ GDP .....                            | 0.1         | 23         |
| 5.2.5 Patent families 2+ offices/bn PPP\$ GDP .....                             | 6.2         | 11         |
| 5.3 Knowledge absorption .....  | 78.0        | 1 ●        |
| 5.3.1 Intellectual property payments, % total trade .....                       | 5.4         | 1 ●        |
| 5.3.2 High-tech imports less re-imports, % total trade .....                    | 12.9        | 19         |
| 5.3.3 ICT services imports, % total trade .....                                 | 5.5         | 1 ●        |
| 5.3.4 FDI net inflows, % GDP .....  | 21.0        | 6 ●        |
| 5.3.5 Research talent, % in business enterprise .....                           | 59.1        | 13         |
| <b>6 Knowledge &amp; technology outputs .....</b>                               | <b>62.9</b> | <b>2 ●</b> |
| 6.1 Knowledge creation .....  | 64.8        | 6 ●        |
| 6.1.1 Patents by origin/bn PPP\$ GDP .....                                      | 11.1        | 10         |
| 6.1.2 PCT patent applications/bn PPP\$ GDP .....                                | 5.4         | 8          |
| 6.1.3 Utility models by origin/bn PPP\$ GDP .....                               | n/a         | n/a        |
| 6.1.4 Scientific & technical articles/bn PPP\$ GDP .....                        | 42.9        | 13         |
| 6.1.5 Citable documents H index .....   | 67.6        | 8          |
| 6.2 Knowledge impact .....  | 44.6        | 17         |
| 6.2.1 Growth rate of PPP\$ GDP/worker, % .....                                  | 1.1         | 52 ○       |
| 6.2.2 New businesses/th pop. 15–64 .....  | 5.3         | 23         |
| 6.2.3 Computer software spending, % GDP .....                                   | 0.6         | 10         |
| 6.2.4 ISO 9001 quality certificates/bn PPP\$ GDP .....                          | 12.4        | 30         |
| 6.2.5 High- & medium-high-tech manufactures, % .....                            | 0.4         | 20         |
| 6.3 Knowledge diffusion .....   | 79.3        | 2 ●        |
| 6.3.1 Intellectual property receipts, % total trade .....                       | 3.7         | 5 ●        |
| 6.3.2 High-tech exports less re-exports, % total trade .....                    | 13.0        | 15         |
| 6.3.3 ICT services exports, % total trade .....                                 | 7.2         | 7          |
| 6.3.4 FDI net outflows, % GDP .....   | 23.1        | 1 ●        |
| <b>7 Creative outputs .....</b>   | <b>59.0</b> | <b>5 ●</b> |
| 7.1 Intangible assets .....   | 57.7        | 21         |
| 7.1.1 Trademarks by origin/bn PPP\$ GDP .....                                   | 61.1        | 33         |
| 7.1.2 Industrial designs by origin/bn PPP\$ GDP .....                           | 3.1         | 36         |
| 7.1.3 ICTs & business model creation <sup>†</sup> .....                         | 83.2        | 3 ●        |
| 7.1.4 ICTs & organizational model creation <sup>†</sup> .....                   | 79.2        | 6          |
| 7.2 Creative goods & services .....   | 42.8        | 8          |
| 7.2.1 Cultural & creative services exports, % of total trade <sup>Ⓐ</sup> ..... | 1.1         | 14         |
| 7.2.2 National feature films/mn pop. 15–69 .....                                | 7.2         | 23         |
| 7.2.3 Global ent. & media market/th pop. 15–69 .....                            | 50.3        | 17         |
| 7.2.4 Printing & publishing manufactures, % .....                               | 1.4         | 36 ○       |
| 7.2.5 Creative goods exports, % total trade .....                               | 4.7         | 11         |
| 7.3 Online creativity .....   | 77.8        | 2 ●        |
| 7.3.1 Generic top-level domains (TLDs)/th pop. 15–69 .....                      | 77.9        | 5 ●        |
| 7.3.2 Country-code TLDs/th pop. 15–69 .....                                     | 100.0       | 1 ●        |
| 7.3.3 Wikipedia edits/mn pop. 15–69 .....                                       | 7.2         | 8          |
| 7.3.4 Video uploads on YouTube/pop. 15–69 .....                                 | 64.0        | 5          |

NOTES: ● indicates a strength; ○ a weakness; \* an index; † a survey question.

Ⓐ indicates that the country's data are older than the base year; see Appendix II for details, including the year of the data, at <http://globalinnovationindex.org>.

Square brackets indicate that the data minimum coverage (DMC) requirements were not met at the sub-pillar or pillar level; see page 181 of this appendix for details.



## Key indicators

|                            |   |
|----------------------------|---|
| Population (millions)..... | 4.6                                     |
| GDP (US\$ billions).....   | 179.4                                   |
| GDP per capita, PPP\$..... | 36,171.6                                |
| Income group.....          | High income                             |
| Region.....                | South East Asia, East Asia, and Oceania |

|  | Score 0–100<br>or value (hard data) | Rank      |
|--|-------------------------------------|-----------|
| <b>Global Innovation Index (out of 127).....</b> | <b>52.9</b>                         | <b>21</b> |
| Innovation Output Sub-Index.....                 | 41.6                                | 24        |
| Innovation Input Sub-Index.....                  | 64.1                                | 13        |
| Innovation Efficiency Ratio.....                 | 0.6                                 | 56        |
| Global Innovation Index 2016 (out of 128).....   | 54.2                                | 17        |

**1 Institutions.....93.4 2 ●**

|   |       |     |
|---|-------|-----|
| 1.1 Political environment.....                        | 95.4  | 2 ● |
| 1.1.1 Political stability & safety*.....              | 100.0 | 1 ● |
| 1.1.2 Government effectiveness*.....                  | 90.7  | 4 ● |
| 1.2 Regulatory environment.....                       | 97.6  | 3 ● |
| 1.2.1 Regulatory quality*.....                        | 91.9  | 3 ● |
| 1.2.2 Rule of law*.....                               | 98.5  | 5 ● |
| 1.2.3 Cost of redundancy dismissal, salary weeks..... | 8.0   | 1 ● |
| 1.3 Business environment.....                         | 87.4  | 13  |
| 1.3.1 Ease of starting a business*.....               | 100.0 | 1 ● |
| 1.3.2 Ease of resolving insolvency*.....              | 71.4  | 32  |
| 1.3.3 Ease of paying taxes*.....                      | 90.7  | 11  |

**2 Human capital & research.....56.0 17**

|  |         |      |
|--|---------|------|
| 2.1 Education.....   | 64.4    | 13   |
| 2.1.1 Expenditure on education, % GDP.....                     | 6.3     | 18   |
| 2.1.2 Gov't expenditure/pupil, secondary, % GDP/cap.....       | 22.0    | 47   |
| 2.1.3 School life expectancy, years.....                       | 19.2    | 5 ●  |
| 2.1.4 PISA scales in reading, maths, & science.....            | 505.9   | 14   |
| 2.1.5 Pupil-teacher ratio, secondary <sup>Ⓐ</sup> .....        | 14.0    | 58 ○ |
| 2.2 Tertiary education.....                                    | 59.7    | 7    |
| 2.2.1 Tertiary enrolment, % gross <sup>Ⓐ</sup> .....           | 80.9    | 16   |
| 2.2.2 Graduates in science & engineering, % <sup>Ⓐ</sup> ..... | 18.8    | 66 ○ |
| 2.2.3 Tertiary inbound mobility, % <sup>Ⓐ</sup> .....          | 18.7    | 5 ●  |
| 2.3 Research & development (R&D).....                          | 44.0    | 23   |
| 2.3.1 Researchers, FTE/mn pop. <sup>Ⓐ</sup> .....              | 4,008.7 | 22   |
| 2.3.2 Gross expenditure on R&D, % GDP <sup>Ⓐ</sup> .....       | 1.2     | 33   |
| 2.3.3 Global R&D companies, avg. expend. top 3, mn \$US.....   | 46.3    | 32   |
| 2.3.4 QS university ranking, average score top 3*.....         | 54.7    | 18   |

**3 Infrastructure.....61.0 22**

|  |         |      |
|--|---------|------|
| 3.1 Information & communication technologies (ICTs).....     | 88.2    | 6    |
| 3.1.1 ICT access*.....                                       | 83.2    | 17   |
| 3.1.2 ICT use*.....  | 80.3    | 11   |
| 3.1.3 Government's online service*.....                      | 94.2    | 5    |
| 3.1.4 E-participation*.....                                  | 94.9    | 5    |
| 3.2 General infrastructure.....                              | 46.6    | 36   |
| 3.2.1 Electricity output, kWh/cap.....                       | 9,821.3 | 15   |
| 3.2.2 Logistics performance*.....                            | 61.3    | 36   |
| 3.2.3 Gross capital formation, % GDP.....                    | 23.3    | 53   |
| 3.3 Ecological sustainability.....                           | 48.1    | 50   |
| 3.3.1 GDP/unit of energy use.....                            | 7.6     | 75 ○ |
| 3.3.2 Environmental performance*.....                        | 88.0    | 11   |
| 3.3.3 ISO 14001 environmental certificates/bn PPP\$ GDP..... | 1.5     | 56   |

**4 Market sophistication.....66.3 8**

|   |       |     |
|---|-------|-----|
| 4.1 Credit.....   | 78.5  | 4 ● |
| 4.1.1 Ease of getting credit*.....                                | 100.0 | 1 ● |
| 4.1.2 Domestic credit to private sector, % GDP <sup>Ⓐ</sup> ..... | 142.3 | 10  |
| 4.1.3 Microfinance gross loans, % GDP.....                        | n/a   | n/a |

|   |       |     |
|---|-------|-----|
| 4.2 Investment.....                                     | 53.0  | 25  |
| 4.2.1 Ease of protecting minority investors*.....       | 83.3  | 1 ● |
| 4.2.2 Market capitalization, % GDP.....                 | 42.8  | 37  |
| 4.2.3 Venture capital deals/bn PPP\$ GDP.....           | 0.1   | 20  |
| 4.3 Trade, competition, & market scale.....             | 67.4  | 45  |
| 4.3.1 Applied tariff rate, weighted mean, %.....        | 1.3   | 19  |
| 4.3.2 Intensity of local competition <sup>†</sup> ..... | 74.6  | 28  |
| 4.3.3 Domestic market scale, bn PPP\$.....              | 174.8 | 60  |

**5 Business sophistication.....44.0 28**

|   |      |       |
|---|------|-------|
| 5.1 Knowledge workers.....  | 54.7 | 29    |
| 5.1.1 Knowledge-intensive employment, % <sup>Ⓐ</sup> .....            | 42.9 | 19    |
| 5.1.2 Firms offering formal training, % firms.....                    | n/a  | n/a   |
| 5.1.3 GERD performed by business, % of GDP <sup>Ⓐ</sup> .....         | 0.5  | 33    |
| 5.1.4 GERD financed by business, % <sup>Ⓐ</sup> .....                 | 39.8 | 37    |
| 5.1.5 Females employed w/advanced degrees, % total <sup>Ⓐ</sup> ..... | 19.5 | 25    |
| 5.2 Innovation linkages.....  | 38.4 | 35    |
| 5.2.1 University/industry research collaboration <sup>†</sup> .....   | 62.5 | 18    |
| 5.2.2 State of cluster development <sup>†</sup> .....                 | 49.1 | 45    |
| 5.2.3 GERD financed by abroad, % <sup>Ⓐ</sup> .....                   | 7.2  | 55 ○  |
| 5.2.4 JV-strategic alliance deals/bn PPP\$ GDP.....                   | 0.1  | 14    |
| 5.2.5 Patent families 2+ offices/bn PPP\$ GDP.....                    | 4.7  | 15    |
| 5.3 Knowledge absorption.....   | 38.8 | 36    |
| 5.3.1 Intellectual property payments, % total trade.....              | 1.7  | 15    |
| 5.3.2 High-tech imports less re-imports, % total trade.....           | 11.6 | 27    |
| 5.3.3 ICT services imports, % total trade.....                        | 1.4  | 50    |
| 5.3.4 FDI net inflows, % GDP.....                                     | 0.5  | 116 ○ |
| 5.3.5 Research talent, % in business enterprise <sup>Ⓐ</sup> .....    | 34.1 | 41    |

**6 Knowledge & technology outputs.....34.2 29**

|   |      |       |
|---|------|-------|
| 6.1 Knowledge creation.....                                       | 41.5 | 20    |
| 6.1.1 Patents by origin/bn PPP\$ GDP.....                         | 7.1  | 17    |
| 6.1.2 PCT patent applications/bn PPP\$ GDP.....                   | 1.8  | 21    |
| 6.1.3 Utility models by origin/bn PPP\$ GDP.....                  | n/a  | n/a   |
| 6.1.4 Scientific & technical articles/bn PPP\$ GDP.....           | 50.9 | 7     |
| 6.1.5 Citable documents H index.....                              | 33.5 | 27    |
| 6.2 Knowledge impact.....   | 41.1 | 27    |
| 6.2.1 Growth rate of PPP\$ GDP/worker, %.....                     | 0.9  | 59 ○  |
| 6.2.2 New businesses/th pop. 15–64.....                           | 16.6 | 3 ●   |
| 6.2.3 Computer software spending, % GDP.....                      | 0.3  | 58    |
| 6.2.4 ISO 9001 quality certificates/bn PPP\$ GDP.....             | 7.2  | 52    |
| 6.2.5 High- & medium-high-tech manufactures, % <sup>Ⓐ</sup> ..... | 0.1  | 73 ○  |
| 6.3 Knowledge diffusion.....                                      | 20.1 | 80 ○  |
| 6.3.1 Intellectual property receipts, % total trade.....          | 0.6  | 21    |
| 6.3.2 High-tech exports less re-exports, % total trade.....       | 1.4  | 64    |
| 6.3.3 ICT services exports, % total trade.....                    | 1.2  | 75 ○  |
| 6.3.4 FDI net outflows, % GDP.....                                | 0.0  | 107 ○ |

**7 Creative outputs.....49.0 16**

|   |      |      |
|---|------|------|
| 7.1 Intangible assets.....  | 56.8 | 22   |
| 7.1.1 Trademarks by origin/bn PPP\$ GDP.....                      | 93.9 | 16   |
| 7.1.2 Industrial designs by origin/bn PPP\$ GDP.....              | 2.1  | 44   |
| 7.1.3 ICTs & business model creation <sup>†</sup> .....           | 76.1 | 21   |
| 7.1.4 ICTs & organizational model creation <sup>†</sup> .....     | 69.1 | 23   |
| 7.2 Creative goods & services.....                                | 26.3 | 42   |
| 7.2.1 Cultural & creative services exports, % of total trade..... | n/a  | n/a  |
| 7.2.2 National feature films/mn pop. 15–69.....                   | 8.8  | 17   |
| 7.2.3 Global ent. & media market/th pop. 15–69.....               | 56.8 | 12   |
| 7.2.4 Printing & publishing manufactures, % <sup>Ⓐ</sup> .....    | 1.8  | 27   |
| 7.2.5 Creative goods exports, % total trade.....                  | 0.3  | 66 ○ |
| 7.3 Online creativity.....  | 56.1 | 13   |
| 7.3.1 Generic top-level domains (TLDs)/th pop. 15–69.....         | 34.3 | 20   |
| 7.3.2 Country-code TLDs/th pop. 15–69.....                        | 62.4 | 10   |
| 7.3.3 Wikipedia edits/mn pop. 15–69.....                          | 6.9  | 13   |
| 7.3.4 Video uploads on YouTube/pop. 15–69.....                    | 60.9 | 8    |

NOTES: ● indicates a strength; ○ a weakness; \* an index; † a survey question.

<sup>Ⓐ</sup> indicates that the country's data are older than the base year; see Appendix II for details, including the year of the data, at <http://globalinnovationindex.org>.

Square brackets indicate that the data minimum coverage (DMC) requirements were not met at the sub-pillar or pillar level; see page 181 of this appendix for details.

## Niger

## Key indicators

|                             |                    |
|-----------------------------|--------------------|
| Population (millions) ..... | 20.7               |
| GDP (US\$ billions) .....   | 7.6                |
| GDP per capita, PPP\$ ..... | 1,079.7            |
| Income group .....          | Low income         |
| Region .....                | Sub-Saharan Africa |

|  | Score 0–100<br>or value (hard data) | Rank       |
|--|-------------------------------------|------------|
| <b>Global Innovation Index (out of 127).....</b> | <b>21.2</b>                         | <b>123</b> |
| Innovation Output Sub-Index .....                | 11.2                                | 123        |
| Innovation Input Sub-Index.....                  | 31.2                                | 111        |
| Innovation Efficiency Ratio.....                 | 0.4                                 | 123        |
| Global Innovation Index 2016 (out of 128) .....  | 20.4                                | 124        |

**1 Institutions.....49.2 97**

|   |      |     |
|---|------|-----|
| 1.1 Political environment .....                       | 33.3 | 110 |
| 1.1.1 Political stability & safety*.....              | 40.1 | 109 |
| 1.1.2 Government effectiveness*.....                  | 26.6 | 101 |
| 1.2 Regulatory environment.....                       | 55.4 | 86  |
| 1.2.1 Regulatory quality*.....                        | 23.6 | 108 |
| 1.2.2 Rule of law*.....                               | 21.7 | 98  |
| 1.2.3 Cost of redundancy dismissal, salary weeks..... | 14.0 | 55  |
| 1.3 Business environment.....                         | 58.9 | 100 |
| 1.3.1 Ease of starting a business*.....               | 86.2 | 71  |
| 1.3.2 Ease of resolving insolvency*.....              | 40.4 | 93  |
| 1.3.3 Ease of paying taxes*.....                      | 50.2 | 113 |

**2 Human capital & research.....20.6 98**

|  |      |       |
|--|------|-------|
| 2.1 Education.....   | 52.9 | 49    |
| 2.1.1 Expenditure on education, % GDP.....                     | 6.7  | 14 ●  |
| 2.1.2 Gov't expenditure/pupil, secondary, % GDP/cap.....       | 72.6 | 1 ●   |
| 2.1.3 School life expectancy, years <sup>Ⓐ</sup> .....         | 5.3  | 115 ○ |
| 2.1.4 PISA scales in reading, maths, & science.....            | n/a  | n/a   |
| 2.1.5 Pupil-teacher ratio, secondary.....                      | 28.0 | 100   |
| 2.2 Tertiary education.....                                    | 9.0  | 112   |
| 2.2.1 Tertiary enrolment, % gross <sup>Ⓐ</sup> .....           | 1.7  | 120 ○ |
| 2.2.2 Graduates in science & engineering, % <sup>Ⓐ</sup> ..... | 4.3  | 101   |
| 2.2.3 Tertiary inbound mobility, % <sup>Ⓐ</sup> .....          | 5.4  | 34 ●  |
| 2.3 Research & development (R&D).....                          | 0.0  | 115 ○ |
| 2.3.1 Researchers, FTE/mn pop.....                             | n/a  | n/a   |
| 2.3.2 Gross expenditure on R&D, % GDP.....                     | n/a  | n/a   |
| 2.3.3 Global R&D companies, avg. expend. top 3, mn \$US.....   | 0.0  | 43 ○  |
| 2.3.4 QS university ranking, average score top 3*.....         | 0.0  | 75 ○  |

**3 Infrastructure.....27.5 112**

|  |      |       |
|--|------|-------|
| 3.1 Information & communication technologies (ICTs).....     | 9.4  | 127 ○ |
| 3.1.1 ICT access*.....                                       | 20.4 | 125 ○ |
| 3.1.2 ICT use*.....  | 1.4  | 126 ○ |
| 3.1.3 Government's online service*.....                      | 7.2  | 124   |
| 3.1.4 E-participation*.....                                  | 8.5  | 123   |
| 3.2 General infrastructure.....                              | 49.9 | 27 ●  |
| 3.2.1 Electricity output, kWh/cap.....                       | 36.1 | 117   |
| 3.2.2 Logistics performance*.....                            | 23.1 | 97    |
| 3.2.3 Gross capital formation, % GDP.....                    | 42.5 | 4 ●   |
| 3.3 Ecological sustainability.....                           | 23.1 | 122   |
| 3.3.1 GDP/unit of energy use.....                            | 5.8  | 94    |
| 3.3.2 Environmental performance*.....                        | 37.5 | 122 ○ |
| 3.3.3 ISO 14001 environmental certificates/bn PPP\$ GDP..... | 0.2  | 114   |

**4 Market sophistication.....28.0 125**

|   |      |      |
|---|------|------|
| 4.1 Credit.....                                     | 16.1 | 118  |
| 4.1.1 Ease of getting credit*.....                  | 30.0 | 108  |
| 4.1.2 Domestic credit to private sector, % GDP..... | 14.2 | 122  |
| 4.1.3 Microfinance gross loans, % GDP.....          | 0.8  | 27 ● |

|   |      |       |
|---|------|-------|
| 4.2 Investment.....                                     | 40.0 | [64]  |
| 4.2.1 Ease of protecting minority investors*.....       | 40.0 | 111   |
| 4.2.2 Market capitalization, % GDP.....                 | n/a  | n/a   |
| 4.2.3 Venture capital deals/bn PPP\$ GDP.....           | n/a  | n/a   |
| 4.3 Trade, competition, & market scale.....             | 27.9 | 126 ○ |
| 4.3.1 Applied tariff rate, weighted mean, %.....        | 11.8 | 120   |
| 4.3.2 Intensity of local competition <sup>†</sup> ..... | n/a  | n/a   |
| 4.3.3 Domestic market scale, bn PPP\$.....              | 20.3 | 120   |

**5 Business sophistication.....30.6 [72]**

|   |      |       |
|---|------|-------|
| 5.1 Knowledge workers.....  | 37.9 | [59]  |
| 5.1.1 Knowledge-intensive employment, %.....                              | n/a  | n/a   |
| 5.1.2 Firms offering formal training, % firms <sup>Ⓐ</sup> .....          | 32.1 | 44    |
| 5.1.3 GERD performed by business, % of GDP.....                           | n/a  | n/a   |
| 5.1.4 GERD financed by business, %.....                                   | n/a  | n/a   |
| 5.1.5 Females employed w/advanced degrees, % total.....                   | n/a  | n/a   |
| 5.2 Innovation linkages.....  | 1.9  | [127] |
| 5.2.1 University/industry research collaboration <sup>†</sup> .....       | n/a  | n/a   |
| 5.2.2 State of cluster development <sup>†</sup> .....                     | n/a  | n/a   |
| 5.2.3 GERD financed by abroad, %.....                                     | n/a  | n/a   |
| 5.2.4 JV-strategic alliance deals/bn PPP\$ GDP.....                       | n/a  | n/a   |
| 5.2.5 Patent families 2+ offices/bn PPP\$ GDP.....                        | 0.2  | 52    |
| 5.3 Knowledge absorption.....   | 52.1 | 10 ●  |
| 5.3.1 Intellectual property payments, % total trade <sup>Ⓐ</sup> .....    | 0.1  | 94    |
| 5.3.2 High-tech imports less re-imports, % total trade <sup>Ⓐ</sup> ..... | 7.6  | 68    |
| 5.3.3 ICT services imports, % total trade <sup>Ⓐ</sup> .....              | 5.0  | 3 ●   |
| 5.3.4 FDI net inflows, % GDP.....   | 8.9  | 14 ●  |
| 5.3.5 Research talent, % in business enterprise.....                      | n/a  | n/a   |

**6 Knowledge & technology outputs.....19.7 78**

|   |      |       |
|---|------|-------|
| 6.1 Knowledge creation.....   | 3.2  | 109   |
| 6.1.1 Patents by origin/bn PPP\$ GDP.....                                 | 0.3  | 85    |
| 6.1.2 PCT patent applications/bn PPP\$ GDP <sup>Ⓐ</sup> .....             | 0.1  | 75    |
| 6.1.3 Utility models by origin/bn PPP\$ GDP.....                          | n/a  | n/a   |
| 6.1.4 Scientific & technical articles/bn PPP\$ GDP.....                   | 6.0  | 90    |
| 6.1.5 Citable documents H index.....                                      | 2.8  | 112   |
| 6.2 Knowledge impact.....   | 26.9 | 83    |
| 6.2.1 Growth rate of PPP\$ GDP/worker, %.....                             | 2.9  | 21 ●  |
| 6.2.2 New businesses/th pop. 15–64 <sup>Ⓐ</sup> .....                     | 0.0  | 105 ○ |
| 6.2.3 Computer software spending, % GDP.....                              | 0.0  | 109   |
| 6.2.4 ISO 9001 quality certificates/bn PPP\$ GDP.....                     | 0.4  | 120   |
| 6.2.5 High- & medium-high-tech manufactures, %.....                       | n/a  | n/a   |
| 6.3 Knowledge diffusion.....  | 29.0 | 42    |
| 6.3.1 Intellectual property receipts, % total trade <sup>Ⓐ</sup> .....    | 0.0  | 106   |
| 6.3.2 High-tech exports less re-exports, % total trade <sup>Ⓐ</sup> ..... | 2.9  | 47    |
| 6.3.3 ICT services exports, % total trade <sup>Ⓐ</sup> .....              | 6.0  | 10 ●  |
| 6.3.4 FDI net outflows, % GDP.....  | 1.0  | 51    |

**7 Creative outputs.....2.7 126 ○**

|   |      |       |
|---|------|-------|
| 7.1 Intangible assets.....  | 0.0  | 127 ○ |
| 7.1.1 Trademarks by origin/bn PPP\$ GDP.....                                    | 1.0  | 116 ○ |
| 7.1.2 Industrial designs by origin/bn PPP\$ GDP <sup>Ⓐ</sup> .....              | 0.1  | 108   |
| 7.1.3 ICTs & business model creation <sup>†</sup> .....                         | n/a  | n/a   |
| 7.1.4 ICTs & organizational model creation <sup>†</sup> .....                   | n/a  | n/a   |
| 7.2 Creative goods & services.....  | 10.2 | 88    |
| 7.2.1 Cultural & creative services exports, % of total trade <sup>Ⓐ</sup> ..... | 0.7  | 20 ●  |
| 7.2.2 National feature films/mn pop. 15–69 <sup>Ⓐ</sup> .....                   | 0.7  | 86    |
| 7.2.3 Global ent. & media market/th pop. 15–69.....                             | n/a  | n/a   |
| 7.2.4 Printing & publishing manufactures, %.....                                | n/a  | n/a   |
| 7.2.5 Creative goods exports, % total trade <sup>Ⓐ</sup> .....                  | 0.0  | 112   |
| 7.3 Online creativity.....  | 0.3  | 126 ○ |
| 7.3.1 Generic top-level domains (TLDs)/th pop. 15–69.....                       | 1.0  | 97    |
| 7.3.2 Country-code TLDs/th pop. 15–69.....                                      | 0.0  | 125   |
| 7.3.3 Wikipedia edits/mn pop. 15–69 <sup>Ⓐ</sup> .....                          | 0.0  | 127 ○ |
| 7.3.4 Video uploads on YouTube/pop. 15–69.....                                  | n/a  | n/a   |

NOTES: ● indicates a strength; ○ a weakness; \* an index; † a survey question.

Ⓐ indicates that the country's data are older than the base year; see Appendix II for details, including the year of the data, at <http://globalinnovationindex.org>.

Square brackets indicate that the data minimum coverage (DMC) requirements were not met at the sub-pillar or pillar level; see page 181 of this appendix for details.

## Key indicators

|                       |                     |
|-----------------------|---------------------|
| Population (millions) | 187.0               |
| GDP (US\$ billions)   | 415.1               |
| GDP per capita, PPP\$ | 6,108.4             |
| Income group          | Lower-middle income |
| Region                | Sub-Saharan Africa  |

|   | Score 0–100<br>or value (hard data) | Rank       |
|---|-------------------------------------|------------|
| <b>Global Innovation Index (out of 127)</b> | <b>21.9</b>                         | <b>119</b> |
| Innovation Output Sub-Index                 | 14.9                                | 119        |
| Innovation Input Sub-Index                  | 28.9                                | 118        |
| Innovation Efficiency Ratio                 | 0.5                                 | 102        |
| Global Innovation Index 2016 (out of 128)   | 23.1                                | 114        |

|          |   |             |              |   |
|----------|---|-------------|--------------|---|
| <b>1</b> | <b>Institutions</b>                               | <b>39.6</b> | <b>123</b>   | ○ |
| 1.1      | Political environment                             | 15.7        | 125          | ○ |
| 1.1.1    | Political stability & safety*                     | 13.6        | 125          | ○ |
| 1.1.2    | Government effectiveness*                         | 17.7        | 120          |   |
| 1.2      | Regulatory environment                            | 57.4        | 78           |   |
| 1.2.1    | Regulatory quality*                               | 20.6        | 114          |   |
| 1.2.2    | Rule of law*                                      | 8.9         | 122          | ○ |
| 1.2.3    | Cost of redundancy dismissal, salary weeks        | 8.0         | 1            | ● |
| 1.3      | Business environment                              | 45.8        | 125          | ○ |
| 1.3.1    | Ease of starting a business*                      | 78.6        | 103          |   |
| 1.3.2    | Ease of resolving insolvency*                     | 30.6        | 113          |   |
| 1.3.3    | Ease of paying taxes*                             | 28.1        | 125          | ○ |
| <b>2</b> | <b>Human capital &amp; research</b>               | <b>15.1</b> | <b>[112]</b> |   |
| 2.1      | Education   | 35.7        | [98]         |   |
| 2.1.1    | Expenditure on education, % GDP                   | n/a         | n/a          |   |
| 2.1.2    | Gov't expenditure/pupil, secondary, % GDP/cap     | n/a         | n/a          |   |
| 2.1.3    | School life expectancy, years <sup>Ⓔ</sup>        | 8.6         | 109          |   |
| 2.1.4    | PISA scales in reading, maths, & science          | n/a         | n/a          |   |
| 2.1.5    | Pupil-teacher ratio, secondary <sup>Ⓔ</sup>       | 19.3        | 79           |   |
| 2.2      | Tertiary education                                | 8.2         | [114]        |   |
| 2.2.1    | Tertiary enrolment, % gross <sup>Ⓔ</sup>          | 10.1        | 104          |   |
| 2.2.2    | Graduates in science & engineering, %             | n/a         | n/a          |   |
| 2.2.3    | Tertiary inbound mobility, %                      | n/a         | n/a          |   |
| 2.3      | Research & development (R&D)                      | 1.3         | 100          |   |
| 2.3.1    | Researchers, FTE/mn pop. <sup>Ⓔ</sup>             | 38.6        | 95           |   |
| 2.3.2    | Gross expenditure on R&D, % GDP <sup>Ⓔ</sup>      | 0.2         | 89           |   |
| 2.3.3    | Global R&D companies, avg. expend. top 3, mn \$US | 0.0         | 43           | ○ |
| 2.3.4    | QS university ranking, average score top 3*       | 0.0         | 75           | ○ |
| <b>3</b> | <b>Infrastructure</b>                             | <b>28.2</b> | <b>111</b>   |   |
| 3.1      | Information & communication technologies (ICTs)   | 32.3        | 105          |   |
| 3.1.1    | ICT access*                                       | 29.6        | 110          |   |
| 3.1.2    | ICT use*  | 22.8        | 94           |   |
| 3.1.3    | Government's online service*                      | 41.3        | 98           |   |
| 3.1.4    | E-participation*                                  | 35.6        | 105          |   |
| 3.2      | General infrastructure                            | 18.5        | 121          |   |
| 3.2.1    | Electricity output, kWh/cap                       | 171.2       | 113          |   |
| 3.2.2    | Logistics performance*                            | 26.1        | 88           |   |
| 3.2.3    | Gross capital formation, % GDP                    | 13.8        | 117          |   |
| 3.3      | Ecological sustainability                         | 33.6        | 108          |   |
| 3.3.1    | GDP/unit of energy use                            | 7.3         | 82           |   |
| 3.3.2    | Environmental performance*                        | 58.3        | 104          |   |
| 3.3.3    | ISO 14001 environmental certificates/bn PPP\$ GDP | 0.1         | 121          |   |
| <b>4</b> | <b>Market sophistication</b>                      | <b>40.2</b> | <b>94</b>    |   |
| 4.1      | Credit  | 23.8        | 103          |   |
| 4.1.1    | Ease of getting credit*                           | 65.0        | 40           | ● |
| 4.1.2    | Domestic credit to private sector, % GDP          | 14.2        | 121          |   |
| 4.1.3    | Microfinance gross loans, % GDP                   | 0.1         | 56           |   |

|       |   |         |     |   |
|-------|---|---------|-----|---|
| 4.2   | Investment                                  | 33.9    | 90  |   |
| 4.2.1 | Ease of protecting minority investors*      | 65.0    | 31  | ● |
| 4.2.2 | Market capitalization, % GDP                | 10.4    | 76  |   |
| 4.2.3 | Venture capital deals/bn PPP\$ GDP          | 0.0     | 86  |   |
| 4.3   | Trade, competition, & market scale          | 62.7    | 58  | ● |
| 4.3.1 | Applied tariff rate, weighted mean, %       | 9.8     | 114 |   |
| 4.3.2 | Intensity of local competition <sup>†</sup> | 67.2    | 72  | ● |
| 4.3.3 | Domestic market scale, bn PPP\$             | 1,088.9 | 22  | ● |

**5 Business sophistication** 21.7 118

|       |   |      |      |   |
|-------|---|------|------|---|
| 5.1   | Knowledge workers   | 24.0 | [99] |   |
| 5.1.1 | Knowledge-intensive employment, %                             | n/a  | n/a  |   |
| 5.1.2 | Firms offering formal training, % firms                       | 30.7 | 51   | ● |
| 5.1.3 | GERD performed by business, % of GDP                          | n/a  | n/a  |   |
| 5.1.4 | GERD financed by business, % <sup>Ⓔ</sup>                     | 0.2  | 92   | ○ |
| 5.1.5 | Females employed w/advanced degrees, % total                  | n/a  | n/a  |   |
| 5.2   | Innovation linkages   | 16.4 | 122  | ○ |
| 5.2.1 | University/industry research collaboration <sup>†</sup>       | 27.8 | 111  |   |
| 5.2.2 | State of cluster development <sup>†</sup>                     | 41.5 | 80   |   |
| 5.2.3 | GERD financed by abroad, % <sup>Ⓔ</sup>                       | 1.0  | 86   |   |
| 5.2.4 | JV-strategic alliance deals/bn PPP\$ GDP                      | 0.0  | 106  |   |
| 5.2.5 | Patent families 2+ offices/bn PPP\$ GDP                       | 0.0  | 115  | ○ |
| 5.3   | Knowledge absorption  | 24.6 | 98   |   |
| 5.3.1 | Intellectual property payments, % total trade                 | 0.4  | 67   | ● |
| 5.3.2 | High-tech imports less re-imports, % total trade <sup>Ⓔ</sup> | 3.4  | 119  |   |
| 5.3.3 | ICT services imports, % total trade                           | 1.7  | 32   | ● |
| 5.3.4 | FDI net inflows, % GDP  | 0.8  | 107  |   |
| 5.3.5 | Research talent, % in business enterprise                     | n/a  | n/a  |   |

**6 Knowledge & technology outputs** 9.9 119

|       |   |       |     |   |
|-------|---|-------|-----|---|
| 6.1   | Knowledge creation  | 3.1   | 112 |   |
| 6.1.1 | Patents by origin/bn PPP\$ GDP <sup>Ⓔ</sup>                   | 0.1   | 116 |   |
| 6.1.2 | PCT patent applications/bn PPP\$ GDP                          | 0.0   | 104 | ○ |
| 6.1.3 | Utility models by origin/bn PPP\$ GDP                         | n/a   | n/a |   |
| 6.1.4 | Scientific & technical articles/bn PPP\$ GDP                  | 2.3   | 117 |   |
| 6.1.5 | Citable documents H index                                     | 9.5   | 66  | ● |
| 6.2   | Knowledge impact  | 10.3  | 116 |   |
| 6.2.1 | Growth rate of PPP\$ GDP/worker, % (2.7)                      | (2.7) | 107 | ○ |
| 6.2.2 | New businesses/th pop. 15–64                                  | 0.8   | 79  |   |
| 6.2.3 | Computer software spending, % GDP                             | 0.1   | 81  |   |
| 6.2.4 | ISO 9001 quality certificates/bn PPP\$ GDP                    | 0.2   | 122 | ○ |
| 6.2.5 | High- & medium-high-tech manufactures, %                      | n/a   | n/a |   |
| 6.3   | Knowledge diffusion   | 16.4  | 105 |   |
| 6.3.1 | Intellectual property receipts, % total trade                 | n/a   | n/a |   |
| 6.3.2 | High-tech exports less re-exports, % total trade <sup>Ⓔ</sup> | 0.2   | 103 |   |
| 6.3.3 | ICT services exports, % total trade                           | 0.1   | 119 |   |
| 6.3.4 | FDI net outflows, % GDP                                       | 0.3   | 78  |   |

**7 Creative outputs** 19.9 102

|       |  |      |     |   |
|-------|--|------|-----|---|
| 7.1   | Intangible assets                                      | 32.8 | 97  |   |
| 7.1.1 | Trademarks by origin/bn PPP\$ GDP <sup>Ⓔ</sup>         | 19.8 | 83  |   |
| 7.1.2 | Industrial designs by origin/bn PPP\$ GDP <sup>Ⓔ</sup> | 0.9  | 67  |   |
| 7.1.3 | ICTs & business model creation <sup>†</sup>            | 57.5 | 75  |   |
| 7.1.4 | ICTs & organizational model creation <sup>†</sup>      | 45.2 | 91  |   |
| 7.2   | Creative goods & services                              | 10.7 | 86  |   |
| 7.2.1 | Cultural & creative services exports, % of total trade | n/a  | n/a |   |
| 7.2.2 | National feature films/mn pop. 15–69 <sup>Ⓔ</sup>      | 11.2 | 13  | ● |
| 7.2.3 | Global ent. & media market/th pop. 15–69               | 0.8  | 59  |   |
| 7.2.4 | Printing & publishing manufactures, %                  | n/a  | n/a |   |
| 7.2.5 | Creative goods exports, % total trade <sup>Ⓔ</sup>     | 0.0  | 115 |   |
| 7.3   | Online creativity                                      | 3.4  | 116 |   |
| 7.3.1 | Generic top-level domains (TLDs)/th pop. 15–69         | 0.5  | 105 |   |
| 7.3.2 | Country-code TLDs/th pop. 15–69                        | 0.1  | 109 |   |
| 7.3.3 | Wikipedia edits/mn pop. 15–69 <sup>Ⓔ</sup>             | 1.3  | 112 |   |
| 7.3.4 | Video uploads on YouTube/pop. 15–69                    | 0.4  | 72  | ○ |

NOTES: ● indicates a strength; ○ a weakness; \* an index; † a survey question.

Ⓔ indicates that the country's data are older than the base year; see Appendix II for details, including the year of the data, at <http://globalinnovationindex.org>.

Square brackets indicate that the data minimum coverage (DMC) requirements were not met at the sub-pillar or pillar level; see page 181 of this appendix for details.

## Norway

## Key indicators

|                            |             |
|----------------------------|-------------|
| Population (millions)..... | 5.3         |
| GDP (US\$ billions).....   | 376.3       |
| GDP per capita, PPP\$..... | 68,430.2    |
| Income group.....          | High income |
| Region.....                | Europe      |

|  | Score 0–100<br>or value (hard data) | Rank      |
|--|-------------------------------------|-----------|
| <b>Global Innovation Index (out of 127).....</b> | <b>53.1</b>                         | <b>19</b> |
| Innovation Output Sub-Index.....                 | 42.3                                | 22        |
| Innovation Input Sub-Index.....                  | 64.0                                | 14        |
| Innovation Efficiency Ratio.....                 | 0.7                                 | 51        |
| Global Innovation Index 2016 (out of 128).....   | 52.0                                | 22        |

**1 Institutions.....91.8 5 ●**

|   |      |     |
|---|------|-----|
| 1.1 Political environment.....                        | 90.8 | 5 ● |
| 1.1.1 Political stability & safety*.....              | 91.7 | 9   |
| 1.1.2 Government effectiveness*.....                  | 90.0 | 5 ● |
| 1.2 Regulatory environment.....                       | 94.9 | 6 ● |
| 1.2.1 Regulatory quality*.....                        | 83.9 | 16  |
| 1.2.2 Rule of law*.....                               | 98.5 | 4 ● |
| 1.2.3 Cost of redundancy dismissal, salary weeks..... | 8.7  | 22  |
| 1.3 Business environment.....                         | 89.6 | 6 ● |
| 1.3.1 Ease of starting a business*.....               | 94.3 | 19  |
| 1.3.2 Ease of resolving insolvency*.....              | 89.1 | 6 ● |
| 1.3.3 Ease of paying taxes*.....                      | 85.5 | 24  |

**2 Human capital & research.....53.3 21**

|  |         |      |
|--|---------|------|
| 2.1 Education.....   | 64.3    | 14   |
| 2.1.1 Expenditure on education, % GDP.....                             | 7.4     | 10   |
| 2.1.2 Gov't expenditure/pupil, secondary, % GDP/cap <sup>Ⓔ</sup> ..... | 25.8    | 26   |
| 2.1.3 School life expectancy, years.....                               | 17.7    | 13   |
| 2.1.4 PISA scales in reading, maths, & science.....                    | 504.5   | 15   |
| 2.1.5 Pupil-teacher ratio, secondary.....                              | n/a     | n/a  |
| 2.2 Tertiary education.....  | 40.2    | 47   |
| 2.2.1 Tertiary enrolment, % gross.....                                 | 76.7    | 20   |
| 2.2.2 Graduates in science & engineering, %.....                       | 20.0    | 57 ○ |
| 2.2.3 Tertiary inbound mobility, %.....                                | 3.5     | 52 ○ |
| 2.3 Research & development (R&D).....                                  | 55.5    | 20   |
| 2.3.1 Researchers, FTE/mn pop.....                                     | 5,915.6 | 7    |
| 2.3.2 Gross expenditure on R&D, % GDP.....                             | 1.9     | 20   |
| 2.3.3 Global R&D companies, avg. expend. top 3, mn \$US.....           | 55.8    | 24   |
| 2.3.4 QS university ranking, average score top 3*.....                 | 49.8    | 20   |

**3 Infrastructure.....69.3 1 ●**

|  |          |     |
|--|----------|-----|
| 3.1 Information & communication technologies (ICTs).....     | 80.9     | 19  |
| 3.1.1 ICT access*.....                                       | 82.1     | 21  |
| 3.1.2 ICT use*.....  | 84.8     | 4 ● |
| 3.1.3 Government's online service*.....                      | 80.4     | 25  |
| 3.1.4 E-participation*.....                                  | 76.3     | 27  |
| 3.2 General infrastructure.....                              | 72.4     | 1 ● |
| 3.2.1 Electricity output, kWh/cap.....                       | 27,803.7 | 1 ● |
| 3.2.2 Logistics performance*.....                            | 77.2     | 22  |
| 3.2.3 Gross capital formation, % GDP.....                    | 28.3     | 27  |
| 3.3 Ecological sustainability.....                           | 54.7     | 30  |
| 3.3.1 GDP/unit of energy use.....                            | 10.4     | 43  |
| 3.3.2 Environmental performance*.....                        | 86.9     | 17  |
| 3.3.3 ISO 14001 environmental certificates/bn PPP\$ GDP..... | 3.5      | 29  |

**4 Market sophistication.....57.2 22**

|   |       |      |
|---|-------|------|
| 4.1 Credit.....                                     | 55.2  | 18   |
| 4.1.1 Ease of getting credit*.....                  | 55.0  | 67 ○ |
| 4.1.2 Domestic credit to private sector, % GDP..... | 138.4 | 12   |
| 4.1.3 Microfinance gross loans, % GDP.....          | n/a   | n/a  |

|   |       |      |
|---|-------|------|
| 4.2 Investment.....                                     | 46.3  | 38   |
| 4.2.1 Ease of protecting minority investors*.....       | 75.0  | 9    |
| 4.2.2 Market capitalization, % GDP.....                 | 50.2  | 32   |
| 4.2.3 Venture capital deals/bn PPP\$ GDP.....           | 0.0   | 33   |
| 4.3 Trade, competition, & market scale.....             | 70.2  | 36   |
| 4.3.1 Applied tariff rate, weighted mean, %.....        | 1.0   | 13   |
| 4.3.2 Intensity of local competition <sup>†</sup> ..... | 68.9  | 67 ○ |
| 4.3.3 Domestic market scale, bn PPP\$.....              | 364.7 | 45   |

**5 Business sophistication.....48.3 23**

|   |      |       |
|---|------|-------|
| 5.1 Knowledge workers.....  | 67.7 | 9     |
| 5.1.1 Knowledge-intensive employment, %.....                        | 51.7 | 4 ●   |
| 5.1.2 Firms offering formal training, % firms.....                  | n/a  | n/a   |
| 5.1.3 GERD performed by business, % of GDP.....                     | 1.0  | 22    |
| 5.1.4 GERD financed by business, % <sup>Ⓔ</sup> .....               | 43.1 | 29    |
| 5.1.5 Females employed w/advanced degrees, % total.....             | 24.7 | 9     |
| 5.2 Innovation linkages.....  | 40.0 | 30    |
| 5.2.1 University/industry research collaboration <sup>†</sup> ..... | 62.4 | 19    |
| 5.2.2 State of cluster development <sup>†</sup> .....               | 70.2 | 8 ●   |
| 5.2.3 GERD financed by abroad, % <sup>Ⓔ</sup> .....                 | 9.5  | 48    |
| 5.2.4 JV-strategic alliance deals/bn PPP\$ GDP.....                 | 0.1  | 22    |
| 5.2.5 Patent families 2+ offices/bn PPP\$ GDP.....                  | 2.2  | 23    |
| 5.3 Knowledge absorption.....                                       | 37.1 | 45    |
| 5.3.1 Intellectual property payments, % total trade.....            | 0.5  | 64 ○  |
| 5.3.2 High-tech imports less re-imports, % total trade.....         | 7.0  | 77 ○  |
| 5.3.3 ICT services imports, % total trade.....                      | 2.1  | 20    |
| 5.3.4 FDI net inflows, % GDP.....                                   | 0.0  | 125 ○ |
| 5.3.5 Research talent, % in business enterprise.....                | 49.4 | 25    |

**6 Knowledge & technology outputs.....37.5 22**

|   |      |      |
|---|------|------|
| 6.1 Knowledge creation.....                                 | 34.0 | 27   |
| 6.1.1 Patents by origin/bn PPP\$ GDP.....                   | 4.7  | 24   |
| 6.1.2 PCT patent applications/bn PPP\$ GDP.....             | 1.8  | 20   |
| 6.1.3 Utility models by origin/bn PPP\$ GDP.....            | n/a  | n/a  |
| 6.1.4 Scientific & technical articles/bn PPP\$ GDP.....     | 35.0 | 20   |
| 6.1.5 Citable documents H index.....                        | 38.3 | 20   |
| 6.2 Knowledge impact.....                                   | 44.1 | 18   |
| 6.2.1 Growth rate of PPP\$ GDP/worker, %.....               | 1.0  | 54 ○ |
| 6.2.2 New businesses/th pop. 15–64.....                     | 7.7  | 15   |
| 6.2.3 Computer software spending, % GDP.....                | 0.6  | 9    |
| 6.2.4 ISO 9001 quality certificates/bn PPP\$ GDP.....       | 6.9  | 53   |
| 6.2.5 High- & medium-high-tech manufactures, %.....         | 0.3  | 32   |
| 6.3 Knowledge diffusion.....                                | 34.4 | 28   |
| 6.3.1 Intellectual property receipts, % total trade.....    | 0.4  | 29   |
| 6.3.2 High-tech exports less re-exports, % total trade..... | 3.9  | 41   |
| 6.3.3 ICT services exports, % total trade.....              | 1.6  | 65 ○ |
| 6.3.4 FDI net outflows, % GDP.....                          | 3.7  | 14   |

**7 Creative outputs.....47.1 20**

|   |       |      |
|---|-------|------|
| 7.1 Intangible assets.....  | 51.5  | 32   |
| 7.1.1 Trademarks by origin/bn PPP\$ GDP.....                      | 32.0  | 69 ○ |
| 7.1.2 Industrial designs by origin/bn PPP\$ GDP.....              | 1.7   | 47   |
| 7.1.3 ICTs & business model creation <sup>†</sup> .....           | 79.1  | 13   |
| 7.1.4 ICTs & organizational model creation <sup>†</sup> .....     | 80.6  | 3 ●  |
| 7.2 Creative goods & services.....                                | 27.4  | 37   |
| 7.2.1 Cultural & creative services exports, % of total trade..... | 0.1   | 62 ○ |
| 7.2.2 National feature films/mn pop. 15–69.....                   | 6.2   | 32   |
| 7.2.3 Global ent. & media market/th pop. 15–69.....               | 100.0 | 1 ●  |
| 7.2.4 Printing & publishing manufactures, %.....                  | 1.3   | 39   |
| 7.2.5 Creative goods exports, % total trade.....                  | 0.5   | 59   |
| 7.3 Online creativity.....  | 57.8  | 10   |
| 7.3.1 Generic top-level domains (TLDs)/th pop. 15–69.....         | 51.5  | 14   |
| 7.3.2 Country-code TLDs/th pop. 15–69.....                        | 56.8  | 13   |
| 7.3.3 Wikipedia edits/mn pop. 15–69.....                          | 7.8   | 2 ●  |
| 7.3.4 Video uploads on YouTube/pop. 15–69.....                    | 47.5  | 17   |

NOTES: ● indicates a strength; ○ a weakness; \* an index; † a survey question.

Ⓔ indicates that the country's data are older than the base year; see Appendix II for details, including the year of the data, at <http://globalinnovationindex.org>.

Square brackets indicate that the data minimum coverage (DMC) requirements were not met at the sub-pillar or pillar level; see page 181 of this appendix for details.

## Key indicators

|                            |                                  |
|----------------------------|----------------------------------|
| Population (millions)..... | 4.7                              |
| GDP (US\$ billions).....   | 59.7                             |
| GDP per capita, PPP\$..... | 44,628.3                         |
| Income group.....          | High income                      |
| Region.....                | Northern Africa and Western Asia |

|  | Score 0–100<br>or value (hard data) | Rank      |
|--|-------------------------------------|-----------|
| <b>Global Innovation Index (out of 127).....</b> | <b>31.8</b>                         | <b>77</b> |
| Innovation Output Sub-Index.....                 | 20.2                                | 90        |
| Innovation Input Sub-Index.....                  | 43.5                                | 62        |
| Innovation Efficiency Ratio.....                 | 0.5                                 | 115 ○     |
| Global Innovation Index 2016 (out of 128).....   | 32.2                                | 73        |

**1 Institutions..... 71.8 39 ●**

|   |      |      |
|---|------|------|
| 1.1 Political environment.....                                      | 62.6 | 47   |
| 1.1.1 Political stability & safety*.....                            | 80.7 | 33 ● |
| 1.1.2 Government effectiveness*.....                                | 44.6 | 67   |
| 1.2 Regulatory environment.....                                     | 77.5 | 31 ● |
| 1.2.1 Regulatory quality*.....                                      | 57.0 | 46   |
| 1.2.2 Rule of law*.....   | 52.9 | 43   |
| 1.2.3 Cost of redundancy dismissal, salary weeks <sup>ⓐ</sup> ..... | 8.0  | 1 ●  |
| 1.3 Business environment.....                                       | 75.4 | 46   |
| 1.3.1 Ease of starting a business*.....                             | 92.9 | 29 ● |
| 1.3.2 Ease of resolving insolvency*.....                            | 42.7 | 84   |
| 1.3.3 Ease of paying taxes*.....                                    | 90.6 | 12 ● |

**2 Human capital & research..... 35.8 51**

|  |       |      |
|--|-------|------|
| 2.1 Education.....   | 42.8  | 81   |
| 2.1.1 Expenditure on education, % GDP.....                   | 5.0   | 48   |
| 2.1.2 Gov't expenditure/pupil, secondary, % GDP/cap.....     | 21.5  | 49   |
| 2.1.3 School life expectancy, years.....                     | 14.1  | 61   |
| 2.1.4 PISA scales in reading, maths, & science.....          | n/a   | n/a  |
| 2.1.5 Pupil-teacher ratio, secondary.....                    | n/a   | n/a  |
| 2.2 Tertiary education.....                                  | 60.5  | 6 ●  |
| 2.2.1 Tertiary enrolment, % gross.....                       | 31.9  | 76   |
| 2.2.2 Graduates in science & engineering, %.....             | 48.7  | 1 ●  |
| 2.2.3 Tertiary inbound mobility, %.....                      | 2.8   | 60   |
| 2.3 Research & development (R&D).....                        | 4.2   | 78   |
| 2.3.1 Researchers, FTE/mn pop.....                           | 202.0 | 74   |
| 2.3.2 Gross expenditure on R&D, % GDP.....                   | 0.2   | 85   |
| 2.3.3 Global R&D companies, avg. expend. top 3, mn \$US..... | 0.0   | 43 ○ |
| 2.3.4 QS university ranking, average score top 3*.....       | 9.1   | 64   |

**3 Infrastructure..... 48.4 56**

|  |         |      |
|--|---------|------|
| 3.1 Information & communication technologies (ICTs).....     | 60.7    | 57   |
| 3.1.1 ICT access*.....                                       | 73.7    | 41 ● |
| 3.1.2 ICT use*.....  | 53.9    | 53   |
| 3.1.3 Government's online service*.....                      | 59.4    | 67   |
| 3.1.4 E-participation*.....                                  | 55.9    | 74   |
| 3.2 General infrastructure.....                              | 50.8    | 24 ● |
| 3.2.1 Electricity output, kWh/cap.....                       | 6,869.8 | 29 ● |
| 3.2.2 Logistics performance*.....                            | 54.2    | 47   |
| 3.2.3 Gross capital formation, % GDP.....                    | 31.0    | 15 ● |
| 3.3 Ecological sustainability.....                           | 33.7    | 107  |
| 3.3.1 GDP/unit of energy use.....                            | 6.3     | 90   |
| 3.3.2 Environmental performance*.....                        | 60.1    | 100  |
| 3.3.3 ISO 14001 environmental certificates/bn PPP\$ GDP..... | 0.7     | 77   |

**4 Market sophistication..... 44.2 72**

|   |      |     |
|---|------|-----|
| 4.1 Credit.....                                     | 30.3 | 78  |
| 4.1.1 Ease of getting credit*.....                  | 35.0 | 104 |
| 4.1.2 Domestic credit to private sector, % GDP..... | 65.6 | 46  |
| 4.1.3 Microfinance gross loans, % GDP.....          | n/a  | n/a |

|   |       |     |
|---|-------|-----|
| 4.2 Investment.....                                     | 39.5  | 68  |
| 4.2.1 Ease of protecting minority investors*.....       | 46.7  | 95  |
| 4.2.2 Market capitalization, % GDP.....                 | 58.9  | 29  |
| 4.2.3 Venture capital deals/bn PPP\$ GDP.....           | n/a   | n/a |
| 4.3 Trade, competition, & market scale.....             | 62.9  | 57  |
| 4.3.1 Applied tariff rate, weighted mean, %.....        | 1.9   | 54  |
| 4.3.2 Intensity of local competition <sup>†</sup> ..... | 60.0  | 103 |
| 4.3.3 Domestic market scale, bn PPP\$.....              | 173.1 | 62  |

**5 Business sophistication..... 17.0 126 ○**

|   |      |       |
|---|------|-------|
| 5.1 Knowledge workers.....  | 14.2 | [118] |
| 5.1.1 Knowledge-intensive employment, %.....                              | n/a  | n/a   |
| 5.1.2 Firms offering formal training, % firms.....                        | n/a  | n/a   |
| 5.1.3 GERD performed by business, % of GDP.....                           | 0.0  | 73    |
| 5.1.4 GERD financed by business, %.....                                   | 21.4 | 61    |
| 5.1.5 Females employed w/advanced degrees, % total.....                   | n/a  | n/a   |
| 5.2 Innovation linkages.....  | 21.1 | 97    |
| 5.2.1 University/industry research collaboration <sup>†</sup> .....       | 43.4 | 51    |
| 5.2.2 State of cluster development <sup>†</sup> .....                     | 45.7 | 61    |
| 5.2.3 GERD financed by abroad, % <sup>ⓐ</sup> .....                       | 0.0  | 99 ○  |
| 5.2.4 JV-strategic alliance deals/bn PPP\$ GDP.....                       | 0.0  | 37 ●  |
| 5.2.5 Patent families 2+ offices/bn PPP\$ GDP <sup>ⓐ</sup> .....          | 0.0  | 103   |
| 5.3 Knowledge absorption.....   | 15.6 | 127 ○ |
| 5.3.1 Intellectual property payments, % total trade.....                  | n/a  | n/a   |
| 5.3.2 High-tech imports less re-imports, % total trade <sup>ⓐ</sup> ..... | 3.1  | 120 ○ |
| 5.3.3 ICT services imports, % total trade <sup>ⓐ</sup> .....              | 0.2  | 116 ○ |
| 5.3.4 FDI net inflows, % GDP.....   | 0.0  | 124 ○ |
| 5.3.5 Research talent, % in business enterprise.....                      | 10.6 | 65    |

**6 Knowledge & technology outputs..... 15.6 100**

|   |       |       |
|---|-------|-------|
| 6.1 Knowledge creation.....   | 2.9   | 114 ○ |
| 6.1.1 Patents by origin/bn PPP\$ GDP.....                                 | 0.0   | 122 ○ |
| 6.1.2 PCT patent applications/bn PPP\$ GDP.....                           | 0.0   | 87    |
| 6.1.3 Utility models by origin/bn PPP\$ GDP.....                          | n/a   | n/a   |
| 6.1.4 Scientific & technical articles/bn PPP\$ GDP.....                   | 4.2   | 103   |
| 6.1.5 Citable documents H index.....                                      | 5.8   | 89    |
| 6.2 Knowledge impact.....   | 23.2  | 95    |
| 6.2.1 Growth rate of PPP\$ GDP/worker, %.....                             | (0.7) | 96    |
| 6.2.2 New businesses/th pop. 15–64 <sup>ⓐ</sup> .....                     | 1.0   | 69    |
| 6.2.3 Computer software spending, % GDP.....                              | 0.1   | 99    |
| 6.2.4 ISO 9001 quality certificates/bn PPP\$ GDP.....                     | 3.2   | 76    |
| 6.2.5 High- & medium-high-tech manufactures, %.....                       | 0.4   | 24 ●  |
| 6.3 Knowledge diffusion.....  | 20.7  | 71    |
| 6.3.1 Intellectual property receipts, % total trade.....                  | n/a   | n/a   |
| 6.3.2 High-tech exports less re-exports, % total trade <sup>ⓐ</sup> ..... | 0.5   | 85    |
| 6.3.3 ICT services exports, % total trade <sup>ⓐ</sup> .....              | 0.2   | 115 ○ |
| 6.3.4 FDI net outflows, % GDP.....  | 1.1   | 49    |

**7 Creative outputs..... 24.8 91**

|   |      |       |
|---|------|-------|
| 7.1 Intangible assets.....  | 40.9 | 70    |
| 7.1.1 Trademarks by origin/bn PPP\$ GDP.....                      | n/a  | n/a   |
| 7.1.2 Industrial designs by origin/bn PPP\$ GDP.....              | 0.0  | 113 ○ |
| 7.1.3 ICTs & business model creation <sup>†</sup> .....           | 55.3 | 83    |
| 7.1.4 ICTs & organizational model creation <sup>†</sup> .....     | 47.0 | 83    |
| 7.2 Creative goods & services.....                                | 3.9  | 114 ○ |
| 7.2.1 Cultural & creative services exports, % of total trade..... | n/a  | n/a   |
| 7.2.2 National feature films/mn pop. 15–69 <sup>ⓐ</sup> .....     | 0.0  | 104 ○ |
| 7.2.3 Global ent. & media market/th pop. 15–69.....               | 4.8  | 46    |
| 7.2.4 Printing & publishing manufactures, %.....                  | 0.7  | 78    |
| 7.2.5 Creative goods exports, % total trade <sup>ⓐ</sup> .....    | 0.0  | 110 ○ |
| 7.3 Online creativity.....  | 13.3 | 88    |
| 7.3.1 Generic top-level domains (TLDs)/th pop. 15–69.....         | 1.8  | 81    |
| 7.3.2 Country-code TLDs/th pop. 15–69.....                        | 0.1  | 105   |
| 7.3.3 Wikipedia edits/mn pop. 15–69 <sup>ⓐ</sup> .....            | 4.0  | 83    |
| 7.3.4 Video uploads on YouTube/pop. 15–69.....                    | 13.0 | 61    |

NOTES: ● indicates a strength; ○ a weakness; \* an index; † a survey question.

ⓐ indicates that the country's data are older than the base year; see Appendix II for details, including the year of the data, at <http://globalinnovationindex.org>.

Square brackets indicate that the data minimum coverage (DMC) requirements were not met at the sub-pillar or pillar level; see page 181 of this appendix for details.



## Pakistan

## Key indicators

|                            |                           |
|----------------------------|---------------------------|
| Population (millions)..... | 192.8                     |
| GDP (US\$ billions).....   | 271.1                     |
| GDP per capita, PPP\$..... | 5,000.0                   |
| Income group.....          | Lower-middle income       |
| Region.....                | Central and Southern Asia |

|  | Score 0–100<br>or value (hard data) | Rank       |
|--|-------------------------------------|------------|
| <b>Global Innovation Index (out of 127).....</b> | <b>23.8</b>                         | <b>113</b> |
| Innovation Output Sub-Index.....                 | 18.2                                | 101        |
| Innovation Input Sub-Index.....                  | 29.4                                | 116 ○      |
| Innovation Efficiency Ratio.....                 | 0.6                                 | 64         |
| Global Innovation Index 2016 (out of 128).....   | 22.6                                | 119        |

|   |             |              |
|---|-------------|--------------|
| <b>1 Institutions.....</b>                            | <b>38.0</b> | <b>124</b> ○ |
| 1.1 Political environment.....                        | 13.7        | 126 ○        |
| 1.1.1 Political stability & safety*.....              | 2.1         | 126 ○        |
| 1.1.2 Government effectiveness*.....                  | 25.2        | 107          |
| 1.2 Regulatory environment.....                       | 41.6        | 113          |
| 1.2.1 Regulatory quality*.....                        | 26.2        | 106          |
| 1.2.2 Rule of law*.....                               | 16.4        | 108          |
| 1.2.3 Cost of redundancy dismissal, salary weeks..... | 27.2        | 105          |
| 1.3 Business environment.....                         | 58.8        | 101          |
| 1.3.1 Ease of starting a business*.....               | 77.9        | 105          |
| 1.3.2 Ease of resolving insolvency*.....              | 45.0        | 77           |
| 1.3.3 Ease of paying taxes*.....                      | 53.4        | 109          |

|  |             |              |
|--|-------------|--------------|
| <b>2 Human capital &amp; research.....</b>                   | <b>12.8</b> | <b>121</b> ○ |
| 2.1 Education.....   | 23.4        | 120 ○        |
| 2.1.1 Expenditure on education, % GDP.....                   | 2.7         | 105          |
| 2.1.2 Gov't expenditure/pupil, secondary, % GDP/cap.....     | 15.2        | 79           |
| 2.1.3 School life expectancy, years.....                     | 8.2         | 112 ○        |
| 2.1.4 PISA scales in reading, maths, & science.....          | n/a         | n/a          |
| 2.1.5 Pupil-teacher ratio, secondary.....                    | 21.1        | 84           |
| 2.2 Tertiary education.....                                  | 8.1         | [115]        |
| 2.2.1 Tertiary enrolment, % gross.....                       | 9.9         | 106          |
| 2.2.2 Graduates in science & engineering, %.....             | n/a         | n/a          |
| 2.2.3 Tertiary inbound mobility, %.....                      | n/a         | n/a          |
| 2.3 Research & development (R&D).....                        | 6.9         | 67           |
| 2.3.1 Researchers, FTE/mn pop.....                           | 294.4       | 71           |
| 2.3.2 Gross expenditure on R&D, % GDP.....                   | 0.2         | 84           |
| 2.3.3 Global R&D companies, avg. expend. top 3, mn \$US..... | 0.0         | 43 ○         |
| 2.3.4 QS university ranking, average score top 3*.....       | 19.0        | 51 ●         |

|  |             |            |
|--|-------------|------------|
| <b>3 Infrastructure.....</b>                                 | <b>29.0</b> | <b>109</b> |
| 3.1 Information & communication technologies (ICTs).....     | 28.7        | 109        |
| 3.1.1 ICT access*.....                                       | 33.9        | 104        |
| 3.1.2 ICT use*.....  | 10.9        | 112        |
| 3.1.3 Government's online service*.....                      | 32.6        | 106        |
| 3.1.4 E-participation*.....                                  | 37.3        | 101        |
| 3.2 General infrastructure.....                              | 23.9        | 111        |
| 3.2.1 Electricity output, kWh/cap.....                       | 569.1       | 105        |
| 3.2.2 Logistics performance*.....                            | 39.8        | 67         |
| 3.2.3 Gross capital formation, % GDP.....                    | 15.2        | 111        |
| 3.3 Ecological sustainability.....                           | 34.5        | 104        |
| 3.3.1 GDP/unit of energy use.....                            | 9.3         | 57 ●       |
| 3.3.2 Environmental performance*.....                        | 51.4        | 109        |
| 3.3.3 ISO 14001 environmental certificates/bn PPP\$ GDP..... | 0.5         | 83         |

|   |             |            |
|---|-------------|------------|
| <b>4 Market sophistication.....</b>                 | <b>38.3</b> | <b>102</b> |
| 4.1 Credit.....                                     | 19.7        | 113        |
| 4.1.1 Ease of getting credit*.....                  | 50.0        | 72         |
| 4.1.2 Domestic credit to private sector, % GDP..... | 15.4        | 115 ○      |
| 4.1.3 Microfinance gross loans, % GDP.....          | 0.2         | 50         |

|   |       |      |
|---|-------|------|
| 4.2 Investment.....   | 35.1  | 83   |
| 4.2.1 Ease of protecting minority investors*.....           | 66.7  | 26 ● |
| 4.2.2 Market capitalization, % GDP <sup>Ⓞ</sup> .....       | 15.2  | 67   |
| 4.2.3 Venture capital deals/bn PPP\$ GDP <sup>Ⓞ</sup> ..... | 0.0   | 89 ○ |
| 4.3 Trade, competition, & market scale.....                 | 60.2  | 68   |
| 4.3.1 Applied tariff rate, weighted mean, %.....            | 9.5   | 111  |
| 4.3.2 Intensity of local competition <sup>†</sup> .....     | 57.8  | 109  |
| 4.3.3 Domestic market scale, bn PPP\$.....                  | 988.2 | 24 ● |

|   |             |           |
|---|-------------|-----------|
| <b>5 Business sophistication.....</b>                               | <b>29.0</b> | <b>78</b> |
| 5.1 Knowledge workers.....  | 35.6        | [74]      |
| 5.1.1 Knowledge-intensive employment, % <sup>Ⓞ</sup> .....          | 19.5        | 75        |
| 5.1.2 Firms offering formal training, % firms.....                  | 32.0        | 46        |
| 5.1.3 GERD performed by business, % of GDP.....                     | n/a         | n/a       |
| 5.1.4 GERD financed by business, %.....                             | n/a         | n/a       |
| 5.1.5 Females employed w/advanced degrees, % total.....             | n/a         | n/a       |
| 5.2 Innovation linkages.....  | 20.8        | 99        |
| 5.2.1 University/industry research collaboration <sup>†</sup> ..... | 40.7        | 65        |
| 5.2.2 State of cluster development <sup>†</sup> .....               | 44.2        | 71        |
| 5.2.3 GERD financed by abroad, %.....                               | 2.7         | 69        |
| 5.2.4 JV-strategic alliance deals/bn PPP\$ GDP.....                 | 0.0         | 57        |
| 5.2.5 Patent families 2+ offices/bn PPP\$ GDP.....                  | 0.0         | 109 ○     |
| 5.3 Knowledge absorption.....                                       | 30.6        | 78        |
| 5.3.1 Intellectual property payments, % total trade.....            | 0.5         | 63        |
| 5.3.2 High-tech imports less re-imports, % total trade.....         | 10.3        | 41 ●      |
| 5.3.3 ICT services imports, % total trade.....                      | 1.1         | 61 ●      |
| 5.3.4 FDI net inflows, % GDP.....                                   | 0.6         | 113       |
| 5.3.5 Research talent, % in business enterprise.....                | n/a         | n/a       |

|   |             |           |
|---|-------------|-----------|
| <b>6 Knowledge &amp; technology outputs.....</b>            | <b>18.9</b> | <b>84</b> |
| 6.1 Knowledge creation.....                                 | 8.5         | 69        |
| 6.1.1 Patents by origin/bn PPP\$ GDP.....                   | 0.2         | 95        |
| 6.1.2 PCT patent applications/bn PPP\$ GDP.....             | n/a         | n/a       |
| 6.1.3 Utility models by origin/bn PPP\$ GDP.....            | n/a         | n/a       |
| 6.1.4 Scientific & technical articles/bn PPP\$ GDP.....     | 8.7         | 71        |
| 6.1.5 Citable documents H index.....                        | 12.8        | 53 ●      |
| 6.2 Knowledge impact.....                                   | 31.2        | 62        |
| 6.2.1 Growth rate of PPP\$ GDP/worker, %.....               | 2.5         | 30 ●      |
| 6.2.2 New businesses/th pop. 15–64.....                     | 0.0         | 103 ○     |
| 6.2.3 Computer software spending, % GDP.....                | 0.3         | 59 ●      |
| 6.2.4 ISO 9001 quality certificates/bn PPP\$ GDP.....       | 2.7         | 83        |
| 6.2.5 High- & medium-high-tech manufactures, %.....         | 0.2         | 52        |
| 6.3 Knowledge diffusion.....                                | 16.9        | 102       |
| 6.3.1 Intellectual property receipts, % total trade.....    | 0.0         | 71        |
| 6.3.2 High-tech exports less re-exports, % total trade..... | 0.7         | 71        |
| 6.3.3 ICT services exports, % total trade.....              | 2.2         | 50 ●      |
| 6.3.4 FDI net outflows, % GDP.....                          | 0.1         | 100       |

|   |             |            |
|---|-------------|------------|
| <b>7 Creative outputs.....</b>  | <b>17.4</b> | <b>112</b> |
| 7.1 Intangible assets.....  | 29.4        | 105        |
| 7.1.1 Trademarks by origin/bn PPP\$ GDP.....                                    | 25.3        | 78         |
| 7.1.2 Industrial designs by origin/bn PPP\$ GDP.....                            | 0.4         | 84         |
| 7.1.3 ICTs & business model creation <sup>†</sup> .....                         | 51.3        | 96         |
| 7.1.4 ICTs & organizational model creation <sup>†</sup> .....                   | 38.0        | 112        |
| 7.2 Creative goods & services.....  | 1.4         | 123 ○      |
| 7.2.1 Cultural & creative services exports, % of total trade <sup>Ⓞ</sup> ..... | 0.0         | 78         |
| 7.2.2 National feature films/mn pop. 15–69.....                                 | 0.0         | 103 ○      |
| 7.2.3 Global ent. & media market/th pop. 15–69.....                             | 0.2         | 62 ○       |
| 7.2.4 Printing & publishing manufactures, %.....                                | 0.3         | 96 ○       |
| 7.2.5 Creative goods exports, % total trade.....                                | 0.1         | 99         |
| 7.3 Online creativity.....  | 9.7         | 100        |
| 7.3.1 Generic top-level domains (TLDs)/th pop. 15–69.....                       | 0.6         | 103        |
| 7.3.2 Country-code TLDs/th pop. 15–69.....                                      | 0.1         | 108        |
| 7.3.3 Wikipedia edits/mn pop. 15–69.....  | 2.9         | 101        |
| 7.3.4 Video uploads on YouTube/pop. 15–69.....                                  | n/a         | n/a        |

NOTES: ● indicates a strength; ○ a weakness; \* an index; † a survey question.

Ⓞ indicates that the country's data are older than the base year; see Appendix II for details, including the year of the data, at <http://globalinnovationindex.org>.

Square brackets indicate that the data minimum coverage (DMC) requirements were not met at the sub-pillar or pillar level; see page 181 of this appendix for details.



## Key indicators

|                            |                                 |
|----------------------------|---------------------------------|
| Population (millions)..... | 4.0                             |
| GDP (US\$ billions).....   | 55.2                            |
| GDP per capita, PPP\$..... | 21,764.6                        |
| Income group.....          | Upper-middle income             |
| Region.....                | Latin America and the Caribbean |

|  | Score 0–100<br>or value (hard data) | Rank      |
|--|-------------------------------------|-----------|
| <b>Global Innovation Index (out of 127).....</b> | <b>35.0</b>                         | <b>63</b> |
| Innovation Output Sub-Index.....                 | 28.7                                | 55        |
| Innovation Input Sub-Index.....                  | 41.3                                | 74        |
| Innovation Efficiency Ratio.....                 | 0.7                                 | 38        |
| Global Innovation Index 2016 (out of 128).....   | 33.5                                | 68        |

|  |             |           |
|--|-------------|-----------|
| <b>1 Institutions.....</b>   | <b>60.5</b> | <b>66</b> |
| 1.1 Political environment.....   | 61.8        | 48        |
| 1.1.1 Political stability & safety*.....                               | 73.8        | 43        |
| 1.1.2 Government effectiveness*.....                                   | 49.8        | 51        |
| 1.2 Regulatory environment.....  | 61.9        | 69        |
| 1.2.1 Regulatory quality*.....   | 51.7        | 56        |
| 1.2.2 Rule of law*.....  | 35.9        | 66        |
| 1.2.3 Cost of redundancy dismissal, salary weeks.....                  | 18.1        | 75        |
| 1.3 Business environment.....  | 57.8        | 107       |
| 1.3.1 Ease of starting a business*.....                                | 92.0        | 36        |
| 1.3.2 Ease of resolving insolvency*.....                               | 33.4        | 110       |
| 1.3.3 Ease of paying taxes*.....                                       | 48.1        | 117       |
| <b>2 Human capital &amp; research.....</b>                             | <b>21.4</b> | <b>96</b> |
| 2.1 Education.....   | 33.6        | 102       |
| 2.1.1 Expenditure on education, % GDP <sup>Ⓐ</sup> .....               | 3.2         | 97        |
| 2.1.2 Gov't expenditure/pupil, secondary, % GDP/cap <sup>Ⓐ</sup> ..... | 9.2         | 98        |
| 2.1.3 School life expectancy, years <sup>Ⓐ</sup> .....                 | 12.8        | 77        |
| 2.1.4 PISA scales in reading, maths, & science.....                    | n/a         | n/a       |
| 2.1.5 Pupil-teacher ratio, secondary <sup>Ⓐ</sup> .....                | 15.5        | 67        |
| 2.2 Tertiary education.....  | 30.3        | 80        |
| 2.2.1 Tertiary enrolment, % gross <sup>Ⓐ</sup> .....                   | 38.7        | 67        |
| 2.2.2 Graduates in science & engineering, %.....                       | 15.9        | 80        |
| 2.2.3 Tertiary inbound mobility, %.....                                | n/a         | n/a       |
| 2.3 Research & development (R&D).....                                  | 0.4         | 110       |
| 2.3.1 Researchers, FTE/mn pop. <sup>Ⓐ</sup> .....                      | 39.4        | 94 ○      |
| 2.3.2 Gross expenditure on R&D, % GDP <sup>Ⓐ</sup> .....               | 0.1         | 108 ○     |
| 2.3.3 Global R&D companies, avg. expend. top 3, mn \$US.....           | 0.0         | 43 ○      |
| 2.3.4 QS university ranking, average score top 3*.....                 | 0.0         | 75 ○      |
| <b>3 Infrastructure.....</b>   | <b>55.1</b> | <b>36</b> |
| 3.1 Information & communication technologies (ICTs).....               | 40.7        | 94        |
| 3.1.1 ICT access*.....   | 59.9        | 72        |
| 3.1.2 ICT use*.....  | 32.4        | 82        |
| 3.1.3 Government's online service*.....                                | 33.3        | 104       |
| 3.1.4 E-participation*.....  | 37.3        | 101       |
| 3.2 General infrastructure.....  | 66.2        | 4 ●       |
| 3.2.1 Electricity output, kWh/cap.....                                 | 2,399.7     | 72        |
| 3.2.2 Logistics performance*.....                                      | 58.9        | 39        |
| 3.2.3 Gross capital formation, % GDP.....                              | 47.2        | 2 ●       |
| 3.3 Ecological sustainability.....                                     | 58.4        | 21 ●      |
| 3.3.1 GDP/unit of energy use.....                                      | 17.9        | 3 ●       |
| 3.3.2 Environmental performance*.....                                  | 78.0        | 50        |
| 3.3.3 ISO 14001 environmental certificates/bn PPP\$ GDP.....           | 0.3         | 98        |
| <b>4 Market sophistication.....</b>                                    | <b>43.0</b> | <b>83</b> |
| 4.1 Credit.....  | 38.4        | 53        |
| 4.1.1 Ease of getting credit*.....                                     | 75.0        | 19 ●      |
| 4.1.2 Domestic credit to private sector, % GDP.....                    | 88.5        | 33        |
| 4.1.3 Microfinance gross loans, % GDP.....                             | 0.3         | 43        |

|  |      |    |
|--|------|----|
| 4.2 Investment.....  | 33.5 | 92 |
| 4.2.1 Ease of protecting minority investors*.....              | 56.7 | 67 |
| 4.2.2 Market capitalization, % GDP <sup>Ⓐ</sup> .....          | 31.1 | 44 |
| 4.2.3 Venture capital deals/bn PPP\$ GDP <sup>Ⓐ</sup> .....    | 0.0  | 46 |
| 4.3 Trade, competition, & market scale.....                    | 57.0 | 83 |
| 4.3.1 Applied tariff rate, weighted mean, % <sup>Ⓐ</sup> ..... | 6.1  | 99 |
| 4.3.2 Intensity of local competition <sup>†</sup> .....        | 73.7 | 33 |
| 4.3.3 Domestic market scale, bn PPP\$.....                     | 93.1 | 74 |

**5 Business sophistication.....26.4 94**

|   |      |       |
|---|------|-------|
| 5.1 Knowledge workers.....  | 23.7 | 101   |
| 5.1.1 Knowledge-intensive employment, % <sup>Ⓐ</sup> .....                | 24.0 | 59    |
| 5.1.2 Firms offering formal training, % firms <sup>Ⓐ</sup> .....          | 11.0 | 88 ○  |
| 5.1.3 GERD performed by business, % of GDP <sup>Ⓐ</sup> .....             | 0.0  | 88 ○  |
| 5.1.4 GERD financed by business, % <sup>Ⓐ</sup> .....                     | 10.8 | 72    |
| 5.1.5 Females employed w/advanced degrees, % total <sup>Ⓐ</sup> .....     | 16.6 | 33    |
| 5.2 Innovation linkages.....  | 21.3 | 93    |
| 5.2.1 University/industry research collaboration <sup>†</sup> .....       | 39.7 | 72    |
| 5.2.2 State of cluster development <sup>†</sup> .....                     | 53.3 | 36    |
| 5.2.3 GERD financed by abroad, % <sup>Ⓐ</sup> .....                       | 0.3  | 94 ○  |
| 5.2.4 JV-strategic alliance deals/bn PPP\$ GDP.....                       | 0.0  | 104 ○ |
| 5.2.5 Patent families 2+ offices/bn PPP\$ GDP.....                        | 0.1  | 64    |
| 5.3 Knowledge absorption.....   | 34.3 | 57    |
| 5.3.1 Intellectual property payments, % total trade.....                  | 0.4  | 70    |
| 5.3.2 High-tech imports less re-imports, % total trade <sup>Ⓐ</sup> ..... | 18.8 | 7 ●   |
| 5.3.3 ICT services imports, % total trade.....                            | 0.3  | 114   |
| 5.3.4 FDI net inflows, % GDP.....   | 10.1 | 9 ●   |
| 5.3.5 Research talent, % in business enterprise <sup>Ⓐ</sup> .....        | 0.9  | 79 ○  |

**6 Knowledge & technology outputs.....21.7 60**

|   |      |     |
|---|------|-----|
| 6.1 Knowledge creation.....   | 4.6  | 91  |
| 6.1.1 Patents by origin/bn PPP\$ GDP.....                                 | 0.2  | 98  |
| 6.1.2 PCT patent applications/bn PPP\$ GDP.....                           | 0.6  | 31  |
| 6.1.3 Utility models by origin/bn PPP\$ GDP.....                          | 0.1  | 58  |
| 6.1.4 Scientific & technical articles/bn PPP\$ GDP.....                   | 4.5  | 102 |
| 6.1.5 Citable documents H index.....                                      | 10.6 | 58  |
| 6.2 Knowledge impact.....   | 28.2 | 76  |
| 6.2.1 Growth rate of PPP\$ GDP/worker, %.....                             | n/a  | n/a |
| 6.2.2 New businesses/th pop. 15–64 <sup>Ⓐ</sup> .....                     | 14.1 | 6 ● |
| 6.2.3 Computer software spending, % GDP.....                              | 0.2  | 70  |
| 6.2.4 ISO 9001 quality certificates/bn PPP\$ GDP.....                     | 2.3  | 88  |
| 6.2.5 High- & medium-high-tech manufactures, % <sup>Ⓐ</sup> .....         | 0.1  | 89  |
| 6.3 Knowledge diffusion.....  | 32.5 | 35  |
| 6.3.1 Intellectual property receipts, % total trade.....                  | 0.0  | 81  |
| 6.3.2 High-tech exports less re-exports, % total trade <sup>Ⓐ</sup> ..... | 17.1 | 6 ● |
| 6.3.3 ICT services exports, % total trade.....                            | 1.1  | 79  |
| 6.3.4 FDI net outflows, % GDP.....  | 1.8  | 37  |

**7 Creative outputs.....35.6 50**

|   |      |       |
|---|------|-------|
| 7.1 Intangible assets.....  | 46.6 | 50    |
| 7.1.1 Trademarks by origin/bn PPP\$ GDP.....                      | 56.4 | 39    |
| 7.1.2 Industrial designs by origin/bn PPP\$ GDP.....              | 0.2  | 94    |
| 7.1.3 ICTs & business model creation <sup>†</sup> .....           | 71.8 | 27 ●  |
| 7.1.4 ICTs & organizational model creation <sup>†</sup> .....     | 62.1 | 34    |
| 7.2 Creative goods & services.....                                | 17.9 | 65    |
| 7.2.1 Cultural & creative services exports, % of total trade..... | 0.1  | 50    |
| 7.2.2 National feature films/mn pop. 15–69 <sup>Ⓐ</sup> .....     | 0.4  | 94    |
| 7.2.3 Global ent. & media market/th pop. 15–69.....               | n/a  | n/a   |
| 7.2.4 Printing & publishing manufactures, % <sup>Ⓐ</sup> .....    | 3.2  | 6 ●   |
| 7.2.5 Creative goods exports, % total trade.....                  | 0.0  | 116 ○ |
| 7.3 Online creativity.....  | 31.3 | 37    |
| 7.3.1 Generic top-level domains (TLDs)/th pop. 15–69.....         | 44.6 | 16 ●  |
| 7.3.2 Country-code TLDs/th pop. 15–69.....                        | 1.2  | 77    |
| 7.3.3 Wikipedia edits/mn pop. 15–69 <sup>Ⓐ</sup> .....            | 5.0  | 63    |
| 7.3.4 Video uploads on YouTube/pop. 15–69.....                    | n/a  | n/a   |

NOTES: ● indicates a strength; ○ a weakness; \* an index; † a survey question.

Ⓐ indicates that the country's data are older than the base year; see Appendix II for details, including the year of the data, at <http://globalinnovationindex.org>.

Square brackets indicate that the data minimum coverage (DMC) requirements were not met at the sub-pillar or pillar level; see page 181 of this appendix for details.

## Paraguay

## Key indicators

|                            |                                 |
|----------------------------|---------------------------------|
| Population (millions)..... | 6.7                             |
| GDP (US\$ billions).....   | 27.3                            |
| GDP per capita, PPP\$..... | 8,707.8                         |
| Income group.....          | Upper-middle income             |
| Region.....                | Latin America and the Caribbean |

|  | Score 0–100<br>or value (hard data) | Rank      |
|--|-------------------------------------|-----------|
| <b>Global Innovation Index (out of 127).....</b> | <b>30.3</b>                         | <b>85</b> |
| Innovation Output Sub-Index.....                 | 23.0                                | 79        |
| Innovation Input Sub-Index.....                  | 37.6                                | 90        |
| Innovation Efficiency Ratio.....                 | 0.6                                 | 72        |
| Global Innovation Index 2016 (out of 128).....   | 28.2                                | 94        |

|  |             |             |
|--|-------------|-------------|
| <b>1 Institutions.....</b>   | <b>46.9</b> | <b>105</b>  |
| 1.1 Political environment.....   | 40.6        | 93          |
| 1.1.1 Political stability & safety*.....                               | 63.3        | 62          |
| 1.1.2 Government effectiveness*.....                                   | 17.9        | 119 ○       |
| 1.2 Regulatory environment.....  | 42.4        | 112         |
| 1.2.1 Regulatory quality*.....   | 35.3        | 86          |
| 1.2.2 Rule of law*.....  | 19.1        | 101         |
| 1.2.3 Cost of redundancy dismissal, salary weeks.....                  | 29.4        | 114         |
| 1.3 Business environment.....  | 57.6        | 108         |
| 1.3.1 Ease of starting a business*.....                                | 77.5        | 107         |
| 1.3.2 Ease of resolving insolvency*.....                               | 40.7        | 91          |
| 1.3.3 Ease of paying taxes*.....                                       | 54.6        | 106         |
| <b>2 Human capital &amp; research.....</b>                             | <b>24.0</b> | <b>87</b>   |
| 2.1 Education.....   | 40.5        | 86          |
| 2.1.1 Expenditure on education, % GDP <sup>Ⓐ</sup> .....               | 5.0         | 51 ●        |
| 2.1.2 Gov't expenditure/pupil, secondary, % GDP/cap <sup>Ⓐ</sup> ..... | 16.6        | 70          |
| 2.1.3 School life expectancy, years <sup>Ⓐ</sup> .....                 | 12.3        | 82          |
| 2.1.4 PISA scales in reading, maths, & science.....                    | n/a         | n/a         |
| 2.1.5 Pupil-teacher ratio, secondary <sup>Ⓐ</sup> .....                | 18.4        | 77          |
| 2.2 Tertiary education.....  | 30.3        | [79]        |
| 2.2.1 Tertiary enrolment, % gross <sup>Ⓐ</sup> .....                   | 35.1        | 74          |
| 2.2.2 Graduates in science & engineering, %.....                       | n/a         | n/a         |
| 2.2.3 Tertiary inbound mobility, %.....                                | n/a         | n/a         |
| 2.3 Research & development (R&D).....                                  | 1.2         | 103         |
| 2.3.1 Researchers, FTE/mn pop.....                                     | 184.1       | 76          |
| 2.3.2 Gross expenditure on R&D, % GDP.....                             | 0.1         | 98          |
| 2.3.3 Global R&D companies, avg. expend. top 3, mn \$US.....           | 0.0         | 43 ○        |
| 2.3.4 QS university ranking, average score top 3*.....                 | 0.0         | 75 ○        |
| <b>3 Infrastructure.....</b>   | <b>39.9</b> | <b>89</b>   |
| 3.1 Information & communication technologies (ICTs).....               | 48.3        | 84          |
| 3.1.1 ICT access*.....   | 45.9        | 91          |
| 3.1.2 ICT use*.....  | 29.6        | 86          |
| 3.1.3 Government's online service*.....                                | 60.1        | 64          |
| 3.1.4 E-participation*.....  | 57.6        | 70          |
| 3.2 General infrastructure.....  | 27.5        | 99          |
| 3.2.1 Electricity output, kWh/cap.....                                 | 8,440.0     | 18 ●        |
| 3.2.2 Logistics performance*.....                                      | 23.0        | 98          |
| 3.2.3 Gross capital formation, % GDP.....                              | 15.8        | 107         |
| 3.3 Ecological sustainability.....                                     | 43.8        | 67          |
| 3.3.1 GDP/unit of energy use.....                                      | 10.5        | 42 ●        |
| 3.3.2 Environmental performance*.....                                  | 70.4        | 75          |
| 3.3.3 ISO 14001 environmental certificates/bn PPP\$ GDP.....           | 0.2         | 104         |
| <b>4 Market sophistication.....</b>                                    | <b>50.5</b> | <b>45 ●</b> |
| 4.1 Credit.....  | 54.1        | 19 ●        |
| 4.1.1 Ease of getting credit*.....                                     | 45.0        | 84          |
| 4.1.2 Domestic credit to private sector, % GDP.....                    | 57.9        | 53 ●        |
| 4.1.3 Microfinance gross loans, % GDP.....                             | 5.3         | 5 ●         |

|   |      |      |
|---|------|------|
| 4.2 Investment.....                                     | 41.7 | [55] |
| 4.2.1 Ease of protecting minority investors*.....       | 41.7 | 105  |
| 4.2.2 Market capitalization, % GDP.....                 | n/a  | n/a  |
| 4.2.3 Venture capital deals/bn PPP\$ GDP.....           | n/a  | n/a  |
| 4.3 Trade, competition, & market scale.....             | 55.7 | 92   |
| 4.3.1 Applied tariff rate, weighted mean, %.....        | 4.4  | 84   |
| 4.3.2 Intensity of local competition <sup>†</sup> ..... | 67.3 | 71   |
| 4.3.3 Domestic market scale, bn PPP\$.....              | 64.1 | 89   |

|   |             |           |
|---|-------------|-----------|
| <b>5 Business sophistication.....</b>                                 | <b>26.9</b> | <b>92</b> |
| 5.1 Knowledge workers.....  | 34.0        | 79        |
| 5.1.1 Knowledge-intensive employment, %.....                          | 19.0        | 76        |
| 5.1.2 Firms offering formal training, % firms <sup>Ⓐ</sup> .....      | 54.9        | 15 ●      |
| 5.1.3 GERD performed by business, % of GDP <sup>Ⓐ</sup> .....         | 0.0         | 89 ○      |
| 5.1.4 GERD financed by business, %.....                               | 0.3         | 90 ○      |
| 5.1.5 Females employed w/advanced degrees, % total <sup>Ⓐ</sup> ..... | 12.4        | 54        |
| 5.2 Innovation linkages.....  | 18.7        | 116       |
| 5.2.1 University/industry research collaboration <sup>†</sup> .....   | 24.6        | 119 ○     |
| 5.2.2 State of cluster development <sup>†</sup> .....                 | 31.9        | 116 ○     |
| 5.2.3 GERD financed by abroad, %.....                                 | 10.3        | 47        |
| 5.2.4 JV-strategic alliance deals/bn PPP\$ GDP.....                   | 0.0         | 58        |
| 5.2.5 Patent families 2+ offices/bn PPP\$ GDP.....                    | 0.0         | 106       |
| 5.3 Knowledge absorption.....   | 28.0        | 87        |
| 5.3.1 Intellectual property payments, % total trade.....              | 0.2         | 87        |
| 5.3.2 High-tech imports less re-imports, % total trade.....           | 13.3        | 18 ●      |
| 5.3.3 ICT services imports, % total trade.....                        | 0.0         | 126 ○     |
| 5.3.4 FDI net inflows, % GDP.....                                     | 1.0         | 105       |
| 5.3.5 Research talent, % in business enterprise.....                  | n/a         | n/a       |

|   |            |              |
|---|------------|--------------|
| <b>6 Knowledge &amp; technology outputs.....</b>                  | <b>9.5</b> | <b>120 ○</b> |
| 6.1 Knowledge creation.....                                       | 2.2        | 119 ○        |
| 6.1.1 Patents by origin/bn PPP\$ GDP <sup>Ⓐ</sup> .....           | 0.4        | 80           |
| 6.1.2 PCT patent applications/bn PPP\$ GDP.....                   | n/a        | n/a          |
| 6.1.3 Utility models by origin/bn PPP\$ GDP.....                  | n/a        | n/a          |
| 6.1.4 Scientific & technical articles/bn PPP\$ GDP.....           | 1.6        | 119 ○        |
| 6.1.5 Citable documents H index.....                              | 2.9        | 111          |
| 6.2 Knowledge impact.....   | 10.1       | 117          |
| 6.2.1 Growth rate of PPP\$ GDP/worker, %.....                     | n/a        | n/a          |
| 6.2.2 New businesses/th pop. 15–64.....                           | n/a        | n/a          |
| 6.2.3 Computer software spending, % GDP.....                      | 0.0        | 106          |
| 6.2.4 ISO 9001 quality certificates/bn PPP\$ GDP.....             | 5.5        | 59 ●         |
| 6.2.5 High- & medium-high-tech manufactures, % <sup>Ⓐ</sup> ..... | 0.1        | 72           |
| 6.3 Knowledge diffusion.....                                      | 16.3       | 108          |
| 6.3.1 Intellectual property receipts, % total trade.....          | n/a        | n/a          |
| 6.3.2 High-tech exports less re-exports, % total trade.....       | 0.5        | 88           |
| 6.3.3 ICT services exports, % total trade.....                    | 0.1        | 118 ○        |
| 6.3.4 FDI net outflows, % GDP.....                                | 0.2        | 86           |

|   |             |             |
|---|-------------|-------------|
| <b>7 Creative outputs.....</b>                                    | <b>36.4</b> | <b>46 ●</b> |
| 7.1 Intangible assets.....  | 62.0        | 12 ●        |
| 7.1.1 Trademarks by origin/bn PPP\$ GDP <sup>Ⓐ</sup> .....        | 296.3       | 1 ●         |
| 7.1.2 Industrial designs by origin/bn PPP\$ GDP.....              | n/a         | n/a         |
| 7.1.3 ICTs & business model creation <sup>†</sup> .....           | 49.9        | 100         |
| 7.1.4 ICTs & organizational model creation <sup>†</sup> .....     | 36.2        | 114         |
| 7.2 Creative goods & services.....                                | 8.6         | 93          |
| 7.2.1 Cultural & creative services exports, % of total trade..... | 0.0         | 82          |
| 7.2.2 National feature films/mn pop. 15–69 <sup>Ⓐ</sup> .....     | 1.3         | 74          |
| 7.2.3 Global ent. & media market/th pop. 15–69.....               | n/a         | n/a         |
| 7.2.4 Printing & publishing manufactures, % <sup>Ⓐ</sup> .....    | 1.3         | 37 ●        |
| 7.2.5 Creative goods exports, % total trade.....                  | 0.1         | 83          |
| 7.3 Online creativity.....  | 13.1        | 90          |
| 7.3.1 Generic top-level domains (TLDs)/th pop. 15–69.....         | 1.7         | 84          |
| 7.3.2 Country-code TLDs/th pop. 15–69.....                        | 1.3         | 75          |
| 7.3.3 Wikipedia edits/mn pop. 15–69 <sup>Ⓐ</sup> .....            | 3.8         | 88          |
| 7.3.4 Video uploads on YouTube/pop. 15–69.....                    | n/a         | n/a         |

NOTES: ● indicates a strength; ○ a weakness; \* an index; † a survey question.

Ⓐ indicates that the country's data are older than the base year; see Appendix II for details, including the year of the data, at <http://globalinnovationindex.org>.

Square brackets indicate that the data minimum coverage (DMC) requirements were not met at the sub-pillar or pillar level; see page 181 of this appendix for details.

## Key indicators

|                            |                                 |
|----------------------------|---------------------------------|
| Population (millions)..... | 31.8                            |
| GDP (US\$ billions).....   | 180.3                           |
| GDP per capita, PPP\$..... | 12,194.7                        |
| Income group.....          | Upper-middle income             |
| Region.....                | Latin America and the Caribbean |

|  | Score 0–100<br>or value (hard data) | Rank      |
|--|-------------------------------------|-----------|
| <b>Global Innovation Index (out of 127).....</b> | <b>32.9</b>                         | <b>70</b> |
| Innovation Output Sub-Index.....                 | 21.6                                | 85        |
| Innovation Input Sub-Index.....                  | 44.2                                | 56        |
| Innovation Efficiency Ratio.....                 | 0.5                                 | 106 ○     |
| Global Innovation Index 2016 (out of 128).....   | 32.5                                | 71        |

|   |             |           |
|---|-------------|-----------|
| <b>1 Institutions.....</b>                            | <b>58.7</b> | <b>67</b> |
| 1.1 Political environment.....                        | 43.3        | 86        |
| 1.1.1 Political stability & safety*.....              | 51.6        | 87        |
| 1.1.2 Government effectiveness*.....                  | 35.0        | 86        |
| 1.2 Regulatory environment.....                       | 66.3        | 57        |
| 1.2.1 Regulatory quality*.....                        | 54.7        | 48        |
| 1.2.2 Rule of law*.....                               | 23.9        | 93        |
| 1.2.3 Cost of redundancy dismissal, salary weeks..... | 11.4        | 40 ●      |
| 1.3 Business environment.....                         | 66.6        | 73        |
| 1.3.1 Ease of starting a business*.....               | 85.0        | 78        |
| 1.3.2 Ease of resolving insolvency*.....              | 45.9        | 72        |
| 1.3.3 Ease of paying taxes*.....                      | 69.0        | 78        |

|  |             |           |
|--|-------------|-----------|
| <b>2 Human capital &amp; research.....</b>                   | <b>26.6</b> | <b>84</b> |
| 2.1 Education.....   | 38.2        | 94        |
| 2.1.1 Expenditure on education, % GDP.....                   | 3.9         | 81        |
| 2.1.2 Gov't expenditure/pupil, secondary, % GDP/cap.....     | 14.1        | 86        |
| 2.1.3 School life expectancy, years <sup>Ⓐ</sup> .....       | 13.4        | 65        |
| 2.1.4 PISA scales in reading, maths, & science.....          | 393.6       | 65 ○      |
| 2.1.5 Pupil-teacher ratio, secondary.....                    | 14.1        | 59        |
| 2.2 Tertiary education.....                                  | 35.1        | [66]      |
| 2.2.1 Tertiary enrolment, % gross <sup>Ⓐ</sup> .....         | 40.5        | 64        |
| 2.2.2 Graduates in science & engineering, %.....             | n/a         | n/a       |
| 2.2.3 Tertiary inbound mobility, %.....                      | n/a         | n/a       |
| 2.3 Research & development (R&D).....                        | 6.5         | 72        |
| 2.3.1 Researchers, FTE/mn pop.....                           | n/a         | n/a       |
| 2.3.2 Gross expenditure on R&D, % GDP.....                   | 0.1         | 97 ○      |
| 2.3.3 Global R&D companies, avg. expend. top 3, mn \$US..... | 0.0         | 43 ○      |
| 2.3.4 QS university ranking, average score top 3*.....       | 16.6        | 54        |

|  |             |           |
|--|-------------|-----------|
| <b>3 Infrastructure.....</b>                                 | <b>45.2</b> | <b>69</b> |
| 3.1 Information & communication technologies (ICTs).....     | 48.7        | 82        |
| 3.1.1 ICT access*.....                                       | 48.0        | 86        |
| 3.1.2 ICT use*.....  | 29.4        | 87        |
| 3.1.3 Government's online service*.....                      | 63.0        | 57        |
| 3.1.4 E-participation*.....                                  | 54.2        | 80        |
| 3.2 General infrastructure.....                              | 34.9        | 75        |
| 3.2.1 Electricity output, kWh/cap.....                       | 1,470.0     | 88        |
| 3.2.2 Logistics performance*.....                            | 38.4        | 68        |
| 3.2.3 Gross capital formation, % GDP.....                    | 24.6        | 47        |
| 3.3 Ecological sustainability.....                           | 52.1        | 40 ●      |
| 3.3.1 GDP/unit of energy use.....                            | 14.5        | 12 ●      |
| 3.3.2 Environmental performance*.....                        | 73.0        | 67        |
| 3.3.3 ISO 14001 environmental certificates/bn PPP\$ GDP..... | 1.0         | 61        |

|   |             |             |
|---|-------------|-------------|
| <b>4 Market sophistication.....</b>                 | <b>54.8</b> | <b>27 ●</b> |
| 4.1 Credit.....                                     | 60.0        | 15 ●        |
| 4.1.1 Ease of getting credit*.....                  | 80.0        | 15 ●        |
| 4.1.2 Domestic credit to private sector, % GDP..... | 37.4        | 86          |
| 4.1.3 Microfinance gross loans, % GDP.....          | 4.8         | 6 ●         |

|  |       |      |
|--|-------|------|
| 4.2 Investment.....  | 34.1  | 87   |
| 4.2.1 Ease of protecting minority investors*.....              | 60.0  | 52   |
| 4.2.2 Market capitalization, % GDP.....                        | 29.9  | 47   |
| 4.2.3 Venture capital deals/bn PPP\$ GDP.....                  | 0.0   | 64   |
| 4.3 Trade, competition, & market scale.....                    | 70.4  | 35 ● |
| 4.3.1 Applied tariff rate, weighted mean, % <sup>Ⓐ</sup> ..... | 1.4   | 22 ● |
| 4.3.2 Intensity of local competition <sup>†</sup> .....        | 69.6  | 66   |
| 4.3.3 Domestic market scale, bn PPP\$.....                     | 409.9 | 44 ● |

|  |             |           |
|--|-------------|-----------|
| <b>5 Business sophistication.....</b>                            | <b>35.7</b> | <b>49</b> |
| 5.1 Knowledge workers.....                                       | 47.8        | 38 ●      |
| 5.1.1 Knowledge-intensive employment, %.....                     | 14.6        | 90 ○      |
| 5.1.2 Firms offering formal training, % firms <sup>Ⓐ</sup> ..... | 60.1        | 8 ●       |
| 5.1.3 GERD performed by business, % of GDP.....                  | n/a         | n/a       |
| 5.1.4 GERD financed by business, %.....                          | n/a         | n/a       |
| 5.1.5 Females employed w/advanced degrees, % total.....          | 13.5        | 45        |

|   |      |       |
|---|------|-------|
| 5.2 Innovation linkages.....  | 21.7 | 88    |
| 5.2.1 University/industry research collaboration <sup>†</sup> ..... | 31.8 | 100 ○ |
| 5.2.2 State of cluster development <sup>†</sup> .....               | 37.4 | 93    |
| 5.2.3 GERD financed by abroad, %.....                               | n/a  | n/a   |
| 5.2.4 JV-strategic alliance deals/bn PPP\$ GDP.....                 | 0.0  | 95 ○  |
| 5.2.5 Patent families 2+ offices/bn PPP\$ GDP.....                  | 0.0  | 105 ○ |
| 5.3 Knowledge absorption.....                                       | 37.5 | 43 ●  |
| 5.3.1 Intellectual property payments, % total trade.....            | 0.7  | 49    |
| 5.3.2 High-tech imports less re-imports, % total trade.....         | 11.1 | 33 ●  |
| 5.3.3 ICT services imports, % total trade.....                      | 1.4  | 46    |
| 5.3.4 FDI net inflows, % GDP.....                                   | 4.2  | 33 ●  |
| 5.3.5 Research talent, % in business enterprise.....                | n/a  | n/a   |

|   |             |           |
|---|-------------|-----------|
| <b>6 Knowledge &amp; technology outputs.....</b>        | <b>15.8</b> | <b>97</b> |
| 6.1 Knowledge creation.....                             | 6.3         | 80        |
| 6.1.1 Patents by origin/bn PPP\$ GDP.....               | 0.2         | 97        |
| 6.1.2 PCT patent applications/bn PPP\$ GDP.....         | 0.0         | 81        |
| 6.1.3 Utility models by origin/bn PPP\$ GDP.....        | 0.5         | 36        |
| 6.1.4 Scientific & technical articles/bn PPP\$ GDP..... | 2.7         | 113 ○     |
| 6.1.5 Citable documents H index.....                    | 11.7        | 56        |

|   |      |       |
|---|------|-------|
| 6.2 Knowledge impact.....   | 27.6 | 80    |
| 6.2.1 Growth rate of PPP\$ GDP/worker, %.....                     | 1.8  | 39    |
| 6.2.2 New businesses/th pop. 15–64.....                           | 2.4  | 42    |
| 6.2.3 Computer software spending, % GDP.....                      | 0.2  | 64    |
| 6.2.4 ISO 9001 quality certificates/bn PPP\$ GDP.....             | 3.3  | 75    |
| 6.2.5 High- & medium-high-tech manufactures, % <sup>Ⓐ</sup> ..... | 0.1  | 83 ○  |
| 6.3 Knowledge diffusion.....                                      | 13.4 | 119 ○ |
| 6.3.1 Intellectual property receipts, % total trade.....          | 0.1  | 66    |
| 6.3.2 High-tech exports less re-exports, % total trade.....       | 0.5  | 84    |
| 6.3.3 ICT services exports, % total trade.....                    | 0.3  | 108 ○ |
| 6.3.4 FDI net outflows, % GDP.....                                | 0.1  | 98    |

|   |             |           |
|---|-------------|-----------|
| <b>7 Creative outputs.....</b>                                | <b>27.4</b> | <b>82</b> |
| 7.1 Intangible assets.....                                    | 38.1        | 80        |
| 7.1.1 Trademarks by origin/bn PPP\$ GDP.....                  | 51.1        | 46        |
| 7.1.2 Industrial designs by origin/bn PPP\$ GDP.....          | 0.3         | 90        |
| 7.1.3 ICTs & business model creation <sup>†</sup> .....       | 59.8        | 65        |
| 7.1.4 ICTs & organizational model creation <sup>†</sup> ..... | 47.0        | 84        |

|   |      |      |
|---|------|------|
| 7.2 Creative goods & services.....                                | 16.3 | 71   |
| 7.2.1 Cultural & creative services exports, % of total trade..... | 0.1  | 54   |
| 7.2.2 National feature films/mn pop. 15–69.....                   | 1.4  | 70   |
| 7.2.3 Global ent. & media market/th pop. 15–69.....               | 5.9  | 42   |
| 7.2.4 Printing & publishing manufactures, % <sup>Ⓐ</sup> .....    | 2.7  | 11 ● |
| 7.2.5 Creative goods exports, % total trade.....                  | 0.3  | 67   |

|   |      |    |
|---|------|----|
| 7.3 Online creativity.....                                | 17.1 | 74 |
| 7.3.1 Generic top-level domains (TLDs)/th pop. 15–69..... | 5.3  | 55 |
| 7.3.2 Country-code TLDs/th pop. 15–69.....                | 1.4  | 72 |
| 7.3.3 Wikipedia edits/mn pop. 15–69.....                  | 4.3  | 74 |
| 7.3.4 Video uploads on YouTube/pop. 15–69.....            | 20.3 | 57 |

NOTES: ● indicates a strength; ○ a weakness; \* an index; † a survey question.

Ⓐ indicates that the country's data are older than the base year; see Appendix II for details, including the year of the data, at <http://globalinnovationindex.org>.

Square brackets indicate that the data minimum coverage (DMC) requirements were not met at the sub-pillar or pillar level; see page 181 of this appendix for details.

## Philippines

## Key indicators

|                       |   |
|-----------------------|---|
| Population (millions) | 102.3                                   |
| GDP (US\$ billions)   | 311.7                                   |
| GDP per capita, PPP\$ | 7,254.2                                 |
| Income group          | Lower-middle income                     |
| Region                | South East Asia, East Asia, and Oceania |

|   | Score 0–100<br>or value (hard data) | Rank      |
|---|-------------------------------------|-----------|
| <b>Global Innovation Index (out of 127)</b> | <b>32.5</b>                         | <b>73</b> |
| Innovation Output Sub-Index                 | 25.6                                | 65        |
| Innovation Input Sub-Index                  | 39.4                                | 83        |
| Innovation Efficiency Ratio                 | 0.6                                 | 55        |
| Global Innovation Index 2016 (out of 128)   | 31.8                                | 74        |

|  |             |           |
|--|-------------|-----------|
| <b>1 Institutions</b>                            | <b>52.0</b> | <b>89</b> |
| 1.1 Political environment                        | 44.2        | 84        |
| 1.1.1 Political stability & safety*              | 43.5        | 98        |
| 1.1.2 Government effectiveness*                  | 44.9        | 65        |
| 1.2 Regulatory environment                       | 48.4        | 105       |
| 1.2.1 Regulatory quality*                        | 41.2        | 72        |
| 1.2.2 Rule of law*                               | 29.3        | 81        |
| 1.2.3 Cost of redundancy dismissal, salary weeks | 27.4        | 111 ○     |
| 1.3 Business environment                         | 63.3        | 81        |
| 1.3.1 Ease of starting a business*               | 68.9        | 120 ○     |
| 1.3.2 Ease of resolving insolvency*              | 55.2        | 53        |
| 1.3.3 Ease of paying taxes*                      | 65.7        | 84        |

|  |             |           |
|--|-------------|-----------|
| <b>2 Human capital &amp; research</b>                            | <b>22.3</b> | <b>95</b> |
| 2.1 Education  | 26.9        | 113 ○     |
| 2.1.1 Expenditure on education, % GDP <sup>Ⓐ</sup>               | 2.7         | 106 ○     |
| 2.1.2 Gov't expenditure/pupil, secondary, % GDP/cap <sup>Ⓐ</sup> | 9.1         | 99 ○      |
| 2.1.3 School life expectancy, years <sup>Ⓐ</sup>                 | 12.7        | 81        |
| 2.1.4 PISA scales in reading, maths, & science                   | n/a         | n/a       |
| 2.1.5 Pupil-teacher ratio, secondary <sup>Ⓐ</sup>                | 27.0        | 99 ○      |
| 2.2 Tertiary education   | 32.7        | 74        |
| 2.2.1 Tertiary enrolment, % gross <sup>Ⓐ</sup>                   | 35.8        | 73        |
| 2.2.2 Graduates in science & engineering, %                      | 25.5        | 27 ●      |
| 2.2.3 Tertiary inbound mobility, % <sup>Ⓐ</sup>                  | 0.1         | 105 ○     |
| 2.3 Research & development (R&D)                                 | 7.4         | 64        |
| 2.3.1 Researchers, FTE/mn pop. <sup>Ⓐ</sup>                      | 189.4       | 75        |
| 2.3.2 Gross expenditure on R&D, % GDP <sup>Ⓐ</sup>               | 0.1         | 96        |
| 2.3.3 Global R&D companies, avg. expend. top 3, mn \$US          | 0.0         | 43 ○      |
| 2.3.4 QS university ranking, average score top 3*                | 24.4        | 47        |

|   |             |           |
|---|-------------|-----------|
| <b>3 Infrastructure</b>                                 | <b>44.6</b> | <b>72</b> |
| 3.1 Information & communication technologies (ICTs)     | 50.6        | 78        |
| 3.1.1 ICT access*                                       | 47.0        | 89        |
| 3.1.2 ICT use*  | 29.3        | 88        |
| 3.1.3 Government's online service*                      | 66.7        | 51        |
| 3.1.4 E-participation*                                  | 59.3        | 65        |
| 3.2 General infrastructure                              | 32.9        | 84        |
| 3.2.1 Electricity output, kWh/cap.                      | 779.3       | 99        |
| 3.2.2 Logistics performance*                            | 36.7        | 70        |
| 3.2.3 Gross capital formation, % GDP                    | 23.7        | 50        |
| 3.3 Ecological sustainability                           | 50.4        | 44        |
| 3.3.1 GDP/unit of energy use                            | 13.5        | 16 ●      |
| 3.3.2 Environmental performance*                        | 73.7        | 62        |
| 3.3.3 ISO 14001 environmental certificates/bn PPP\$ GDP | 0.7         | 75        |

|  |             |           |
|--|-------------|-----------|
| <b>4 Market sophistication</b>                 | <b>41.3</b> | <b>92</b> |
| 4.1 Credit                                     | 20.7        | 110       |
| 4.1.1 Ease of getting credit*                  | 40.0        | 98        |
| 4.1.2 Domestic credit to private sector, % GDP | 41.8        | 79        |
| 4.1.3 Microfinance gross loans, % GDP          | 0.3         | 39        |

|  |       |      |
|--|-------|------|
| 4.2 Investment   | 30.2  | 111  |
| 4.2.1 Ease of protecting minority investors*             | 41.7  | 105  |
| 4.2.2 Market capitalization, % GDP                       | 81.7  | 17 ● |
| 4.2.3 Venture capital deals/bn PPP\$ GDP                 | 0.0   | 74   |
| 4.3 Trade, competition, & market scale                   | 72.9  | 27 ● |
| 4.3.1 Applied tariff rate, weighted mean, % <sup>Ⓐ</sup> | 2.2   | 56   |
| 4.3.2 Intensity of local competition <sup>†</sup>        | 70.2  | 59   |
| 4.3.3 Domestic market scale, bn PPP\$                    | 801.9 | 28 ● |

|   |             |           |
|---|-------------|-----------|
| <b>5 Business sophistication</b>                              | <b>36.9</b> | <b>45</b> |
| 5.1 Knowledge workers   | 45.5        | 45        |
| 5.1.1 Knowledge-intensive employment, %                       | 24.0        | 58        |
| 5.1.2 Firms offering formal training, % firms                 | 59.8        | 9 ●       |
| 5.1.3 GERD performed by business, % of GDP <sup>Ⓐ</sup>       | 0.0         | 69        |
| 5.1.4 GERD financed by business, % <sup>Ⓐ</sup>               | 36.9        | 41        |
| 5.1.5 Females employed w/advanced degrees, % total            | 13.0        | 47        |
| 5.2 Innovation linkages                                       | 21.2        | 95        |
| 5.2.1 University/industry research collaboration <sup>†</sup> | 41.4        | 59        |
| 5.2.2 State of cluster development <sup>†</sup>               | 45.7        | 62        |
| 5.2.3 GERD financed by abroad, % <sup>Ⓐ</sup>                 | 1.8         | 77        |
| 5.2.4 JV-strategic alliance deals/bn PPP\$ GDP                | 0.0         | 50        |
| 5.2.5 Patent families 2+ offices/bn PPP\$ GDP                 | 0.1         | 79        |
| 5.3 Knowledge absorption                                      | 43.8        | 25 ●      |
| 5.3.1 Intellectual property payments, % total trade           | 0.8         | 45        |
| 5.3.2 High-tech imports less re-imports, % total trade        | n/a         | n/a       |
| 5.3.3 ICT services imports, % total trade                     | 1.0         | 68        |
| 5.3.4 FDI net inflows, % GDP                                  | 1.8         | 86        |
| 5.3.5 Research talent, % in business enterprise <sup>Ⓐ</sup>  | 63.2        | 8 ●       |

|   |             |           |
|---|-------------|-----------|
| <b>6 Knowledge &amp; technology outputs</b>                 | <b>28.3</b> | <b>42</b> |
| 6.1 Knowledge creation                                      | 10.6        | 65        |
| 6.1.1 Patents by origin/bn PPP\$ GDP                        | 0.5         | 75        |
| 6.1.2 PCT patent applications/bn PPP\$ GDP                  | 0.0         | 89        |
| 6.1.3 Utility models by origin/bn PPP\$ GDP                 | 1.1         | 23        |
| 6.1.4 Scientific & technical articles/bn PPP\$ GDP          | 1.6         | 120 ○     |
| 6.1.5 Citable documents H index                             | 12.5        | 54        |
| 6.2 Knowledge impact  | 40.3        | 31 ●      |
| 6.2.1 Growth rate of PPP\$ GDP/worker, %                    | 4.0         | 15 ●      |
| 6.2.2 New businesses/th pop. 15–64 <sup>Ⓐ</sup>             | 0.3         | 92 ○      |
| 6.2.3 Computer software spending, % GDP                     | 0.3         | 61        |
| 6.2.4 ISO 9001 quality certificates/bn PPP\$ GDP            | 3.0         | 81        |
| 6.2.5 High- & medium-high-tech manufactures, % <sup>Ⓐ</sup> | 0.4         | 18 ●      |
| 6.3 Knowledge diffusion                                     | 34.0        | 30 ●      |
| 6.3.1 Intellectual property receipts, % total trade         | 0.0         | 84        |
| 6.3.2 High-tech exports less re-exports, % total trade      | n/a         | n/a       |
| 6.3.3 ICT services exports, % total trade                   | 4.3         | 16 ●      |
| 6.3.4 FDI net outflows, % GDP                               | 1.9         | 33 ●      |

|  |             |           |
|--|-------------|-----------|
| <b>7 Creative outputs</b>                                    | <b>22.8</b> | <b>94</b> |
| 7.1 Intangible assets  | 37.6        | 86        |
| 7.1.1 Trademarks by origin/bn PPP\$ GDP                      | 28.2        | 74        |
| 7.1.2 Industrial designs by origin/bn PPP\$ GDP              | 0.7         | 71        |
| 7.1.3 ICTs & business model creation <sup>†</sup>            | 60.9        | 60        |
| 7.1.4 ICTs & organizational model creation <sup>†</sup>      | 54.8        | 57        |
| 7.2 Creative goods & services                                | 3.7         | 115 ○     |
| 7.2.1 Cultural & creative services exports, % of total trade | 0.1         | 63        |
| 7.2.2 National feature films/mn pop. 15–69 <sup>Ⓐ</sup>      | 0.8         | 83        |
| 7.2.3 Global ent. & media market/th pop. 15–69               | 2.3         | 51        |
| 7.2.4 Printing & publishing manufactures, % <sup>Ⓐ</sup>     | 0.5         | 90 ○      |
| 7.2.5 Creative goods exports, % total trade                  | n/a         | n/a       |
| 7.3 Online creativity  | 12.4        | 92        |
| 7.3.1 Generic top-level domains (TLDs)/th pop. 15–69         | 1.2         | 91        |
| 7.3.2 Country-code TLDs/th pop. 15–69                        | 0.3         | 97        |
| 7.3.3 Wikipedia edits/mn pop. 15–69                          | 4.0         | 82        |
| 7.3.4 Video uploads on YouTube/pop. 15–69                    | 9.2         | 63 ○      |

NOTES: ● indicates a strength; ○ a weakness; \* an index; † a survey question.

Ⓐ indicates that the country's data are older than the base year; see Appendix II for details, including the year of the data, at <http://globalinnovationindex.org>.

Square brackets indicate that the data minimum coverage (DMC) requirements were not met at the sub-pillar or pillar level; see page 181 of this appendix for details.

## Key indicators

|                             |             |
|-----------------------------|-------------|
| Population (millions) ..... | 38.6        |
| GDP (US\$ billions) .....   | 467.4       |
| GDP per capita, PPP\$ ..... | 26,455.3    |
| Income group .....          | High income |
| Region .....                | Europe      |

|  | Score 0–100<br>or value (hard data) | Rank      |
|--|-------------------------------------|-----------|
| <b>Global Innovation Index (out of 127).....</b> | <b>42.0</b>                         | <b>38</b> |
| Innovation Output Sub-Index .....                | 33.8                                | 41        |
| Innovation Input Sub-Index .....                 | 50.2                                | 37        |
| Innovation Efficiency Ratio .....                | 0.7                                 | 48        |
| Global Innovation Index 2016 (out of 128) .....  | 40.2                                | 39        |

|   |             |           |
|---|-------------|-----------|
| <b>1 Institutions.....</b>                                    | <b>75.6</b> | <b>33</b> |
| 1.1 Political environment .....                               | 73.9        | 33        |
| 1.1.1 Political stability & safety* .....                     | 85.0        | 26        |
| 1.1.2 Government effectiveness* .....                         | 62.7        | 40        |
| 1.2 Regulatory environment .....                              | 71.9        | 41        |
| 1.2.1 Regulatory quality* .....                               | 67.6        | 33        |
| 1.2.2 Rule of law* .....                                      | 62.7        | 35        |
| 1.2.3 Cost of redundancy dismissal, salary weeks .....        | 18.8        | 78        |
| 1.3 Business environment .....                                | 81.1        | 30        |
| 1.3.1 Ease of starting a business* .....                      | 84.2        | 82 ○      |
| 1.3.2 Ease of resolving insolvency* .....                     | 76.4        | 25 ●      |
| 1.3.3 Ease of paying taxes* .....                             | 82.7        | 40        |
| <b>2 Human capital &amp; research.....</b>                    | <b>36.5</b> | <b>48</b> |
| 2.1 Education .....   | 57.1        | 36        |
| 2.1.1 Expenditure on education, % GDP .....                   | 4.9         | 55        |
| 2.1.2 Gov't expenditure/pupil, secondary, % GDP/cap .....     | 22.1        | 45        |
| 2.1.3 School life expectancy, years <sup>Ⓜ</sup> .....        | 16.4        | 25        |
| 2.1.4 PISA scales in reading, maths, & science .....          | 503.9       | 17        |
| 2.1.5 Pupil-teacher ratio, secondary <sup>Ⓜ</sup> .....       | 9.5         | 20 ●      |
| 2.2 Tertiary education .....                                  | 33.5        | 71        |
| 2.2.1 Tertiary enrolment, % gross <sup>Ⓜ</sup> .....          | 71.2        | 24 ●      |
| 2.2.2 Graduates in science & engineering, % .....             | 17.4        | 71 ○      |
| 2.2.3 Tertiary inbound mobility, % <sup>Ⓜ</sup> .....         | 1.5         | 77 ○      |
| 2.3 Research & development (R&D) .....                        | 19.0        | 46        |
| 2.3.1 Researchers, FTE/mn pop. .....                          | 2,139.1     | 34        |
| 2.3.2 Gross expenditure on R&D, % GDP .....                   | 1.0         | 36        |
| 2.3.3 Global R&D companies, avg. expend. top 3, mn \$US ..... | 0.0         | 43 ○      |
| 2.3.4 QS university ranking, average score top 3* .....       | 26.9        | 44        |
| <b>3 Infrastructure.....</b>                                  | <b>53.3</b> | <b>41</b> |
| 3.1 Information & communication technologies (ICTs) .....     | 70.7        | 35        |
| 3.1.1 ICT access* .....                                       | 70.9        | 48        |
| 3.1.2 ICT use* .....  | 53.5        | 54        |
| 3.1.3 Government's online service* .....                      | 70.3        | 45        |
| 3.1.4 E-participation* .....                                  | 88.1        | 14 ●      |
| 3.2 General infrastructure .....                              | 38.7        | 55        |
| 3.2.1 Electricity output, kWh/cap .....                       | 4,263.4     | 49        |
| 3.2.2 Logistics performance* .....                            | 63.0        | 32        |
| 3.2.3 Gross capital formation, % GDP .....                    | 20.3        | 78 ○      |
| 3.3 Ecological sustainability .....                           | 50.3        | 45        |
| 3.3.1 GDP/unit of energy use .....                            | 9.7         | 55        |
| 3.3.2 Environmental performance* .....                        | 81.3        | 38        |
| 3.3.3 ISO 14001 environmental certificates/bn PPP\$ GDP ..... | 2.8         | 40        |
| <b>4 Market sophistication .....</b>                          | <b>48.2</b> | <b>55</b> |
| 4.1 Credit .....  | 32.6        | 70        |
| 4.1.1 Ease of getting credit* .....                           | 75.0        | 19        |
| 4.1.2 Domestic credit to private sector, % GDP .....          | 53.6        | 65        |
| 4.1.3 Microfinance gross loans, % GDP .....                   | 0.1         | 55 ○      |

|   |         |      |
|---|---------|------|
| 4.2 Investment .....                                    | 36.6    | 81 ○ |
| 4.2.1 Ease of protecting minority investors* .....      | 63.3    | 41   |
| 4.2.2 Market capitalization, % GDP .....                | 28.9    | 50   |
| 4.2.3 Venture capital deals/bn PPP\$ GDP .....          | 0.0     | 47   |
| 4.3 Trade, competition, & market scale .....            | 75.6    | 20 ● |
| 4.3.1 Applied tariff rate, weighted mean, % .....       | 1.6     | 23   |
| 4.3.2 Intensity of local competition <sup>†</sup> ..... | 71.8    | 46   |
| 4.3.3 Domestic market scale, bn PPP\$ .....             | 1,052.2 | 23 ● |

**5 Business sophistication .....** **37.4** **42**

|   |      |      |
|---|------|------|
| 5.1 Knowledge workers .....   | 47.8 | 39   |
| 5.1.1 Knowledge-intensive employment, % .....                       | 37.6 | 29   |
| 5.1.2 Firms offering formal training, % firms .....                 | 34.6 | 40   |
| 5.1.3 GERD performed by business, % of GDP .....                    | 0.5  | 35   |
| 5.1.4 GERD financed by business, % .....                            | 39.0 | 38   |
| 5.1.5 Females employed w/advanced degrees, % total .....            | 19.5 | 26   |
| 5.2 Innovation linkages .....                                       | 27.5 | 66   |
| 5.2.1 University/industry research collaboration <sup>†</sup> ..... | 38.2 | 80 ○ |
| 5.2.2 State of cluster development <sup>†</sup> .....               | 44.9 | 66   |
| 5.2.3 GERD financed by abroad, % .....                              | 16.7 | 27   |
| 5.2.4 JV-strategic alliance deals/bn PPP\$ GDP .....                | 0.0  | 83 ○ |
| 5.2.5 Patent families 2+ offices/bn PPP\$ GDP .....                 | 0.4  | 40   |
| 5.3 Knowledge absorption .....                                      | 36.9 | 47   |
| 5.3.1 Intellectual property payments, % total trade .....           | 1.1  | 30   |
| 5.3.2 High-tech imports less re-imports, % total trade .....        | 10.7 | 37   |
| 5.3.3 ICT services imports, % total trade .....                     | 1.2  | 60   |
| 5.3.4 FDI net inflows, % GDP .....                                  | 2.2  | 76   |
| 5.3.5 Research talent, % in business enterprise .....               | 34.8 | 40   |

**6 Knowledge & technology outputs .....** **27.9** **44**

|  |      |      |
|--|------|------|
| 6.1 Knowledge creation .....                                 | 24.2 | 37   |
| 6.1.1 Patents by origin/bn PPP\$ GDP .....                   | 5.2  | 23 ● |
| 6.1.2 PCT patent applications/bn PPP\$ GDP .....             | 0.3  | 47   |
| 6.1.3 Utility models by origin/bn PPP\$ GDP .....            | 1.0  | 25   |
| 6.1.4 Scientific & technical articles/bn PPP\$ GDP .....     | 25.1 | 32   |
| 6.1.5 Citable documents H index .....                        | 34.8 | 24 ● |
| 6.2 Knowledge impact .....                                   | 35.7 | 46   |
| 6.2.1 Growth rate of PPP\$ GDP/worker, % .....               | 2.2  | 35   |
| 6.2.2 New businesses/th pop. 15–64 <sup>Ⓜ</sup> .....        | 0.5  | 85 ○ |
| 6.2.3 Computer software spending, % GDP .....                | 0.3  | 44   |
| 6.2.4 ISO 9001 quality certificates/bn PPP\$ GDP .....       | 10.6 | 35   |
| 6.2.5 High- & medium-high-tech manufactures, % .....         | 0.3  | 35   |
| 6.3 Knowledge diffusion .....                                | 23.8 | 58   |
| 6.3.1 Intellectual property receipts, % total trade .....    | 0.2  | 41   |
| 6.3.2 High-tech exports less re-exports, % total trade ..... | 7.3  | 25   |
| 6.3.3 ICT services exports, % total trade .....              | 1.9  | 54   |
| 6.3.4 FDI net outflows, % GDP .....                          | 0.5  | 67   |

**7 Creative outputs .....** **39.7** **37**

|   |      |      |
|---|------|------|
| 7.1 Intangible assets .....   | 45.9 | 54   |
| 7.1.1 Trademarks by origin/bn PPP\$ GDP .....                                   | 45.0 | 55   |
| 7.1.2 Industrial designs by origin/bn PPP\$ GDP .....                           | n/a  | n/a  |
| 7.1.3 ICTs & business model creation <sup>†</sup> .....                         | 61.0 | 59   |
| 7.1.4 ICTs & organizational model creation <sup>†</sup> .....                   | 54.0 | 62   |
| 7.2 Creative goods & services .....   | 34.1 | 22 ● |
| 7.2.1 Cultural & creative services exports, % of total trade <sup>Ⓜ</sup> ..... | 1.0  | 16 ● |
| 7.2.2 National feature films/mn pop. 15–69 .....                                | 1.5  | 69 ○ |
| 7.2.3 Global ent. & media market/th pop. 15–69 .....                            | 11.1 | 34   |
| 7.2.4 Printing & publishing manufactures, % .....                               | 1.1  | 57   |
| 7.2.5 Creative goods exports, % total trade .....                               | 5.5  | 9 ●  |
| 7.3 Online creativity .....   | 32.7 | 35   |
| 7.3.1 Generic top-level domains (TLDs)/th pop. 15–69 .....                      | 7.1  | 46   |
| 7.3.2 Country-code TLDs/th pop. 15–69 .....                                     | 27.9 | 22 ● |
| 7.3.3 Wikipedia edits/mn pop. 15–69 .....                                       | 6.2  | 31   |
| 7.3.4 Video uploads on YouTube/pop. 15–69 .....                                 | 35.8 | 39   |

NOTES: ● indicates a strength; ○ a weakness; \* an index; † a survey question.

Ⓜ indicates that the country's data are older than the base year; see Appendix II for details, including the year of the data, at <http://globalinnovationindex.org>.

Square brackets indicate that the data minimum coverage (DMC) requirements were not met at the sub-pillar or pillar level; see page 181 of this appendix for details.



## Portugal

## Key indicators

|                             |             |
|-----------------------------|-------------|
| Population (millions) ..... | 10.3        |
| GDP (US\$ billions) .....   | 205.9       |
| GDP per capita, PPP\$ ..... | 27,834.8    |
| Income group .....          | High income |
| Region .....                | Europe      |

|  | Score 0–100<br>or value (hard data) | Rank      |
|--|-------------------------------------|-----------|
| <b>Global Innovation Index (out of 127).....</b> | <b>46.1</b>                         | <b>31</b> |
| Innovation Output Sub-Index .....                | 38.3                                | 31        |
| Innovation Input Sub-Index .....                 | 53.8                                | 33        |
| Innovation Efficiency Ratio .....                | 0.7                                 | 33        |
| Global Innovation Index 2016 (out of 128) .....  | 46.4                                | 30        |

**1 Institutions..... 80.8 23**

|  |      |      |
|--|------|------|
| 1.1 Political environment .....                        | 79.4 | 22   |
| 1.1.1 Political stability & safety* .....              | 85.0 | 27   |
| 1.1.2 Government effectiveness* .....                  | 73.8 | 24   |
| 1.2 Regulatory environment .....                       | 75.8 | 34   |
| 1.2.1 Regulatory quality* .....                        | 66.2 | 34   |
| 1.2.2 Rule of law* .....                               | 72.8 | 26   |
| 1.2.3 Cost of redundancy dismissal, salary weeks ..... | 17.0 | 70 ○ |
| 1.3 Business environment .....                         | 87.3 | 15 ● |
| 1.3.1 Ease of starting a business* .....               | 92.9 | 29   |
| 1.3.2 Ease of resolving insolvency* .....              | 85.2 | 7 ●  |
| 1.3.3 Ease of paying taxes* .....                      | 83.8 | 34   |

**2 Human capital & research..... 47.6 29**

|   |         |      |
|---|---------|------|
| 2.1 Education .....   | 60.9    | 19   |
| 2.1.1 Expenditure on education, % GDP .....                   | 5.3     | 38   |
| 2.1.2 Gov't expenditure/pupil, secondary, % GDP/cap .....     | 30.3    | 14 ● |
| 2.1.3 School life expectancy, years .....                     | 16.6    | 19   |
| 2.1.4 PISA scales in reading, maths, & science .....          | 497.0   | 22   |
| 2.1.5 Pupil-teacher ratio, secondary <sup>Ⓔ</sup> .....       | 9.9     | 24   |
| 2.2 Tertiary education .....                                  | 45.1    | 33   |
| 2.2.1 Tertiary enrolment, % gross <sup>Ⓔ</sup> .....          | 65.6    | 35   |
| 2.2.2 Graduates in science & engineering, % .....             | 26.1    | 23   |
| 2.2.3 Tertiary inbound mobility, % <sup>Ⓔ</sup> .....         | 4.1     | 49   |
| 2.3 Research & development (R&D) .....                        | 36.9    | 30   |
| 2.3.1 Researchers, FTE/mn pop. ....                           | 3,824.2 | 23   |
| 2.3.2 Gross expenditure on R&D, % GDP .....                   | 1.3     | 28   |
| 2.3.3 Global R&D companies, avg. expend. top 3, mn \$US ..... | 38.0    | 39   |
| 2.3.4 QS university ranking, average score top 3* .....       | 34.0    | 36   |

**3 Infrastructure..... 54.0 39**

|   |         |       |
|---|---------|-------|
| 3.1 Information & communication technologies (ICTs) .....     | 69.2    | 37    |
| 3.1.1 ICT access* .....                                       | 79.3    | 26    |
| 3.1.2 ICT use* .....  | 56.7    | 46    |
| 3.1.3 Government's online service* .....                      | 74.6    | 33    |
| 3.1.4 E-participation* .....                                  | 66.1    | 49    |
| 3.2 General infrastructure .....                              | 33.1    | 82 ○  |
| 3.2.1 Electricity output, kWh/cap .....                       | 4,900.3 | 43    |
| 3.2.2 Logistics performance* .....                            | 62.3    | 35    |
| 3.2.3 Gross capital formation, % GDP .....                    | 15.0    | 112 ○ |
| 3.3 Ecological sustainability .....                           | 59.5    | 18 ●  |
| 3.3.1 GDP/unit of energy use .....                            | 12.3    | 25    |
| 3.3.2 Environmental performance* .....                        | 88.6    | 7 ●   |
| 3.3.3 ISO 14001 environmental certificates/bn PPP\$ GDP ..... | 4.4     | 21    |

**4 Market sophistication ..... 51.1 43**

|  |       |      |
|--|-------|------|
| 4.1 Credit .....                                     | 46.4  | 37   |
| 4.1.1 Ease of getting credit* .....                  | 45.0  | 84 ○ |
| 4.1.2 Domestic credit to private sector, % GDP ..... | 120.1 | 19   |
| 4.1.3 Microfinance gross loans, % GDP .....          | n/a   | n/a  |

|   |       |      |
|---|-------|------|
| 4.2 Investment .....                                    | 38.2  | 74 ○ |
| 4.2.1 Ease of protecting minority investors* .....      | 56.7  | 67 ○ |
| 4.2.2 Market capitalization, % GDP .....                | 30.1  | 46   |
| 4.2.3 Venture capital deals/bn PPP\$ GDP .....          | 0.1   | 21   |
| 4.3 Trade, competition, & market scale .....            | 68.8  | 42   |
| 4.3.1 Applied tariff rate, weighted mean, % .....       | 1.6   | 23   |
| 4.3.2 Intensity of local competition <sup>†</sup> ..... | 70.5  | 55   |
| 4.3.3 Domestic market scale, bn PPP\$ .....             | 297.1 | 51   |

**5 Business sophistication ..... 35.4 50**

|   |      |      |
|---|------|------|
| 5.1 Knowledge workers .....   | 47.8 | 37   |
| 5.1.1 Knowledge-intensive employment, % .....                       | 35.5 | 37   |
| 5.1.2 Firms offering formal training, % firms .....                 | n/a  | n/a  |
| 5.1.3 GERD performed by business, % of GDP .....                    | 0.6  | 31   |
| 5.1.4 GERD financed by business, % <sup>Ⓔ</sup> .....               | 41.8 | 30   |
| 5.1.5 Females employed w/advanced degrees, % total .....            | 15.3 | 40   |
| 5.2 Innovation linkages .....                                       | 26.8 | 68   |
| 5.2.1 University/industry research collaboration <sup>†</sup> ..... | 50.5 | 35   |
| 5.2.2 State of cluster development <sup>†</sup> .....               | 52.6 | 37   |
| 5.2.3 GERD financed by abroad, % <sup>Ⓔ</sup> .....                 | 5.6  | 62 ○ |
| 5.2.4 JV-strategic alliance deals/bn PPP\$ GDP .....                | 0.0  | 72 ○ |
| 5.2.5 Patent families 2+ offices/bn PPP\$ GDP .....                 | 0.7  | 32   |
| 5.3 Knowledge absorption .....                                      | 31.6 | 71 ○ |
| 5.3.1 Intellectual property payments, % total trade .....           | 0.9  | 40   |
| 5.3.2 High-tech imports less re-imports, % total trade .....        | 6.5  | 87 ○ |
| 5.3.3 ICT services imports, % total trade .....                     | 1.2  | 58   |
| 5.3.4 FDI net inflows, % GDP .....                                  | 3.6  | 46   |
| 5.3.5 Research talent, % in business enterprise .....               | 29.0 | 44   |

**6 Knowledge & technology outputs ..... 29.9 39**

|  |      |      |
|--|------|------|
| 6.1 Knowledge creation .....                                 | 22.9 | 41   |
| 6.1.1 Patents by origin/bn PPP\$ GDP .....                   | 3.7  | 28   |
| 6.1.2 PCT patent applications/bn PPP\$ GDP .....             | 0.6  | 34   |
| 6.1.3 Utility models by origin/bn PPP\$ GDP .....            | 0.4  | 38 ○ |
| 6.1.4 Scientific & technical articles/bn PPP\$ GDP .....     | 45.5 | 12 ● |
| 6.1.5 Citable documents H index .....                        | 28.5 | 30   |
| 6.2 Knowledge impact .....                                   | 41.1 | 26   |
| 6.2.1 Growth rate of PPP\$ GDP/worker, % .....               | 0.1  | 86 ○ |
| 6.2.2 New businesses/th pop. 15–64 .....                     | 4.6  | 26   |
| 6.2.3 Computer software spending, % GDP .....                | 0.6  | 11 ● |
| 6.2.4 ISO 9001 quality certificates/bn PPP\$ GDP .....       | 25.8 | 11 ● |
| 6.2.5 High- & medium-high-tech manufactures, % .....         | 0.3  | 47   |
| 6.3 Knowledge diffusion .....                                | 25.9 | 50   |
| 6.3.1 Intellectual property receipts, % total trade .....    | 0.1  | 49   |
| 6.3.2 High-tech exports less re-exports, % total trade ..... | 2.6  | 48   |
| 6.3.3 ICT services exports, % total trade .....              | 1.4  | 70 ○ |
| 6.3.4 FDI net outflows, % GDP .....                          | 2.3  | 27   |

**7 Creative outputs ..... 46.7 21**

|   |      |      |
|---|------|------|
| 7.1 Intangible assets .....   | 61.2 | 14 ● |
| 7.1.1 Trademarks by origin/bn PPP\$ GDP .....                                   | 95.4 | 15 ● |
| 7.1.2 Industrial designs by origin/bn PPP\$ GDP .....                           | 9.7  | 14 ● |
| 7.1.3 ICTs & business model creation <sup>†</sup> .....                         | 76.8 | 16 ● |
| 7.1.4 ICTs & organizational model creation <sup>†</sup> .....                   | 62.6 | 32   |
| 7.2 Creative goods & services .....   | 24.6 | 47   |
| 7.2.1 Cultural & creative services exports, % of total trade <sup>Ⓔ</sup> ..... | 0.6  | 26   |
| 7.2.2 National feature films/mn pop. 15–69 .....                                | 4.2  | 47   |
| 7.2.3 Global ent. & media market/th pop. 15–69 .....                            | 32.2 | 22   |
| 7.2.4 Printing & publishing manufactures, % .....                               | 1.3  | 43   |
| 7.2.5 Creative goods exports, % total trade .....                               | 1.2  | 37   |
| 7.3 Online creativity .....   | 39.6 | 28   |
| 7.3.1 Generic top-level domains (TLDs)/th pop. 15–69 .....                      | 18.9 | 29   |
| 7.3.2 Country-code TLDs/th pop. 15–69 .....                                     | 35.6 | 18 ● |
| 7.3.3 Wikipedia edits/mn pop. 15–69 .....                                       | 5.8  | 45   |
| 7.3.4 Video uploads on YouTube/pop. 15–69 .....                                 | 47.5 | 17   |

NOTES: ● indicates a strength; ○ a weakness; \* an index; † a survey question.

Ⓔ indicates that the country's data are older than the base year; see Appendix II for details, including the year of the data, at <http://globalinnovationindex.org>.

Square brackets indicate that the data minimum coverage (DMC) requirements were not met at the sub-pillar or pillar level; see page 181 of this appendix for details.



## Key indicators

|                            |                                  |
|----------------------------|----------------------------------|
| Population (millions)..... | 2.3                              |
| GDP (US\$ billions).....   | 156.6                            |
| GDP per capita, PPP\$..... | 132,098.7                        |
| Income group.....          | High income                      |
| Region.....                | Northern Africa and Western Asia |

|  | Score 0–100<br>or value (hard data) | Rank      |
|--|-------------------------------------|-----------|
| <b>Global Innovation Index (out of 127).....</b> | <b>37.9</b>                         | <b>49</b> |
| Innovation Output Sub-Index.....                 | 28.8                                | 54        |
| Innovation Input Sub-Index.....                  | 47.0                                | 48        |
| Innovation Efficiency Ratio.....                 | 0.6                                 | 68        |
| Global Innovation Index 2016 (out of 128).....   | 37.5                                | 50        |

**1 Institutions.....72.8 37**

|   |      |      |
|---|------|------|
| 1.1 Political environment.....                        | 77.6 | 26   |
| 1.1.1 Political stability & safety*.....              | 87.5 | 16 ● |
| 1.1.2 Government effectiveness*.....                  | 67.7 | 35   |
| 1.2 Regulatory environment.....                       | 66.2 | 58   |
| 1.2.1 Regulatory quality*.....                        | 59.8 | 43   |
| 1.2.2 Rule of law*.....                               | 65.3 | 33   |
| 1.2.3 Cost of redundancy dismissal, salary weeks..... | 23.2 | 98   |
| 1.3 Business environment.....                         | 74.6 | 52   |
| 1.3.1 Ease of starting a business*.....               | 86.1 | 74   |
| 1.3.2 Ease of resolving insolvency*.....              | 38.2 | 102  |
| 1.3.3 Ease of paying taxes*.....                      | 99.4 | 1 ●  |

**2 Human capital & research.....33.3 58**

|  |       |      |
|--|-------|------|
| 2.1 Education.....   | 37.2  | 97   |
| 2.1.1 Expenditure on education, % GDP.....                             | 3.5   | 90   |
| 2.1.2 Gov't expenditure/pupil, secondary, % GDP/cap <sup>Ⓢ</sup> ..... | 10.5  | 95 ○ |
| 2.1.3 School life expectancy, years <sup>Ⓢ</sup> .....                 | 13.1  | 73   |
| 2.1.4 PISA scales in reading, maths, & science.....                    | 407.3 | 60 ○ |
| 2.1.5 Pupil-teacher ratio, secondary.....                              | 10.7  | 30   |
| 2.2 Tertiary education.....  | 55.7  | 13 ● |
| 2.2.1 Tertiary enrolment, % gross.....                                 | 17.2  | 96   |
| 2.2.2 Graduates in science & engineering, %.....                       | 27.6  | 18   |
| 2.2.3 Tertiary inbound mobility, %.....                                | 37.7  | 1 ●  |
| 2.3 Research & development (R&D).....                                  | 7.0   | 66   |
| 2.3.1 Researchers, FTE/mn pop. <sup>Ⓢ</sup> .....                      | 597.1 | 60   |
| 2.3.2 Gross expenditure on R&D, % GDP <sup>Ⓢ</sup> .....               | 0.5   | 66   |
| 2.3.3 Global R&D companies, avg. expend. top 3, mn \$US.....           | 0.0   | 43 ○ |
| 2.3.4 QS university ranking, average score top 3*.....                 | 10.2  | 63   |

**3 Infrastructure.....58.1 26**

|  |          |     |
|--|----------|-----|
| 3.1 Information & communication technologies (ICTs).....     | 68.5     | 39  |
| 3.1.1 ICT access*.....                                       | 79.1     | 29  |
| 3.1.2 ICT use*.....  | 63.2     | 31  |
| 3.1.3 Government's online service*.....                      | 67.4     | 49  |
| 3.1.4 E-participation*.....                                  | 64.4     | 54  |
| 3.2 General infrastructure.....                              | 67.6     | 2 ● |
| 3.2.1 Electricity output, kWh/cap.....                       | 17,830.4 | 4 ● |
| 3.2.2 Logistics performance*.....                            | 71.0     | 29  |
| 3.2.3 Gross capital formation, % GDP.....                    | n/a      | n/a |
| 3.3 Ecological sustainability.....                           | 38.3     | 88  |
| 3.3.1 GDP/unit of energy use.....                            | 6.5      | 88  |
| 3.3.2 Environmental performance*.....                        | 69.9     | 78  |
| 3.3.3 ISO 14001 environmental certificates/bn PPP\$ GDP..... | 1.0      | 64  |

**4 Market sophistication.....42.6 85**

|   |      |       |
|---|------|-------|
| 4.1 Credit.....                                     | 28.6 | 85    |
| 4.1.1 Ease of getting credit*.....                  | 30.0 | 108 ○ |
| 4.1.2 Domestic credit to private sector, % GDP..... | 69.6 | 43    |
| 4.1.3 Microfinance gross loans, % GDP.....          | n/a  | n/a   |

|   |       |       |
|---|-------|-------|
| 4.2 Investment.....                                     | 30.1  | 113 ○ |
| 4.2.1 Ease of protecting minority investors*.....       | 26.7  | 127 ○ |
| 4.2.2 Market capitalization, % GDP.....                 | 86.6  | 15    |
| 4.2.3 Venture capital deals/bn PPP\$ GDP.....           | n/a   | n/a   |
| 4.3 Trade, competition, & market scale.....             | 68.9  | 40    |
| 4.3.1 Applied tariff rate, weighted mean, %.....        | 3.4   | 74    |
| 4.3.2 Intensity of local competition <sup>†</sup> ..... | 79.0  | 16 ●  |
| 4.3.3 Domestic market scale, bn PPP\$.....              | 334.5 | 48    |

**5 Business sophistication.....28.0 84**

|   |      |       |
|---|------|-------|
| 5.1 Knowledge workers.....  | 20.4 | 112 ○ |
| 5.1.1 Knowledge-intensive employment, %.....                          | 16.1 | 84    |
| 5.1.2 Firms offering formal training, % firms.....                    | n/a  | n/a   |
| 5.1.3 GERD performed by business, % of GDP <sup>Ⓢ</sup> .....         | 0.1  | 60    |
| 5.1.4 GERD financed by business, % <sup>Ⓢ</sup> .....                 | 24.2 | 58    |
| 5.1.5 Females employed w/advanced degrees, % total <sup>Ⓢ</sup> ..... | 4.5  | 79 ○  |
| 5.2 Innovation linkages.....  | 33.0 | 51    |
| 5.2.1 University/industry research collaboration <sup>†</sup> .....   | 70.5 | 10 ●  |
| 5.2.2 State of cluster development <sup>†</sup> .....                 | 70.0 | 9 ●   |
| 5.2.3 GERD financed by abroad, % <sup>Ⓢ</sup> .....                   | 2.4  | 73    |
| 5.2.4 JV-strategic alliance deals/bn PPP\$ GDP.....                   | 0.0  | 41    |
| 5.2.5 Patent families 2+ offices/bn PPP\$ GDP.....                    | 0.0  | 82    |
| 5.3 Knowledge absorption.....   | 30.6 | 79    |
| 5.3.1 Intellectual property payments, % total trade.....              | n/a  | n/a   |
| 5.3.2 High-tech imports less re-imports, % total trade.....           | 4.4  | 113 ○ |
| 5.3.3 ICT services imports, % total trade.....                        | 2.0  | 23    |
| 5.3.4 FDI net inflows, % GDP.....                                     | 0.2  | 121 ○ |
| 5.3.5 Research talent, % in business enterprise <sup>Ⓢ</sup> .....    | 28.0 | 45    |

**6 Knowledge & technology outputs.....23.1 55**

|   |      |       |
|---|------|-------|
| 6.1 Knowledge creation.....                                       | 3.5  | 103   |
| 6.1.1 Patents by origin/bn PPP\$ GDP.....                         | 0.0  | 120 ○ |
| 6.1.2 PCT patent applications/bn PPP\$ GDP.....                   | 0.0  | 86    |
| 6.1.3 Utility models by origin/bn PPP\$ GDP.....                  | n/a  | n/a   |
| 6.1.4 Scientific & technical articles/bn PPP\$ GDP.....           | 6.3  | 86    |
| 6.1.5 Citable documents H index.....                              | 5.3  | 92    |
| 6.2 Knowledge impact.....   | 33.9 | 51    |
| 6.2.1 Growth rate of PPP\$ GDP/worker, %.....                     | 0.6  | 70    |
| 6.2.2 New businesses/th pop. 15–64.....                           | 1.7  | 51    |
| 6.2.3 Computer software spending, % GDP.....                      | 0.4  | 31    |
| 6.2.4 ISO 9001 quality certificates/bn PPP\$ GDP.....             | 2.1  | 90    |
| 6.2.5 High- & medium-high-tech manufactures, % <sup>Ⓢ</sup> ..... | 0.4  | 12 ●  |
| 6.3 Knowledge diffusion.....                                      | 32.0 | 36    |
| 6.3.1 Intellectual property receipts, % total trade.....          | n/a  | n/a   |
| 6.3.2 High-tech exports less re-exports, % total trade.....       | 0.3  | 94    |
| 6.3.3 ICT services exports, % total trade.....                    | 0.7  | 91    |
| 6.3.4 FDI net outflows, % GDP.....                                | 3.3  | 19    |

**7 Creative outputs.....34.5 54**

|   |      |       |
|---|------|-------|
| 7.1 Intangible assets.....  | 51.8 | 31    |
| 7.1.1 Trademarks by origin/bn PPP\$ GDP <sup>Ⓢ</sup> .....        | 4.6  | 112 ○ |
| 7.1.2 Industrial designs by origin/bn PPP\$ GDP.....              | n/a  | n/a   |
| 7.1.3 ICTs & business model creation <sup>†</sup> .....           | 79.4 | 11 ●  |
| 7.1.4 ICTs & organizational model creation <sup>†</sup> .....     | 74.1 | 16 ●  |
| 7.2 Creative goods & services.....                                | 12.2 | 81    |
| 7.2.1 Cultural & creative services exports, % of total trade..... | n/a  | n/a   |
| 7.2.2 National feature films/mn pop. 15–69.....                   | n/a  | n/a   |
| 7.2.3 Global ent. & media market/th pop. 15–69.....               | 25.9 | 25    |
| 7.2.4 Printing & publishing manufactures, % <sup>Ⓢ</sup> .....    | 0.9  | 68    |
| 7.2.5 Creative goods exports, % total trade.....                  | 0.2  | 78    |
| 7.3 Online creativity.....  | 22.4 | 57    |
| 7.3.1 Generic top-level domains (TLDs)/th pop. 15–69.....         | 4.4  | 58    |
| 7.3.2 Country-code TLDs/th pop. 15–69.....                        | 3.4  | 56    |
| 7.3.3 Wikipedia edits/mn pop. 15–69 <sup>Ⓢ</sup> .....            | 4.6  | 70    |
| 7.3.4 Video uploads on YouTube/pop. 15–69.....                    | 37.7 | 34    |

NOTES: ● indicates a strength; ○ a weakness; \* an index; † a survey question.

Ⓢ indicates that the country's data are older than the base year; see Appendix II for details, including the year of the data, at <http://globalinnovationindex.org>.

Square brackets indicate that the data minimum coverage (DMC) requirements were not met at the sub-pillar or pillar level; see page 181 of this appendix for details.

## Romania

## Key indicators

|                            |                     |
|----------------------------|---------------------|
| Population (millions)..... | 19.4                |
| GDP (US\$ billions).....   | 186.5               |
| GDP per capita, PPP\$..... | 20,786.9            |
| Income group.....          | Upper-middle income |
| Region.....                | Europe              |

|  | Score 0–100<br>or value (hard data) | Rank      |
|--|-------------------------------------|-----------|
| <b>Global Innovation Index (out of 127).....</b> | <b>39.2</b>                         | <b>42</b> |
| Innovation Output Sub-Index.....                 | 32.0                                | 44        |
| Innovation Input Sub-Index.....                  | 46.4                                | 51        |
| Innovation Efficiency Ratio.....                 | 0.7                                 | 39        |
| Global Innovation Index 2016 (out of 128).....   | 37.9                                | 48        |

|   |             |           |
|---|-------------|-----------|
| <b>1 Institutions.....</b>                            | <b>69.0</b> | <b>43</b> |
| 1.1 Political environment.....                        | 54.9        | 57        |
| 1.1.1 Political stability & safety*.....              | 68.6        | 51        |
| 1.1.2 Government effectiveness*.....                  | 41.2        | 73        |
| 1.2 Regulatory environment.....                       | 75.3        | 35        |
| 1.2.1 Regulatory quality*.....                        | 57.2        | 45        |
| 1.2.2 Rule of law*.....                               | 43.9        | 54        |
| 1.2.3 Cost of redundancy dismissal, salary weeks..... | 8.0         | 1 ●       |
| 1.3 Business environment.....                         | 76.8        | 39        |
| 1.3.1 Ease of starting a business*.....               | 89.5        | 53        |
| 1.3.2 Ease of resolving insolvency*.....              | 59.2        | 46        |
| 1.3.3 Ease of paying taxes*.....                      | 81.6        | 43        |

|  |             |           |
|--|-------------|-----------|
| <b>2 Human capital &amp; research.....</b>                   | <b>30.5</b> | <b>75</b> |
| 2.1 Education.....   | 40.9        | 84        |
| 2.1.1 Expenditure on education, % GDP <sup>Ⓔ</sup> .....     | 2.9         | 100 ○     |
| 2.1.2 Gov't expenditure/pupil, secondary, % GDP/cap.....     | 13.4        | 87 ○      |
| 2.1.3 School life expectancy, years.....                     | 14.9        | 52        |
| 2.1.4 PISA scales in reading, maths, & science.....          | 437.5       | 47        |
| 2.1.5 Pupil-teacher ratio, secondary.....                    | 12.1        | 41        |
| 2.2 Tertiary education.....                                  | 41.9        | 42        |
| 2.2.1 Tertiary enrolment, % gross.....                       | 53.2        | 50        |
| 2.2.2 Graduates in science & engineering, %.....             | 25.5        | 29        |
| 2.2.3 Tertiary inbound mobility, %.....                      | 4.3         | 42        |
| 2.3 Research & development (R&D).....                        | 8.6         | 62        |
| 2.3.1 Researchers, FTE/mn pop.....                           | 894.8       | 50        |
| 2.3.2 Gross expenditure on R&D, % GDP.....                   | 0.5         | 64        |
| 2.3.3 Global R&D companies, avg. expend. top 3, mn \$US..... | 0.0         | 43 ○      |
| 2.3.4 QS university ranking, average score top 3*.....       | 12.8        | 59        |

|  |             |           |
|--|-------------|-----------|
| <b>3 Infrastructure.....</b>                                 | <b>55.1</b> | <b>37</b> |
| 3.1 Information & communication technologies (ICTs).....     | 57.0        | 66        |
| 3.1.1 ICT access*.....                                       | 69.0        | 52        |
| 3.1.2 ICT use*.....  | 50.8        | 58        |
| 3.1.3 Government's online service*.....                      | 45.7        | 91 ○      |
| 3.1.4 E-participation*.....                                  | 62.7        | 59        |
| 3.2 General infrastructure.....                              | 38.1        | 60        |
| 3.2.1 Electricity output, kWh/cap.....                       | 3,274.8     | 60        |
| 3.2.2 Logistics performance*.....                            | 43.0        | 59        |
| 3.2.3 Gross capital formation, % GDP.....                    | 25.0        | 43        |
| 3.3 Ecological sustainability.....                           | 70.1        | 3 ●       |
| 3.3.1 GDP/unit of energy use.....                            | 11.5        | 31        |
| 3.3.2 Environmental performance*.....                        | 83.2        | 34        |
| 3.3.3 ISO 14001 environmental certificates/bn PPP\$ GDP..... | 25.5        | 1 ●       |

|   |             |           |
|---|-------------|-----------|
| <b>4 Market sophistication.....</b>                 | <b>44.2</b> | <b>73</b> |
| 4.1 Credit.....                                     | 32.1        | 72        |
| 4.1.1 Ease of getting credit*.....                  | 85.0        | 7 ●       |
| 4.1.2 Domestic credit to private sector, % GDP..... | 29.9        | 100 ○     |
| 4.1.3 Microfinance gross loans, % GDP.....          | 0.0         | 72 ○      |

|   |       |       |
|---|-------|-------|
| 4.2 Investment.....                                     | 31.7  | 102 ○ |
| 4.2.1 Ease of protecting minority investors*.....       | 60.0  | 52    |
| 4.2.2 Market capitalization, % GDP <sup>Ⓔ</sup> .....   | 7.6   | 79 ○  |
| 4.2.3 Venture capital deals/bn PPP\$ GDP.....           | 0.0   | 67    |
| 4.3 Trade, competition, & market scale.....             | 69.0  | 39    |
| 4.3.1 Applied tariff rate, weighted mean, %.....        | 1.6   | 23    |
| 4.3.2 Intensity of local competition <sup>†</sup> ..... | 63.1  | 88    |
| 4.3.3 Domestic market scale, bn PPP\$.....              | 441.0 | 40    |

|   |             |           |
|---|-------------|-----------|
| <b>5 Business sophistication.....</b>                               | <b>33.0</b> | <b>63</b> |
| 5.1 Knowledge workers.....  | 37.4        | 63        |
| 5.1.1 Knowledge-intensive employment, %.....                        | 22.7        | 63        |
| 5.1.2 Firms offering formal training, % firms.....                  | 40.7        | 32        |
| 5.1.3 GERD performed by business, % of GDP.....                     | 0.2         | 49        |
| 5.1.4 GERD financed by business, %.....                             | 37.3        | 39        |
| 5.1.5 Females employed w/advanced degrees, % total.....             | 10.6        | 63        |
| 5.2 Innovation linkages.....  | 25.5        | 71        |
| 5.2.1 University/industry research collaboration <sup>†</sup> ..... | 38.8        | 77        |
| 5.2.2 State of cluster development <sup>†</sup> .....               | 37.0        | 95 ○      |
| 5.2.3 GERD financed by abroad, %.....                               | 19.2        | 21 ●      |
| 5.2.4 JV-strategic alliance deals/bn PPP\$ GDP.....                 | 0.0         | 108 ○     |
| 5.2.5 Patent families 2+ offices/bn PPP\$ GDP.....                  | 0.1         | 75        |
| 5.3 Knowledge absorption.....                                       | 36.1        | 50        |
| 5.3.1 Intellectual property payments, % total trade.....            | 1.1         | 28        |
| 5.3.2 High-tech imports less re-imports, % total trade.....         | 10.3        | 43        |
| 5.3.3 ICT services imports, % total trade.....                      | 1.8         | 26 ●      |
| 5.3.4 FDI net inflows, % GDP.....                                   | 2.1         | 79        |
| 5.3.5 Research talent, % in business enterprise.....                | 24.3        | 51        |

|   |             |           |
|---|-------------|-----------|
| <b>6 Knowledge &amp; technology outputs.....</b>                  | <b>31.0</b> | <b>37</b> |
| 6.1 Knowledge creation.....                                       | 9.5         | 66        |
| 6.1.1 Patents by origin/bn PPP\$ GDP.....                         | 2.4         | 41        |
| 6.1.2 PCT patent applications/bn PPP\$ GDP.....                   | 0.1         | 65        |
| 6.1.3 Utility models by origin/bn PPP\$ GDP.....                  | 0.1         | 48 ○      |
| 6.1.4 Scientific & technical articles/bn PPP\$ GDP.....           | 16.5        | 45        |
| 6.1.5 Citable documents H index.....                              | 14.8        | 47        |
| 6.2 Knowledge impact.....   | 57.9        | 4 ●       |
| 6.2.1 Growth rate of PPP\$ GDP/worker, %.....                     | 4.7         | 8 ●       |
| 6.2.2 New businesses/th pop. 15–64.....                           | 4.1         | 31        |
| 6.2.3 Computer software spending, % GDP.....                      | 0.3         | 45        |
| 6.2.4 ISO 9001 quality certificates/bn PPP\$ GDP.....             | 49.5        | 2 ●       |
| 6.2.5 High- & medium-high-tech manufactures, % <sup>Ⓔ</sup> ..... | 0.4         | 27        |
| 6.3 Knowledge diffusion.....                                      | 25.6        | 51        |
| 6.3.1 Intellectual property receipts, % total trade.....          | 0.1         | 47        |
| 6.3.2 High-tech exports less re-exports, % total trade.....       | 6.0         | 29        |
| 6.3.3 ICT services exports, % total trade.....                    | 4.1         | 18 ●      |
| 6.3.4 FDI net outflows, % GDP.....                                | 0.2         | 82        |

|   |             |           |
|---|-------------|-----------|
| <b>7 Creative outputs.....</b>  | <b>32.9</b> | <b>57</b> |
| 7.1 Intangible assets.....  | 39.8        | 75        |
| 7.1.1 Trademarks by origin/bn PPP\$ GDP.....                                    | 52.7        | 42        |
| 7.1.2 Industrial designs by origin/bn PPP\$ GDP.....                            | 2.5         | 40        |
| 7.1.3 ICTs & business model creation <sup>†</sup> .....                         | 57.2        | 77        |
| 7.1.4 ICTs & organizational model creation <sup>†</sup> .....                   | 48.7        | 79        |
| 7.2 Creative goods & services.....  | 25.2        | 46        |
| 7.2.1 Cultural & creative services exports, % of total trade <sup>Ⓔ</sup> ..... | 1.6         | 5 ●       |
| 7.2.2 National feature films/mn pop. 15–69.....                                 | 1.8         | 62        |
| 7.2.3 Global ent. & media market/th pop. 15–69.....                             | 4.9         | 45        |
| 7.2.4 Printing & publishing manufactures, % <sup>Ⓔ</sup> .....                  | 1.1         | 62        |
| 7.2.5 Creative goods exports, % total trade.....                                | 1.2         | 39        |
| 7.3 Online creativity.....  | 26.9        | 43        |
| 7.3.1 Generic top-level domains (TLDs)/th pop. 15–69.....                       | 4.5         | 57        |
| 7.3.2 Country-code TLDs/th pop. 15–69.....                                      | 18.4        | 29 ●      |
| 7.3.3 Wikipedia edits/mn pop. 15–69.....  | 5.1         | 59        |
| 7.3.4 Video uploads on YouTube/pop. 15–69.....                                  | 35.4        | 40        |

NOTES: ● indicates a strength; ○ a weakness; \* an index; † a survey question.

Ⓔ indicates that the country's data are older than the base year; see Appendix II for details, including the year of the data, at <http://globalinnovationindex.org>.

Square brackets indicate that the data minimum coverage (DMC) requirements were not met at the sub-pillar or pillar level; see page 181 of this appendix for details.

## Key indicators

|                             |                     |
|-----------------------------|---------------------|
| Population (millions) ..... | 143.4               |
| GDP (US\$ billions) .....   | 1,267.8             |
| GDP per capita, PPP\$ ..... | 25,410.9            |
| Income group .....          | Upper-middle income |
| Region .....                | Europe              |

|   | Score 0–100<br>or value (hard data) | Rank      |
|---|-------------------------------------|-----------|
| <b>Global Innovation Index (out of 127)</b> ..... | <b>38.8</b>                         | <b>45</b> |
| Innovation Output Sub-Index .....                 | 29.3                                | 51        |
| Innovation Input Sub-Index .....                  | 48.2                                | 43        |
| Innovation Efficiency Ratio .....                 | 0.6                                 | 75        |
| Global Innovation Index 2016 (out of 128) .....   | 38.5                                | 43        |

|  |             |           |
|--|-------------|-----------|
| <b>1 Institutions</b> .....                                    | <b>56.1</b> | <b>73</b> |
| 1.1 Political environment .....                                | 37.9        | 100 ○     |
| 1.1.1 Political stability & safety* .....                      | 38.4        | 112 ○     |
| 1.1.2 Government effectiveness* .....                          | 37.5        | 80        |
| 1.2 Regulatory environment .....                               | 52.5        | 94 ○      |
| 1.2.1 Regulatory quality* .....                                | 28.8        | 102 ○     |
| 1.2.2 Rule of law* .....                                       | 18.4        | 104 ○     |
| 1.2.3 Cost of redundancy dismissal, salary weeks .....         | 17.3        | 73        |
| 1.3 Business environment .....                                 | 77.7        | 36        |
| 1.3.1 Ease of starting a business* .....                       | 93.6        | 23        |
| 1.3.2 Ease of resolving insolvency* .....                      | 56.7        | 48        |
| 1.3.3 Ease of paying taxes* .....                              | 83.0        | 38        |
| <b>2 Human capital &amp; research</b> .....                    | <b>50.0</b> | <b>23</b> |
| 2.1 Education .....  | 59.7        | 23        |
| 2.1.1 Expenditure on education, % GDP <sup>Ⓐ</sup> .....       | 3.9         | 83        |
| 2.1.2 Gov't expenditure/pupil, secondary, % GDP/cap .....      | n/a         | n/a       |
| 2.1.3 School life expectancy, years .....                      | 15.0        | 50        |
| 2.1.4 PISA scales in reading, maths, & science .....           | 491.8       | 26        |
| 2.1.5 Pupil-teacher ratio, secondary <sup>Ⓐ</sup> .....        | 8.8         | 14 ●      |
| 2.2 Tertiary education .....                                   | 48.8        | 23        |
| 2.2.1 Tertiary enrolment, % gross <sup>Ⓐ</sup> .....           | 78.7        | 17 ●      |
| 2.2.2 Graduates in science & engineering, % <sup>Ⓐ</sup> ..... | 28.1        | 13 ●      |
| 2.2.3 Tertiary inbound mobility, % <sup>Ⓐ</sup> .....          | 3.0         | 56        |
| 2.3 Research & development (R&D) .....                         | 41.5        | 25        |
| 2.3.1 Researchers, FTE/mn pop. .....                           | 3,131.1     | 29        |
| 2.3.2 Gross expenditure on R&D, % GDP .....                    | 1.1         | 34        |
| 2.3.3 Global R&D companies, avg. expend. top 3, mn \$US .....  | 55.6        | 25        |
| 2.3.4 QS university ranking, average score top 3* .....        | 46.5        | 25        |
| <b>3 Infrastructure</b> .....                                  | <b>47.5</b> | <b>62</b> |
| 3.1 Information & communication technologies (ICTs) .....      | 69.7        | 36        |
| 3.1.1 ICT access* .....  | 72.3        | 44        |
| 3.1.2 ICT use* .....   | 58.7        | 40        |
| 3.1.3 Government's online service* .....                       | 73.2        | 37        |
| 3.1.4 E-participation* .....                                   | 74.6        | 32        |
| 3.2 General infrastructure .....                               | 33.1        | 81        |
| 3.2.1 Electricity output, kWh/cap .....                        | 7,386.5     | 25        |
| 3.2.2 Logistics performance* .....                             | 23.5        | 96 ○      |
| 3.2.3 Gross capital formation, % GDP .....                     | 21.6        | 69        |
| 3.3 Ecological sustainability .....                            | 39.8        | 83        |
| 3.3.1 GDP/unit of energy use .....                             | 4.5         | 108 ○     |
| 3.3.2 Environmental performance* .....                         | 83.5        | 32        |
| 3.3.3 ISO 14001 environmental certificates/bn PPP\$ GDP .....  | 0.3         | 94 ○      |
| <b>4 Market sophistication</b> .....                           | <b>47.1</b> | <b>60</b> |
| 4.1 Credit .....   | 29.4        | 81        |
| 4.1.1 Ease of getting credit* .....                            | 65.0        | 40        |
| 4.1.2 Domestic credit to private sector, % GDP .....           | 56.4        | 57        |
| 4.1.3 Microfinance gross loans, % GDP .....                    | 0.1         | 60        |

|   |         |      |
|---|---------|------|
| 4.2 Investment .....                                    | 33.2    | 95 ○ |
| 4.2.1 Ease of protecting minority investors* .....      | 60.0    | 52   |
| 4.2.2 Market capitalization, % GDP .....                | 29.5    | 48   |
| 4.2.3 Venture capital deals/bn PPP\$ GDP .....          | 0.0     | 90 ○ |
| 4.3 Trade, competition, & market scale .....            | 78.7    | 12 ● |
| 4.3.1 Applied tariff rate, weighted mean, % .....       | 2.8     | 66   |
| 4.3.2 Intensity of local competition <sup>†</sup> ..... | 65.8    | 78   |
| 4.3.3 Domestic market scale, bn PPP\$ .....             | 3,745.1 | 6 ●  |

## 5 Business sophistication ..... 40.3 33

|   |      |       |
|---|------|-------|
| 5.1 Knowledge workers .....   | 59.8 | 24    |
| 5.1.1 Knowledge-intensive employment, % .....                       | 44.3 | 15 ●  |
| 5.1.2 Firms offering formal training, % firms <sup>Ⓐ</sup> .....    | 46.2 | 26    |
| 5.1.3 GERD performed by business, % of GDP .....                    | 0.7  | 28    |
| 5.1.4 GERD financed by business, % .....                            | 26.5 | 56    |
| 5.1.5 Females employed w/advanced degrees, % total .....            | 33.2 | 2 ●   |
| 5.2 Innovation linkages .....                                       | 20.2 | 105 ○ |
| 5.2.1 University/industry research collaboration <sup>†</sup> ..... | 44.6 | 44    |
| 5.2.2 State of cluster development <sup>†</sup> .....               | 39.4 | 86    |
| 5.2.3 GERD financed by abroad, % .....                              | 2.6  | 70    |
| 5.2.4 JV-strategic alliance deals/bn PPP\$ GDP .....                | 0.0  | 62    |
| 5.2.5 Patent families 2+ offices/bn PPP\$ GDP .....                 | 0.2  | 50    |
| 5.3 Knowledge absorption .....                                      | 41.0 | 31    |
| 5.3.1 Intellectual property payments, % total trade .....           | 1.7  | 16 ●  |
| 5.3.2 High-tech imports less re-imports, % total trade .....        | 8.5  | 59    |
| 5.3.3 ICT services imports, % total trade .....                     | 1.6  | 35    |
| 5.3.4 FDI net inflows, % GDP .....                                  | 1.6  | 94 ○  |
| 5.3.5 Research talent, % in business enterprise .....               | 46.4 | 29    |

## 6 Knowledge & technology outputs ..... 27.6 45

|  |       |       |
|--|-------|-------|
| 6.1 Knowledge creation .....                                 | 38.4  | 22 ●  |
| 6.1.1 Patents by origin/bn PPP\$ GDP .....                   | 7.9   | 15 ●  |
| 6.1.2 PCT patent applications/bn PPP\$ GDP .....             | 0.2   | 49    |
| 6.1.3 Utility models by origin/bn PPP\$ GDP .....            | 3.1   | 8 ●   |
| 6.1.4 Scientific & technical articles/bn PPP\$ GDP .....     | 8.8   | 70    |
| 6.1.5 Citable documents H index .....                        | 36.6  | 22 ●  |
| 6.2 Knowledge impact .....                                   | 15.6  | 111 ○ |
| 6.2.1 Growth rate of PPP\$ GDP/worker, % .....               | (4.8) | 110 ○ |
| 6.2.2 New businesses/th pop. 15–64 .....                     | 4.2   | 29    |
| 6.2.3 Computer software spending, % GDP .....                | 0.3   | 35    |
| 6.2.4 ISO 9001 quality certificates/bn PPP\$ GDP .....       | 2.4   | 85    |
| 6.2.5 High- & medium-high-tech manufactures, % .....         | 0.2   | 51    |
| 6.3 Knowledge diffusion .....                                | 28.7  | 43    |
| 6.3.1 Intellectual property receipts, % total trade .....    | 0.2   | 37    |
| 6.3.2 High-tech exports less re-exports, % total trade ..... | 3.4   | 44    |
| 6.3.3 ICT services exports, % total trade .....              | 1.2   | 76    |
| 6.3.4 FDI net outflows, % GDP .....                          | 2.8   | 24    |

## 7 Creative outputs ..... 31.0 62

|   |      |      |
|---|------|------|
| 7.1 Intangible assets .....   | 37.6 | 87   |
| 7.1.1 Trademarks by origin/bn PPP\$ GDP .....                                   | 43.4 | 56   |
| 7.1.2 Industrial designs by origin/bn PPP\$ GDP .....                           | 0.7  | 72   |
| 7.1.3 ICTs & business model creation <sup>†</sup> .....                         | 52.7 | 91   |
| 7.1.4 ICTs & organizational model creation <sup>†</sup> .....                   | 55.1 | 55   |
| 7.2 Creative goods & services .....   | 18.9 | 61   |
| 7.2.1 Cultural & creative services exports, % of total trade <sup>Ⓐ</sup> ..... | 0.9  | 17   |
| 7.2.2 National feature films/mn pop. 15–69 .....                                | 1.1  | 76   |
| 7.2.3 Global ent. & media market/th pop. 15–69 .....                            | 4.6  | 48 ○ |
| 7.2.4 Printing & publishing manufactures, % .....                               | 1.2  | 47   |
| 7.2.5 Creative goods exports, % total trade .....                               | 0.8  | 49   |
| 7.3 Online creativity .....   | 30.1 | 39   |
| 7.3.1 Generic top-level domains (TLDs)/th pop. 15–69 .....                      | 3.3  | 61   |
| 7.3.2 Country-code TLDs/th pop. 15–69 .....                                     | 15.2 | 34   |
| 7.3.3 Wikipedia edits/mn pop. 15–69 .....                                       | 6.2  | 34   |
| 7.3.4 Video uploads on YouTube/pop. 15–69 .....                                 | 42.1 | 28   |

NOTES: ● indicates a strength; ○ a weakness; \* an index; † a survey question.

Ⓐ indicates that the country's data are older than the base year; see Appendix II for details, including the year of the data, at <http://globalinnovationindex.org>.

Square brackets indicate that the data minimum coverage (DMC) requirements were not met at the sub-pillar or pillar level; see page 181 of this appendix for details.

## Rwanda

## Key indicators

|                            |                    |
|----------------------------|--------------------|
| Population (millions)..... | 11.9               |
| GDP (US\$ billions).....   | 8.3                |
| GDP per capita, PPP\$..... | 1,807.0            |
| Income group.....          | Low income         |
| Region.....                | Sub-Saharan Africa |

|  | Score 0–100<br>or value (hard data) | Rank      |
|--|-------------------------------------|-----------|
| <b>Global Innovation Index (out of 127).....</b> | <b>27.4</b>                         | <b>99</b> |
| Innovation Output Sub-Index.....                 | 13.7                                | 121 ○     |
| Innovation Input Sub-Index.....                  | 41.1                                | 76        |
| Innovation Efficiency Ratio.....                 | 0.3                                 | 125 ○     |
| Global Innovation Index 2016 (out of 128).....   | 30.0                                | 83        |

|   |             |           |
|---|-------------|-----------|
| <b>1 Institutions.....</b>                            | <b>63.5</b> | <b>61</b> |
| 1.1 Political environment.....                        | 51.5        | 65        |
| 1.1.1 Political stability & safety*.....              | 61.8        | 67        |
| 1.1.2 Government effectiveness*.....                  | 41.1        | 74        |
| 1.2 Regulatory environment.....                       | 67.6        | 50        |
| 1.2.1 Regulatory quality*.....                        | 48.5        | 62        |
| 1.2.2 Rule of law*.....                               | 41.5        | 55        |
| 1.2.3 Cost of redundancy dismissal, salary weeks..... | 13.0        | 45        |
| 1.3 Business environment.....                         | 71.6        | 60        |
| 1.3.1 Ease of starting a business*.....               | 87.2        | 63        |
| 1.3.2 Ease of resolving insolvency*.....              | 47.9        | 67        |
| 1.3.3 Ease of paying taxes*.....                      | 79.7        | 50        |

|  |             |           |
|--|-------------|-----------|
| <b>2 Human capital &amp; research.....</b>                     | <b>23.5</b> | <b>90</b> |
| 2.1 Education.....   | 46.4        | 67        |
| 2.1.1 Expenditure on education, % GDP.....                     | 5.0         | 47        |
| 2.1.2 Gov't expenditure/pupil, secondary, % GDP/cap.....       | 39.0        | 6 ●       |
| 2.1.3 School life expectancy, years <sup>Ⓐ</sup> .....         | 11.0        | 95        |
| 2.1.4 PISA scales in reading, maths, & science.....            | n/a         | n/a       |
| 2.1.5 Pupil-teacher ratio, secondary <sup>Ⓐ</sup> .....        | 21.7        | 85        |
| 2.2 Tertiary education.....                                    | 24.2        | 95        |
| 2.2.1 Tertiary enrolment, % gross <sup>Ⓐ</sup> .....           | 7.5         | 111       |
| 2.2.2 Graduates in science & engineering, % <sup>Ⓐ</sup> ..... | 22.5        | 39        |
| 2.2.3 Tertiary inbound mobility, % <sup>Ⓐ</sup> .....          | 1.0         | 82        |
| 2.3 Research & development (R&D).....                          | 0.0         | 115 ○     |
| 2.3.1 Researchers, FTE/mn pop. <sup>Ⓐ</sup> .....              | 12.3        | 101 ○     |
| 2.3.2 Gross expenditure on R&D, % GDP.....                     | n/a         | n/a       |
| 2.3.3 Global R&D companies, avg. expend. top 3, mn \$US.....   | 0.0         | 43 ○      |
| 2.3.4 QS university ranking, average score top 3*.....         | 0.0         | 75 ○      |

|  |             |           |
|--|-------------|-----------|
| <b>3 Infrastructure.....</b>                                 | <b>40.4</b> | <b>85</b> |
| 3.1 Information & communication technologies (ICTs).....     | 34.0        | 100       |
| 3.1.1 ICT access*.....                                       | 26.5        | 117 ○     |
| 3.1.2 ICT use*.....  | 14.7        | 104       |
| 3.1.3 Government's online service*.....                      | 45.7        | 91        |
| 3.1.4 E-participation*.....                                  | 49.2        | 89        |
| 3.2 General infrastructure.....                              | 53.6        | 14 ●      |
| 3.2.1 Electricity output, kWh/cap.....                       | n/a         | n/a       |
| 3.2.2 Logistics performance*.....                            | 42.7        | 61        |
| 3.2.3 Gross capital formation, % GDP.....                    | 29.5        | 20 ●      |
| 3.3 Ecological sustainability.....                           | 33.6        | 109       |
| 3.3.1 GDP/unit of energy use.....                            | n/a         | n/a       |
| 3.3.2 Environmental performance*.....                        | 50.3        | 111       |
| 3.3.3 ISO 14001 environmental certificates/bn PPP\$ GDP..... | 0.0         | 123 ○     |

|   |             |           |
|---|-------------|-----------|
| <b>4 Market sophistication.....</b>                 | <b>40.9</b> | <b>93</b> |
| 4.1 Credit.....                                     | 38.3        | 54        |
| 4.1.1 Ease of getting credit*.....                  | 95.0        | 2 ●       |
| 4.1.2 Domestic credit to private sector, % GDP..... | 21.6        | 109       |
| 4.1.3 Microfinance gross loans, % GDP.....          | 0.7         | 31        |

|   |      |      |
|---|------|------|
| 4.2 Investment.....   | 39.6 | 67   |
| 4.2.1 Ease of protecting minority investors*.....           | 51.7 | 86   |
| 4.2.2 Market capitalization, % GDP.....                     | n/a  | n/a  |
| 4.2.3 Venture capital deals/bn PPP\$ GDP <sup>Ⓐ</sup> ..... | 0.0  | 31 ● |
| 4.3 Trade, competition, & market scale.....                 | 44.8 | 116  |
| 4.3.1 Applied tariff rate, weighted mean, %.....            | 7.2  | 104  |
| 4.3.2 Intensity of local competition <sup>†</sup> .....     | 66.4 | 74   |
| 4.3.3 Domestic market scale, bn PPP\$.....                  | 22.0 | 117  |

|  |             |           |
|--|-------------|-----------|
| <b>5 Business sophistication.....</b>                                  | <b>37.0</b> | <b>44</b> |
| 5.1 Knowledge workers.....   | 37.0        | [66]      |
| 5.1.1 Knowledge-intensive employment, % <sup>Ⓐ</sup> .....             | 3.8         | 105 ○     |
| 5.1.2 Firms offering formal training, % firms <sup>Ⓐ</sup> .....       | 55.4        | 13 ●      |
| 5.1.3 GERD performed by business, % of GDP.....                        | n/a         | n/a       |
| 5.1.4 GERD financed by business, %.....                                | n/a         | n/a       |
| 5.1.5 Females employed w/advanced degrees, % total.....                | n/a         | n/a       |
| 5.2 Innovation linkages.....   | 41.7        | 25 ●      |
| 5.2.1 University/industry research collaboration <sup>†</sup> .....    | 38.9        | 75        |
| 5.2.2 State of cluster development <sup>†</sup> .....                  | 52.1        | 40 ●      |
| 5.2.3 GERD financed by abroad, %.....                                  | n/a         | n/a       |
| 5.2.4 JV-strategic alliance deals/bn PPP\$ GDP.....                    | 0.1         | 21 ●      |
| 5.2.5 Patent families 2+ offices/bn PPP\$ GDP.....                     | n/a         | n/a       |
| 5.3 Knowledge absorption.....  | 32.2        | 68        |
| 5.3.1 Intellectual property payments, % total trade <sup>Ⓐ</sup> ..... | 0.1         | 108 ○     |
| 5.3.2 High-tech imports less re-imports, % total trade.....            | 12.8        | 20 ●      |
| 5.3.3 ICT services imports, % total trade <sup>Ⓐ</sup> .....           | 0.5         | 95        |
| 5.3.4 FDI net inflows, % GDP.....                                      | 3.7         | 40 ●      |
| 5.3.5 Research talent, % in business enterprise.....                   | n/a         | n/a       |

|  |            |            |
|--|------------|------------|
| <b>6 Knowledge &amp; technology outputs.....</b>                       | <b>7.7</b> | <b>125</b> |
| 6.1 Knowledge creation.....  | 4.5        | 94         |
| 6.1.1 Patents by origin/bn PPP\$ GDP.....                              | 0.2        | 91         |
| 6.1.2 PCT patent applications/bn PPP\$ GDP <sup>Ⓐ</sup> .....          | 0.0        | 80         |
| 6.1.3 Utility models by origin/bn PPP\$ GDP.....                       | 0.2        | 41         |
| 6.1.4 Scientific & technical articles/bn PPP\$ GDP.....                | 9.5        | 69         |
| 6.1.5 Citable documents H index.....                                   | 2.3        | 114        |
| 6.2 Knowledge impact.....  | 4.3        | 120 ○      |
| 6.2.1 Growth rate of PPP\$ GDP/worker, %.....                          | n/a        | n/a        |
| 6.2.2 New businesses/th pop. 15–64.....                                | 1.5        | 57         |
| 6.2.3 Computer software spending, % GDP.....                           | 0.1        | 100        |
| 6.2.4 ISO 9001 quality certificates/bn PPP\$ GDP.....                  | 0.1        | 125 ○      |
| 6.2.5 High- & medium-high-tech manufactures, %.....                    | n/a        | n/a        |
| 6.3 Knowledge diffusion.....   | 14.2       | 115        |
| 6.3.1 Intellectual property receipts, % total trade <sup>Ⓐ</sup> ..... | 0.0        | 83         |
| 6.3.2 High-tech exports less re-exports, % total trade.....            | 0.5        | 89         |
| 6.3.3 ICT services exports, % total trade <sup>Ⓐ</sup> .....           | 0.9        | 86         |
| 6.3.4 FDI net outflows, % GDP.....                                     | 0.1        | 93         |

|   |             |            |
|---|-------------|------------|
| <b>7 Creative outputs.....</b>  | <b>19.6</b> | <b>103</b> |
| 7.1 Intangible assets.....  | 36.0        | 93         |
| 7.1.1 Trademarks by origin/bn PPP\$ GDP.....                                    | 12.0        | 98         |
| 7.1.2 Industrial designs by origin/bn PPP\$ GDP.....                            | 0.2         | 92         |
| 7.1.3 ICTs & business model creation <sup>†</sup> .....                         | 68.0        | 36 ●       |
| 7.1.4 ICTs & organizational model creation <sup>†</sup> .....                   | 51.7        | 68         |
| 7.2 Creative goods & services.....  | 3.3         | [116]      |
| 7.2.1 Cultural & creative services exports, % of total trade <sup>Ⓐ</sup> ..... | 0.0         | 87 ○       |
| 7.2.2 National feature films/mn pop. 15–69.....                                 | n/a         | n/a        |
| 7.2.3 Global ent. & media market/th pop. 15–69.....                             | n/a         | n/a        |
| 7.2.4 Printing & publishing manufactures, %.....                                | n/a         | n/a        |
| 7.2.5 Creative goods exports, % total trade.....                                | 0.1         | 84         |
| 7.3 Online creativity.....  | 3.2         | 119 ○      |
| 7.3.1 Generic top-level domains (TLDs)/th pop. 15–69.....                       | 0.2         | 118 ○      |
| 7.3.2 Country-code TLDs/th pop. 15–69.....                                      | 0.1         | 112        |
| 7.3.3 Wikipedia edits/mn pop. 15–69 <sup>Ⓐ</sup> .....                          | 1.0         | 117        |
| 7.3.4 Video uploads on YouTube/pop. 15–69.....                                  | n/a         | n/a        |

NOTES: ● indicates a strength; ○ a weakness; \* an index; † a survey question.

Ⓐ indicates that the country's data are older than the base year; see Appendix II for details, including the year of the data, at <http://globalinnovationindex.org>.

Square brackets indicate that the data minimum coverage (DMC) requirements were not met at the sub-pillar or pillar level; see page 181 of this appendix for details.

## Key indicators

|                            |                                  |
|----------------------------|----------------------------------|
| Population (millions)..... | 32.2                             |
| GDP (US\$ billions).....   | 637.8                            |
| GDP per capita, PPP\$..... | 53,624.4                         |
| Income group.....          | High income                      |
| Region.....                | Northern Africa and Western Asia |

|  | Score 0–100<br>or value (hard data) | Rank      |
|--|-------------------------------------|-----------|
| <b>Global Innovation Index (out of 127).....</b> | <b>36.2</b>                         | <b>55</b> |
| Innovation Output Sub-Index.....                 | 25.0                                | 66        |
| Innovation Input Sub-Index.....                  | 47.3                                | 46        |
| Innovation Efficiency Ratio.....                 | 0.5                                 | 96        |
| Global Innovation Index 2016 (out of 128).....   | 37.8                                | 49        |

|  |             |           |
|--|-------------|-----------|
| <b>1 Institutions.....</b>   | <b>52.4</b> | <b>88</b> |
| 1.1 Political environment.....   | 49.1        | 71        |
| 1.1.1 Political stability & safety*.....                               | 50.6        | 89        |
| 1.1.2 Government effectiveness*.....                                   | 47.5        | 60        |
| 1.2 Regulatory environment.....  | 56.9        | 79        |
| 1.2.1 Regulatory quality*.....   | 42.9        | 70        |
| 1.2.2 Rule of law*.....  | 46.8        | 49        |
| 1.2.3 Cost of redundancy dismissal, salary weeks.....                  | 23.7        | 99        |
| 1.3 Business environment.....  | 51.4        | 120 ○     |
| 1.3.1 Ease of starting a business*.....                                | 77.1        | 108 ○     |
| 1.3.2 Ease of resolving insolvency*.....                               | 0.0         | 127 ○     |
| 1.3.3 Ease of paying taxes*.....                                       | 77.0        | 58        |
| <b>2 Human capital &amp; research.....</b>                             | <b>46.5</b> | <b>31</b> |
| 2.1 Education.....   | 52.0        | 50        |
| 2.1.1 Expenditure on education, % GDP <sup>Ⓔ</sup> .....               | 5.1         | 45        |
| 2.1.2 Gov't expenditure/pupil, secondary, % GDP/cap <sup>Ⓔ</sup> ..... | 18.2        | 61        |
| 2.1.3 School life expectancy, years.....                               | 16.1        | 28 ●      |
| 2.1.4 PISA scales in reading, maths, & science.....                    | n/a         | n/a       |
| 2.1.5 Pupil-teacher ratio, secondary <sup>Ⓔ</sup> .....                | 11.0        | 31        |
| 2.2 Tertiary education.....  | 46.3        | 29 ●      |
| 2.2.1 Tertiary enrolment, % gross.....                                 | 63.1        | 40        |
| 2.2.2 Graduates in science & engineering, %.....                       | 26.9        | 20 ●      |
| 2.2.3 Tertiary inbound mobility, %.....                                | 4.8         | 38        |
| 2.3 Research & development (R&D).....                                  | 41.2        | 26 ●      |
| 2.3.1 Researchers, FTE/mn pop.....                                     | n/a         | n/a       |
| 2.3.2 Gross expenditure on R&D, % GDP <sup>Ⓔ</sup> .....               | 0.8         | 44        |
| 2.3.3 Global R&D companies, avg. expend. top 3, mn \$US.....           | 61.9        | 23 ●      |
| 2.3.4 QS university ranking, average score top 3*.....                 | 43.1        | 30 ●      |
| <b>3 Infrastructure.....</b>   | <b>53.3</b> | <b>40</b> |
| 3.1 Information & communication technologies (ICTs).....               | 68.7        | 38        |
| 3.1.1 ICT access*.....   | 72.9        | 42        |
| 3.1.2 ICT use*.....  | 63.2        | 31        |
| 3.1.3 Government's online service*.....                                | 67.4        | 49        |
| 3.1.4 E-participation*.....  | 71.2        | 39        |
| 3.2 General infrastructure.....  | 53.6        | 13 ●      |
| 3.2.1 Electricity output, kWh/cap.....                                 | 10,094.1    | 14 ●      |
| 3.2.2 Logistics performance*.....                                      | 50.6        | 51        |
| 3.2.3 Gross capital formation, % GDP.....                              | 31.7        | 13 ●      |
| 3.3 Ecological sustainability.....                                     | 37.6        | 89        |
| 3.3.1 GDP/unit of energy use.....                                      | 7.0         | 85        |
| 3.3.2 Environmental performance*.....                                  | 68.6        | 84        |
| 3.3.3 ISO 14001 environmental certificates/bn PPP\$ GDP.....           | 0.2         | 106 ○     |
| <b>4 Market sophistication.....</b>                                    | <b>49.4</b> | <b>51</b> |
| 4.1 Credit.....  | 36.0        | 59        |
| 4.1.1 Ease of getting credit*.....                                     | 50.0        | 72        |
| 4.1.2 Domestic credit to private sector, % GDP.....                    | 56.6        | 56        |
| 4.1.3 Microfinance gross loans, % GDP.....                             | n/a         | n/a       |

|  |         |      |
|--|---------|------|
| 4.2 Investment.....  | 36.5    | 82   |
| 4.2.1 Ease of protecting minority investors*.....              | 58.3    | 62   |
| 4.2.2 Market capitalization, % GDP.....                        | 65.2    | 25   |
| 4.2.3 Venture capital deals/bn PPP\$ GDP.....                  | 0.0     | 84 ○ |
| 4.3 Trade, competition, & market scale.....                    | 75.8    | 19 ● |
| 4.3.1 Applied tariff rate, weighted mean, % <sup>Ⓔ</sup> ..... | 3.4     | 75   |
| 4.3.2 Intensity of local competition <sup>†</sup> .....        | 73.4    | 36   |
| 4.3.3 Domestic market scale, bn PPP\$.....                     | 1,731.2 | 14 ● |

|   |             |           |
|---|-------------|-----------|
| <b>5 Business sophistication.....</b>                                 | <b>35.0</b> | <b>54</b> |
| 5.1 Knowledge workers.....  | 37.2        | [64]      |
| 5.1.1 Knowledge-intensive employment, %.....                          | 27.3        | 52        |
| 5.1.2 Firms offering formal training, % firms.....                    | n/a         | n/a       |
| 5.1.3 GERD performed by business, % of GDP.....                       | n/a         | n/a       |
| 5.1.4 GERD financed by business, %.....                               | n/a         | n/a       |
| 5.1.5 Females employed w/advanced degrees, % total <sup>Ⓔ</sup> ..... | 5.8         | 75 ○      |
| 5.2 Innovation linkages.....  | 33.8        | 49        |
| 5.2.1 University/industry research collaboration <sup>†</sup> .....   | 41.9        | 54        |
| 5.2.2 State of cluster development <sup>†</sup> .....                 | 60.6        | 22 ●      |
| 5.2.3 GERD financed by abroad, %.....                                 | n/a         | n/a       |
| 5.2.4 JV-strategic alliance deals/bn PPP\$ GDP.....                   | 0.0         | 80        |
| 5.2.5 Patent families 2+ offices/bn PPP\$ GDP.....                    | 0.2         | 51        |
| 5.3 Knowledge absorption.....   | 34.0        | 59        |
| 5.3.1 Intellectual property payments, % total trade.....              | n/a         | n/a       |
| 5.3.2 High-tech imports less re-imports, % total trade.....           | 9.1         | 53        |
| 5.3.3 ICT services imports, % total trade.....                        | 1.4         | 49        |
| 5.3.4 FDI net inflows, % GDP.....                                     | 1.2         | 101 ○     |
| 5.3.5 Research talent, % in business enterprise.....                  | n/a         | n/a       |

|   |             |           |
|---|-------------|-----------|
| <b>6 Knowledge &amp; technology outputs.....</b>                  | <b>21.6</b> | <b>62</b> |
| 6.1 Knowledge creation.....                                       | 7.8         | 75        |
| 6.1.1 Patents by origin/bn PPP\$ GDP.....                         | 0.5         | 74        |
| 6.1.2 PCT patent applications/bn PPP\$ GDP.....                   | 0.2         | 55        |
| 6.1.3 Utility models by origin/bn PPP\$ GDP.....                  | n/a         | n/a       |
| 6.1.4 Scientific & technical articles/bn PPP\$ GDP.....           | 8.0         | 74        |
| 6.1.5 Citable documents H index.....                              | 15.5        | 42        |
| 6.2 Knowledge impact.....   | 38.6        | 39        |
| 6.2.1 Growth rate of PPP\$ GDP/worker, %.....                     | 1.0         | 53        |
| 6.2.2 New businesses/th pop. 15–64.....                           | n/a         | n/a       |
| 6.2.3 Computer software spending, % GDP.....                      | 0.4         | 23 ●      |
| 6.2.4 ISO 9001 quality certificates/bn PPP\$ GDP.....             | 1.8         | 95        |
| 6.2.5 High- & medium-high-tech manufactures, % <sup>Ⓔ</sup> ..... | 0.4         | 29        |
| 6.3 Knowledge diffusion.....                                      | 18.6        | 93        |
| 6.3.1 Intellectual property receipts, % total trade.....          | n/a         | n/a       |
| 6.3.2 High-tech exports less re-exports, % total trade.....       | 0.1         | 109 ○     |
| 6.3.3 ICT services exports, % total trade.....                    | 0.1         | 120 ○     |
| 6.3.4 FDI net outflows, % GDP.....                                | 0.7         | 62        |

|   |             |           |
|---|-------------|-----------|
| <b>7 Creative outputs.....</b>                                    | <b>28.4</b> | <b>74</b> |
| 7.1 Intangible assets.....  | 36.4        | 92        |
| 7.1.1 Trademarks by origin/bn PPP\$ GDP.....                      | 4.4         | 113 ○     |
| 7.1.2 Industrial designs by origin/bn PPP\$ GDP.....              | 0.2         | 97 ○      |
| 7.1.3 ICTs & business model creation <sup>†</sup> .....           | 68.8        | 33        |
| 7.1.4 ICTs & organizational model creation <sup>†</sup> .....     | 56.5        | 51        |
| 7.2 Creative goods & services.....                                | 17.1        | 69        |
| 7.2.1 Cultural & creative services exports, % of total trade..... | n/a         | n/a       |
| 7.2.2 National feature films/mn pop. 15–69.....                   | n/a         | n/a       |
| 7.2.3 Global ent. & media market/th pop. 15–69.....               | 11.3        | 31        |
| 7.2.4 Printing & publishing manufactures, % <sup>Ⓔ</sup> .....    | 2.3         | 17 ●      |
| 7.2.5 Creative goods exports, % total trade.....                  | 0.1         | 96        |
| 7.3 Online creativity.....  | 23.5        | 54        |
| 7.3.1 Generic top-level domains (TLDs)/th pop. 15–69.....         | 3.1         | 63        |
| 7.3.2 Country-code TLDs/th pop. 15–69.....                        | 0.6         | 87        |
| 7.3.3 Wikipedia edits/mn pop. 15–69.....                          | 4.6         | 66        |
| 7.3.4 Video uploads on YouTube/pop. 15–69.....                    | 45.4        | 21        |

NOTES: ● indicates a strength; ○ a weakness; \* an index; † a survey question.

Ⓔ indicates that the country's data are older than the base year; see Appendix II for details, including the year of the data, at <http://globalinnovationindex.org>.

Square brackets indicate that the data minimum coverage (DMC) requirements were not met at the sub-pillar or pillar level; see page 181 of this appendix for details.



## Senegal

## Key indicators

|                       |                    |
|-----------------------|--------------------|
| Population (millions) | 15.6               |
| GDP (US\$ billions)   | 14.9               |
| GDP per capita, PPP\$ | 2,451.3            |
| Income group          | Low income         |
| Region                | Sub-Saharan Africa |

|   | Score 0–100<br>or value (hard data) | Rank       |
|---|-------------------------------------|------------|
| <b>Global Innovation Index (out of 127)</b> | <b>27.1</b>                         | <b>100</b> |
| Innovation Output Sub-Index                 | 19.0                                | 98         |
| Innovation Input Sub-Index                  | 35.2                                | 102        |
| Innovation Efficiency Ratio                 | 0.5                                 | 95         |
| Global Innovation Index 2016 (out of 128)   | 26.1                                | 106        |

|  |             |            |
|--|-------------|------------|
| <b>1 Institutions</b>  | <b>54.5</b> | <b>80</b>  |
| 1.1 Political environment  | 45.4        | 81         |
| 1.1.1 Political stability & safety*                              | 59.7        | 72         |
| 1.1.2 Government effectiveness*                                  | 31.0        | 90         |
| 1.2 Regulatory environment                                       | 61.4        | 71         |
| 1.2.1 Regulatory quality*  | 37.5        | 79         |
| 1.2.2 Rule of law*   | 35.0        | 69         |
| 1.2.3 Cost of redundancy dismissal, salary weeks                 | 14.8        | 59         |
| 1.3 Business environment   | 56.8        | 109        |
| 1.3.1 Ease of starting a business*                               | 86.1        | 73         |
| 1.3.2 Ease of resolving insolvency*                              | 40.7        | 90         |
| 1.3.3 Ease of paying taxes*                                      | 43.7        | 120 ○      |
| <b>2 Human capital &amp; research</b>                            | <b>31.7</b> | <b>67</b>  |
| 2.1 Education  | 45.6        | 69         |
| 2.1.1 Expenditure on education, % GDP                            | 7.2         | ●          |
| 2.1.2 Gov't expenditure/pupil, secondary, % GDP/cap <sup>Ⓔ</sup> | 27.6        | ●          |
| 2.1.3 School life expectancy, years                              | 9.0         | 107 ○      |
| 2.1.4 PISA scales in reading, maths, & science                   | n/a         | n/a        |
| 2.1.5 Pupil-teacher ratio, secondary                             | 20.4        | 82         |
| 2.2 Tertiary education   | 45.4        | ●          |
| 2.2.1 Tertiary enrolment, % gross                                | 10.4        | 103        |
| 2.2.2 Graduates in science & engineering, %                      | n/a         | n/a        |
| 2.2.3 Tertiary inbound mobility, %                               | 15.8        | ●          |
| 2.3 Research & development (R&D)                                 | 4.1         | 79         |
| 2.3.1 Researchers, FTE/mn pop. <sup>Ⓔ</sup>                      | 361.1       | 68         |
| 2.3.2 Gross expenditure on R&D, % GDP <sup>Ⓔ</sup>               | 0.5         | 61         |
| 2.3.3 Global R&D companies, avg. expend. top 3, mn \$US          | 0.0         | 43 ○       |
| 2.3.4 QS university ranking, average score top 3*                | 0.0         | 75 ○       |
| <b>3 Infrastructure</b>  | <b>33.1</b> | <b>106</b> |
| 3.1 Information & communication technologies (ICTs)              | 32.2        | 106        |
| 3.1.1 ICT access*  | 35.9        | 102        |
| 3.1.2 ICT use*   | 16.4        | 103        |
| 3.1.3 Government's online service*                               | 37.7        | 100        |
| 3.1.4 E-participation*   | 39.0        | 98         |
| 3.2 General infrastructure                                       | 29.5        | 94         |
| 3.2.1 Electricity output, kWh/cap.                               | 254.2       | 110        |
| 3.2.2 Logistics performance*                                     | 12.2        | 119 ○      |
| 3.2.3 Gross capital formation, % GDP                             | 26.6        | ●          |
| 3.3 Ecological sustainability                                    | 37.6        | 90         |
| 3.3.1 GDP/unit of energy use                                     | 8.1         | 69         |
| 3.3.2 Environmental performance*                                 | 63.7        | 97         |
| 3.3.3 ISO 14001 environmental certificates/bn PPP\$ GDP          | 0.5         | 84         |
| <b>4 Market sophistication</b>                                   | <b>32.4</b> | <b>115</b> |
| 4.1 Credit   | 23.2        | 106        |
| 4.1.1 Ease of getting credit*                                    | 30.0        | 108        |
| 4.1.2 Domestic credit to private sector, % GDP                   | 33.3        | 96         |
| 4.1.3 Microfinance gross loans, % GDP                            | 1.5         | ●          |

|   |      |       |
|---|------|-------|
| 4.2 Investment  | 30.6 | 108   |
| 4.2.1 Ease of protecting minority investors*          | 41.7 | 105   |
| 4.2.2 Market capitalization, % GDP                    | n/a  | n/a   |
| 4.2.3 Venture capital deals/bn PPP\$ GDP <sup>Ⓔ</sup> | 0.0  | 43    |
| 4.3 Trade, competition, & market scale                | 43.3 | 118   |
| 4.3.1 Applied tariff rate, weighted mean, %           | 11.6 | 118 ○ |
| 4.3.2 Intensity of local competition <sup>†</sup>     | 70.6 | ●     |
| 4.3.3 Domestic market scale, bn PPP\$                 | 39.7 | 97    |

**5 Business sophistication** 24.5 105

|  |      |       |
|--|------|-------|
| 5.1 Knowledge workers  | 8.8  | 124 ○ |
| 5.1.1 Knowledge-intensive employment, %                          | n/a  | n/a   |
| 5.1.2 Firms offering formal training, % firms                    | 17.4 | 82    |
| 5.1.3 GERD performed by business, % of GDP <sup>Ⓔ</sup>          | 0.0  | 85 ○  |
| 5.1.4 GERD financed by business, % <sup>Ⓔ</sup>                  | 4.1  | 80    |
| 5.1.5 Females employed w/advanced degrees, % total <sup>Ⓔ</sup>  | 0.7  | 86 ○  |
| 5.2 Innovation linkages  | 39.0 | ●     |
| 5.2.1 University/industry research collaboration <sup>†</sup>    | 44.0 | ●     |
| 5.2.2 State of cluster development <sup>†</sup>                  | 44.4 | 69    |
| 5.2.3 GERD financed by abroad, % <sup>Ⓔ</sup>                    | 40.5 | ●     |
| 5.2.4 JV-strategic alliance deals/bn PPP\$ GDP                   | 0.0  | 86    |
| 5.2.5 Patent families 2+ offices/bn PPP\$ GDP <sup>Ⓔ</sup>       | 0.1  | 76    |
| 5.3 Knowledge absorption   | 25.5 | 95    |
| 5.3.1 Intellectual property payments, % total trade <sup>Ⓔ</sup> | 0.1  | 98    |
| 5.3.2 High-tech imports less re-imports, % total trade           | 5.5  | 102   |
| 5.3.3 ICT services imports, % total trade <sup>Ⓔ</sup>           | 2.6  | ●     |
| 5.3.4 FDI net inflows, % GDP                                     | 2.4  | 74    |
| 5.3.5 Research talent, % in business enterprise <sup>Ⓔ</sup>     | 0.1  | 85 ○  |

**6 Knowledge & technology outputs** 18.4 86

|  |      |     |
|--|------|-----|
| 6.1 Knowledge creation   | 6.1  | 82  |
| 6.1.1 Patents by origin/bn PPP\$ GDP                             | 0.4  | 79  |
| 6.1.2 PCT patent applications/bn PPP\$ GDP                       | 0.2  | 53  |
| 6.1.3 Utility models by origin/bn PPP\$ GDP                      | n/a  | n/a |
| 6.1.4 Scientific & technical articles/bn PPP\$ GDP               | 10.3 | 65  |
| 6.1.5 Citable documents H index                                  | 6.2  | 85  |
| 6.2 Knowledge impact   | 25.7 | 89  |
| 6.2.1 Growth rate of PPP\$ GDP/worker, %                         | 1.3  | 49  |
| 6.2.2 New businesses/th pop. 15–64                               | 0.3  | 90  |
| 6.2.3 Computer software spending, % GDP                          | 0.3  | 56  |
| 6.2.4 ISO 9001 quality certificates/bn PPP\$ GDP                 | 1.7  | 99  |
| 6.2.5 High- & medium-high-tech manufactures, % <sup>Ⓔ</sup>      | 0.2  | 64  |
| 6.3 Knowledge diffusion  | 23.4 | 62  |
| 6.3.1 Intellectual property receipts, % total trade <sup>Ⓔ</sup> | 0.1  | 63  |
| 6.3.2 High-tech exports less re-exports, % total trade           | 0.6  | 78  |
| 6.3.3 ICT services exports, % total trade <sup>Ⓔ</sup>           | 5.2  | ●   |
| 6.3.4 FDI net outflows, % GDP                                    | 0.2  | 85  |

**7 Creative outputs** 19.6 104

|  |      |      |
|--|------|------|
| 7.1 Intangible assets  | 34.2 | 95   |
| 7.1.1 Trademarks by origin/bn PPP\$ GDP                      | 11.5 | 100  |
| 7.1.2 Industrial designs by origin/bn PPP\$ GDP              | 0.6  | 74   |
| 7.1.3 ICTs & business model creation <sup>†</sup>            | 59.7 | 66   |
| 7.1.4 ICTs & organizational model creation <sup>†</sup>      | 53.0 | 65   |
| 7.2 Creative goods & services                                | 6.5  | 100  |
| 7.2.1 Cultural & creative services exports, % of total trade | 0.2  | 47   |
| 7.2.2 National feature films/mn pop. 15–69                   | 0.4  | 95   |
| 7.2.3 Global ent. & media market/th pop. 15–69               | n/a  | n/a  |
| 7.2.4 Printing & publishing manufactures, % <sup>Ⓔ</sup>     | 0.8  | 72   |
| 7.2.5 Creative goods exports, % total trade                  | 0.1  | 93   |
| 7.3 Online creativity  | 3.4  | 115  |
| 7.3.1 Generic top-level domains (TLDs)/th pop. 15–69         | 1.0  | 95   |
| 7.3.2 Country-code TLDs/th pop. 15–69                        | 0.2  | 103  |
| 7.3.3 Wikipedia edits/mn pop. 15–69 <sup>Ⓔ</sup>             | 1.1  | 114  |
| 7.3.4 Video uploads on YouTube/pop. 15–69                    | 1.9  | 69 ○ |

NOTES: ● indicates a strength; ○ a weakness; \* an index; † a survey question.

Ⓔ indicates that the country's data are older than the base year; see Appendix II for details, including the year of the data, at <http://globalinnovationindex.org>.

Square brackets indicate that the data minimum coverage (DMC) requirements were not met at the sub-pillar or pillar level; see page 181 of this appendix for details.



## Key indicators

|                            |                     |
|----------------------------|---------------------|
| Population (millions)..... | 8.8                 |
| GDP (US\$ billions).....   | 37.8                |
| GDP per capita, PPP\$..... | 13,671.4            |
| Income group.....          | Upper-middle income |
| Region.....                | Europe              |

|  | Score 0–100<br>or value (hard data) | Rank      |
|--|-------------------------------------|-----------|
| <b>Global Innovation Index (out of 127).....</b> | <b>35.3</b>                         | <b>62</b> |
| Innovation Output Sub-Index.....                 | 26.9                                | 61        |
| Innovation Input Sub-Index.....                  | 43.8                                | 58        |
| Innovation Efficiency Ratio.....                 | 0.6                                 | 67        |
| Global Innovation Index 2016 (out of 128).....   | 33.8                                | 65        |

**1 Institutions.....67.7 50**

|   |      |     |
|---|------|-----|
| 1.1 Political environment.....                        | 57.2 | 52  |
| 1.1.1 Political stability & safety*.....              | 69.3 | 50  |
| 1.1.2 Government effectiveness*.....                  | 45.1 | 64  |
| 1.2 Regulatory environment.....                       | 70.6 | 43  |
| 1.2.1 Regulatory quality*.....                        | 45.6 | 67  |
| 1.2.2 Rule of law*.....                               | 36.6 | 64  |
| 1.2.3 Cost of redundancy dismissal, salary weeks..... | 8.0  | 1 ● |
| 1.3 Business environment.....                         | 75.2 | 48  |
| 1.3.1 Ease of starting a business*.....               | 91.7 | 40  |
| 1.3.2 Ease of resolving insolvency*.....              | 59.7 | 44  |
| 1.3.3 Ease of paying taxes*.....                      | 74.4 | 63  |

**2 Human capital & research.....33.9 54**

|  |         |      |
|--|---------|------|
| 2.1 Education.....   | 45.6    | 70   |
| 2.1.1 Expenditure on education, % GDP.....                             | 4.2     | 74   |
| 2.1.2 Gov't expenditure/pupil, secondary, % GDP/cap <sup>Ⓢ</sup> ..... | 13.1    | 88 ○ |
| 2.1.3 School life expectancy, years.....                               | 14.6    | 58   |
| 2.1.4 PISA scales in reading, maths, & science <sup>Ⓢ</sup> .....      | 446.6   | 43   |
| 2.1.5 Pupil-teacher ratio, secondary.....                              | 8.5     | 13 ● |
| 2.2 Tertiary education.....  | 43.7    | 38   |
| 2.2.1 Tertiary enrolment, % gross.....                                 | 58.3    | 43   |
| 2.2.2 Graduates in science & engineering, %.....                       | 26.2    | 22   |
| 2.2.3 Tertiary inbound mobility, %.....                                | 4.1     | 48   |
| 2.3 Research & development (R&D).....                                  | 12.6    | 53   |
| 2.3.1 Researchers, FTE/mn pop.....                                     | 2,071.2 | 35   |
| 2.3.2 Gross expenditure on R&D, % GDP.....                             | 0.9     | 40   |
| 2.3.3 Global R&D companies, avg. expend. top 3, mn \$US.....           | 0.0     | 43 ○ |
| 2.3.4 QS university ranking, average score top 3*.....                 | 5.1     | 71   |

**3 Infrastructure.....49.7 52**

|  |         |       |
|--|---------|-------|
| 3.1 Information & communication technologies (ICTs).....     | 73.0    | 31    |
| 3.1.1 ICT access*.....                                       | 72.2    | 45    |
| 3.1.2 ICT use*.....  | 55.0    | 49    |
| 3.1.3 Government's online service*.....                      | 81.9    | 24 ●  |
| 3.1.4 E-participation*.....                                  | 83.1    | 17 ●  |
| 3.2 General infrastructure.....                              | 29.1    | 95    |
| 3.2.1 Electricity output, kWh/cap.....                       | 4,690.9 | 45    |
| 3.2.2 Logistics performance*.....                            | 32.4    | 76    |
| 3.2.3 Gross capital formation, % GDP.....                    | 18.3    | 97    |
| 3.3 Ecological sustainability.....                           | 47.0    | 56    |
| 3.3.1 GDP/unit of energy use.....                            | 0.7     | 119 ○ |
| 3.3.2 Environmental performance*.....                        | 78.7    | 47    |
| 3.3.3 ISO 14001 environmental certificates/bn PPP\$ GDP..... | 11.5    | 4 ●   |

**4 Market sophistication.....38.7 99**

|   |      |    |
|---|------|----|
| 4.1 Credit.....                                     | 28.7 | 84 |
| 4.1.1 Ease of getting credit*.....                  | 65.0 | 40 |
| 4.1.2 Domestic credit to private sector, % GDP..... | 43.4 | 78 |
| 4.1.3 Microfinance gross loans, % GDP.....          | 0.3  | 45 |

|   |       |       |
|---|-------|-------|
| 4.2 Investment.....                                     | 39.0  | 69    |
| 4.2.1 Ease of protecting minority investors*.....       | 56.7  | 67    |
| 4.2.2 Market capitalization, % GDP <sup>Ⓢ</sup> .....   | 8.7   | 78 ○  |
| 4.2.3 Venture capital deals/bn PPP\$ GDP.....           | n/a   | n/a   |
| 4.3 Trade, competition, & market scale.....             | 48.4  | 107 ○ |
| 4.3.1 Applied tariff rate, weighted mean, %.....        | n/a   | n/a   |
| 4.3.2 Intensity of local competition <sup>†</sup> ..... | 53.9  | 118 ○ |
| 4.3.3 Domestic market scale, bn PPP\$.....              | 101.5 | 72    |

**5 Business sophistication.....28.9 79**

|   |      |       |
|---|------|-------|
| 5.1 Knowledge workers.....  | 35.9 | 72    |
| 5.1.1 Knowledge-intensive employment, %.....                          | 28.9 | 48    |
| 5.1.2 Firms offering formal training, % firms.....                    | 37.8 | 34    |
| 5.1.3 GERD performed by business, % of GDP.....                       | 0.3  | 48    |
| 5.1.4 GERD financed by business, %.....                               | 12.8 | 69    |
| 5.1.5 Females employed w/advanced degrees, % total <sup>Ⓢ</sup> ..... | 12.2 | 56    |
| 5.2 Innovation linkages.....  | 21.8 | 87    |
| 5.2.1 University/industry research collaboration <sup>†</sup> .....   | 35.9 | 89    |
| 5.2.2 State of cluster development <sup>†</sup> .....                 | 35.1 | 102 ○ |
| 5.2.3 GERD financed by abroad, %.....                                 | 12.6 | 40    |
| 5.2.4 JV-strategic alliance deals/bn PPP\$ GDP <sup>Ⓢ</sup> .....     | 0.0  | 91 ○  |
| 5.2.5 Patent families 2+ offices/bn PPP\$ GDP.....                    | 0.1  | 58    |
| 5.3 Knowledge absorption.....   | 29.1 | 82    |
| 5.3.1 Intellectual property payments, % total trade.....              | 0.9  | 37    |
| 5.3.2 High-tech imports less re-imports, % total trade.....           | 6.8  | 81    |
| 5.3.3 ICT services imports, % total trade.....                        | 1.6  | 39    |
| 5.3.4 FDI net inflows, % GDP.....                                     | 5.1  | 27 ●  |
| 5.3.5 Research talent, % in business enterprise.....                  | 9.6  | 67    |

**6 Knowledge & technology outputs.....24.7 53**

|   |      |       |
|---|------|-------|
| 6.1 Knowledge creation.....                                 | 19.2 | 49    |
| 6.1.1 Patents by origin/bn PPP\$ GDP.....                   | 1.9  | 47    |
| 6.1.2 PCT patent applications/bn PPP\$ GDP.....             | 0.1  | 57    |
| 6.1.3 Utility models by origin/bn PPP\$ GDP.....            | 0.6  | 33    |
| 6.1.4 Scientific & technical articles/bn PPP\$ GDP.....     | 49.2 | 8 ●   |
| 6.1.5 Citable documents H index.....                        | 8.3  | 74    |
| 6.2 Knowledge impact.....                                   | 30.4 | 68    |
| 6.2.1 Growth rate of PPP\$ GDP/worker, %.....               | 0.4  | 74    |
| 6.2.2 New businesses/th pop. 15–64.....                     | 1.6  | 53    |
| 6.2.3 Computer software spending, % GDP.....                | 0.0  | 103 ○ |
| 6.2.4 ISO 9001 quality certificates/bn PPP\$ GDP.....       | 25.7 | 12 ●  |
| 6.2.5 High- & medium-high-tech manufactures, %.....         | 0.3  | 45    |
| 6.3 Knowledge diffusion.....                                | 24.5 | 55    |
| 6.3.1 Intellectual property receipts, % total trade.....    | 0.2  | 39    |
| 6.3.2 High-tech exports less re-exports, % total trade..... | 2.2  | 53    |
| 6.3.3 ICT services exports, % total trade.....              | 3.4  | 23 ●  |
| 6.3.4 FDI net outflows, % GDP.....                          | 0.8  | 56    |

**7 Creative outputs.....29.1 70**

|   |      |       |
|---|------|-------|
| 7.1 Intangible assets.....  | 31.7 | 100   |
| 7.1.1 Trademarks by origin/bn PPP\$ GDP.....                      | 32.0 | 70    |
| 7.1.2 Industrial designs by origin/bn PPP\$ GDP.....              | 1.2  | 55    |
| 7.1.3 ICTs & business model creation <sup>†</sup> .....           | 49.7 | 101 ○ |
| 7.1.4 ICTs & organizational model creation <sup>†</sup> .....     | 42.1 | 103 ○ |
| 7.2 Creative goods & services.....                                | 19.8 | 59    |
| 7.2.1 Cultural & creative services exports, % of total trade..... | 0.2  | 45    |
| 7.2.2 National feature films/mn pop. 15–69.....                   | 5.4  | 37    |
| 7.2.3 Global ent. & media market/th pop. 15–69.....               | n/a  | n/a   |
| 7.2.4 Printing & publishing manufactures, %.....                  | 1.6  | 32    |
| 7.2.5 Creative goods exports, % total trade.....                  | 0.8  | 50    |
| 7.3 Online creativity.....  | 33.2 | 34    |
| 7.3.1 Generic top-level domains (TLDs)/th pop. 15–69.....         | 1.5  | 88    |
| 7.3.2 Country-code TLDs/th pop. 15–69.....                        | 4.4  | 53    |
| 7.3.3 Wikipedia edits/mn pop. 15–69.....                          | 10.4 | 1 ●   |
| 7.3.4 Video uploads on YouTube/pop. 15–69.....                    | 27.0 | 47    |

NOTES: ● indicates a strength; ○ a weakness; \* an index; † a survey question.

Ⓢ indicates that the country's data are older than the base year; see Appendix II for details, including the year of the data, at <http://globalinnovationindex.org>.

Square brackets indicate that the data minimum coverage (DMC) requirements were not met at the sub-pillar or pillar level; see page 181 of this appendix for details.

## Singapore

## Key indicators

|                            |   |
|----------------------------|---|
| Population (millions)..... | 5.7                                     |
| GDP (US\$ billions).....   | 296.6                                   |
| GDP per capita, PPP\$..... | 85,253.2                                |
| Income group.....          | High income                             |
| Region.....                | South East Asia, East Asia, and Oceania |

|  | Score 0–100<br>or value (hard data) | Rank     |
|--|-------------------------------------|----------|
| <b>Global Innovation Index (out of 127).....</b> | <b>58.7</b>                         | <b>7</b> |
| Innovation Output Sub-Index.....                 | 45.1                                | 17       |
| Innovation Input Sub-Index.....                  | 72.3                                | 1 ●      |
| Innovation Efficiency Ratio.....                 | 0.6                                 | 63 ○     |
| Global Innovation Index 2016 (out of 128).....   | 59.2                                | 6        |

**1 Institutions.....94.4 1 ●**

|   |       |     |
|---|-------|-----|
| 1.1 Political environment.....                        | 96.9  | 1 ● |
| 1.1.1 Political stability & safety*.....              | 93.9  | 6   |
| 1.1.2 Government effectiveness*.....                  | 100.0 | 1 ● |
| 1.2 Regulatory environment.....                       | 98.6  | 1 ● |
| 1.2.1 Regulatory quality*.....                        | 100.0 | 1 ● |
| 1.2.2 Rule of law*.....                               | 94.4  | 8   |
| 1.2.3 Cost of redundancy dismissal, salary weeks..... | 8.0   | 1 ● |
| 1.3 Business environment.....                         | 87.6  | 11  |
| 1.3.1 Ease of starting a business*.....               | 96.5  | 6   |
| 1.3.2 Ease of resolving insolvency*.....              | 74.3  | 27  |
| 1.3.3 Ease of paying taxes*.....                      | 91.9  | 8   |

**2 Human capital & research.....63.7 5**

|  |         |       |
|--|---------|-------|
| 2.1 Education.....   | 44.0    | 76 ○  |
| 2.1.1 Expenditure on education, % GDP.....                             | 2.9     | 102 ○ |
| 2.1.2 Gov't expenditure/pupil, secondary, % GDP/cap <sup>Ⓔ</sup> ..... | 16.7    | 68 ○  |
| 2.1.3 School life expectancy, years <sup>Ⓔ</sup> .....                 | 12.8    | 78 ○  |
| 2.1.4 PISA scales in reading, maths, & science.....                    | 551.6   | 1 ●   |
| 2.1.5 Pupil-teacher ratio, secondary <sup>Ⓔ</sup> .....                | 14.9    | 64 ○  |
| 2.2 Tertiary education.....  | 80.5    | 1 ●   |
| 2.2.1 Tertiary enrolment, % gross <sup>Ⓔ</sup> .....                   | 69.8    | 25    |
| 2.2.2 Graduates in science & engineering, %.....                       | n/a     | n/a   |
| 2.2.3 Tertiary inbound mobility, % <sup>Ⓔ</sup> .....                  | 19.2    | 1 ●   |
| 2.3 Research & development (R&D).....                                  | 66.5    | 11    |
| 2.3.1 Researchers, FTE/mn pop. <sup>Ⓔ</sup> .....                      | 6,658.5 | 6     |
| 2.3.2 Gross expenditure on R&D, % GDP <sup>Ⓔ</sup> .....               | 2.2     | 15    |
| 2.3.3 Global R&D companies, avg. expend. top 3, mn \$US.....           | 64.0    | 22    |
| 2.3.4 QS university ranking, average score top 3*.....                 | 70.3    | 12    |

**3 Infrastructure.....69.1 2 ●**

|  |         |     |
|--|---------|-----|
| 3.1 Information & communication technologies (ICTs).....     | 87.8    | 7   |
| 3.1.1 ICT access*.....                                       | 87.0    | 11  |
| 3.1.2 ICT use*.....  | 75.4    | 18  |
| 3.1.3 Government's online service*.....                      | 97.1    | 3 ● |
| 3.1.4 E-participation*.....                                  | 91.5    | 8   |
| 3.2 General infrastructure.....                              | 57.7    | 10  |
| 3.2.1 Electricity output, kWh/cap.....                       | 9,027.4 | 16  |
| 3.2.2 Logistics performance*.....                            | 96.2    | 5   |
| 3.2.3 Gross capital formation, % GDP.....                    | 26.0    | 39  |
| 3.3 Ecological sustainability.....                           | 62.0    | 14  |
| 3.3.1 GDP/unit of energy use.....                            | 15.2    | 9   |
| 3.3.2 Environmental performance*.....                        | 87.0    | 14  |
| 3.3.3 ISO 14001 environmental certificates/bn PPP\$ GDP..... | 3.4     | 30  |

**4 Market sophistication.....71.2 4**

|   |       |     |
|---|-------|-----|
| 4.1 Credit.....                                     | 63.4  | 11  |
| 4.1.1 Ease of getting credit*.....                  | 75.0  | 19  |
| 4.1.2 Domestic credit to private sector, % GDP..... | 129.7 | 15  |
| 4.1.3 Microfinance gross loans, % GDP.....          | n/a   | n/a |

|   |       |     |
|---|-------|-----|
| 4.2 Investment.....                                     | 75.0  | 1 ● |
| 4.2.1 Ease of protecting minority investors*.....       | 83.3  | 1 ● |
| 4.2.2 Market capitalization, % GDP.....                 | 218.6 | 4   |
| 4.2.3 Venture capital deals/bn PPP\$ GDP.....           | 0.1   | 14  |
| 4.3 Trade, competition, & market scale.....             | 75.2  | 22  |
| 4.3.1 Applied tariff rate, weighted mean, %.....        | 0.0   | 1 ● |
| 4.3.2 Intensity of local competition <sup>†</sup> ..... | 76.9  | 19  |
| 4.3.3 Domestic market scale, bn PPP\$.....              | 486.9 | 38  |

**5 Business sophistication.....62.9 2 ●**

|   |      |      |
|---|------|------|
| 5.1 Knowledge workers.....  | 73.2 | 4    |
| 5.1.1 Knowledge-intensive employment, %.....                          | 54.3 | 2 ●  |
| 5.1.2 Firms offering formal training, % firms.....                    | n/a  | n/a  |
| 5.1.3 GERD performed by business, % of GDP <sup>Ⓔ</sup> .....         | 1.3  | 16   |
| 5.1.4 GERD financed by business, % <sup>Ⓔ</sup> .....                 | 54.1 | 16   |
| 5.1.5 Females employed w/advanced degrees, % total <sup>Ⓔ</sup> ..... | 23.3 | 13   |
| 5.2 Innovation linkages.....  | 46.5 | 16   |
| 5.2.1 University/industry research collaboration <sup>†</sup> .....   | 74.5 | 7    |
| 5.2.2 State of cluster development <sup>†</sup> .....                 | 69.5 | 11   |
| 5.2.3 GERD financed by abroad, % <sup>Ⓔ</sup> .....                   | 6.8  | 57 ○ |
| 5.2.4 JV-strategic alliance deals/bn PPP\$ GDP.....                   | 0.2  | 4    |
| 5.2.5 Patent families 2+ offices/bn PPP\$ GDP.....                    | 2.8  | 19   |
| 5.3 Knowledge absorption.....   | 68.9 | 2 ●  |
| 5.3.1 Intellectual property payments, % total trade.....              | 3.6  | 1 ●  |
| 5.3.2 High-tech imports less re-imports, % total trade.....           | 21.4 | 5    |
| 5.3.3 ICT services imports, % total trade.....                        | 1.7  | 33   |
| 5.3.4 FDI net inflows, % GDP.....                                     | 22.2 | 5    |
| 5.3.5 Research talent, % in business enterprise <sup>Ⓔ</sup> .....    | 50.5 | 23   |

**6 Knowledge & technology outputs.....47.3 11**

|   |       |      |
|---|-------|------|
| 6.1 Knowledge creation.....                                 | 27.7  | 34   |
| 6.1.1 Patents by origin/bn PPP\$ GDP.....                   | 3.1   | 33   |
| 6.1.2 PCT patent applications/bn PPP\$ GDP.....             | 1.8   | 19   |
| 6.1.3 Utility models by origin/bn PPP\$ GDP.....            | n/a   | n/a  |
| 6.1.4 Scientific & technical articles/bn PPP\$ GDP.....     | 26.1  | 28   |
| 6.1.5 Citable documents H index.....                        | 33.9  | 25   |
| 6.2 Knowledge impact.....                                   | 47.2  | 14   |
| 6.2.1 Growth rate of PPP\$ GDP/worker, %.....               | (0.2) | 91 ○ |
| 6.2.2 New businesses/th pop. 15–64.....                     | 9.5   | 11   |
| 6.2.3 Computer software spending, % GDP.....                | 0.3   | 34   |
| 6.2.4 ISO 9001 quality certificates/bn PPP\$ GDP.....       | 12.2  | 31   |
| 6.2.5 High- & medium-high-tech manufactures, %.....         | 0.6   | 2 ●  |
| 6.3 Knowledge diffusion.....                                | 67.1  | 4    |
| 6.3.1 Intellectual property receipts, % total trade.....    | 0.7   | 20   |
| 6.3.2 High-tech exports less re-exports, % total trade..... | 29.1  | 3 ●  |
| 6.3.3 ICT services exports, % total trade.....              | 1.0   | 84 ○ |
| 6.3.4 FDI net outflows, % GDP.....                          | 12.7  | 1 ●  |

**7 Creative outputs.....42.9 32**

|   |      |      |
|---|------|------|
| 7.1 Intangible assets.....  | 49.0 | 42   |
| 7.1.1 Trademarks by origin/bn PPP\$ GDP.....                      | 17.9 | 85 ○ |
| 7.1.2 Industrial designs by origin/bn PPP\$ GDP.....              | 1.7  | 48 ○ |
| 7.1.3 ICTs & business model creation <sup>†</sup> .....           | 81.5 | 7    |
| 7.1.4 ICTs & organizational model creation <sup>†</sup> .....     | 76.7 | 9    |
| 7.2 Creative goods & services.....                                | 36.0 | 16   |
| 7.2.1 Cultural & creative services exports, % of total trade..... | n/a  | n/a  |
| 7.2.2 National feature films/mn pop. 15–69.....                   | 4.8  | 38   |
| 7.2.3 Global ent. & media market/th pop. 15–69.....               | 42.2 | 20   |
| 7.2.4 Printing & publishing manufactures, %.....                  | 0.8  | 75 ○ |
| 7.2.5 Creative goods exports, % total trade.....                  | 5.2  | 10   |
| 7.3 Online creativity.....  | 37.8 | 30   |
| 7.3.1 Generic top-level domains (TLDs)/th pop. 15–69.....         | 25.8 | 23   |
| 7.3.2 Country-code TLDs/th pop. 15–69.....                        | 11.9 | 36   |
| 7.3.3 Wikipedia edits/mn pop. 15–69.....                          | 6.0  | 44   |
| 7.3.4 Video uploads on YouTube/pop. 15–69.....                    | 55.9 | 13   |

NOTES: ● indicates a strength; ○ a weakness; \* an index; † a survey question.

Ⓔ indicates that the country's data are older than the base year; see Appendix II for details, including the year of the data, at <http://globalinnovationindex.org>.

Square brackets indicate that the data minimum coverage (DMC) requirements were not met at the sub-pillar or pillar level; see page 181 of this appendix for details.

## Key indicators

|                            |             |
|----------------------------|-------------|
| Population (millions)..... | 5.4         |
| GDP (US\$ billions).....   | 90.3        |
| GDP per capita, PPP\$..... | 29,720.1    |
| Income group.....          | High income |
| Region.....                | Europe      |

|  | Score 0–100<br>or value (hard data) | Rank      |
|--|-------------------------------------|-----------|
| <b>Global Innovation Index (out of 127).....</b> | <b>43.4</b>                         | <b>34</b> |
| Innovation Output Sub-Index.....                 | 37.2                                | 35        |
| Innovation Input Sub-Index.....                  | 49.7                                | 39        |
| Innovation Efficiency Ratio.....                 | 0.7                                 | 25        |
| Global Innovation Index 2016 (out of 128).....   | 41.7                                | 37        |

**1 Institutions..... 74.5 34**

|   |      |      |
|---|------|------|
| 1.1 Political environment.....                        | 75.4 | 30   |
| 1.1.1 Political stability & safety*.....              | 87.0 | 19 ● |
| 1.1.2 Government effectiveness*.....                  | 63.7 | 39   |
| 1.2 Regulatory environment.....                       | 68.3 | 48   |
| 1.2.1 Regulatory quality*.....                        | 62.3 | 38   |
| 1.2.2 Rule of law*.....                               | 53.6 | 41   |
| 1.2.3 Cost of redundancy dismissal, salary weeks..... | 18.8 | 77   |
| 1.3 Business environment.....                         | 79.9 | 32   |
| 1.3.1 Ease of starting a business*.....               | 88.6 | 56   |
| 1.3.2 Ease of resolving insolvency*.....              | 70.5 | 33   |
| 1.3.3 Ease of paying taxes*.....                      | 80.6 | 47   |

**2 Human capital & research..... 34.4 53**

|  |         |      |
|--|---------|------|
| 2.1 Education.....   | 48.5    | 60   |
| 2.1.1 Expenditure on education, % GDP.....                   | 4.1     | 79 ○ |
| 2.1.2 Gov't expenditure/pupil, secondary, % GDP/cap.....     | 19.7    | 53   |
| 2.1.3 School life expectancy, years.....                     | 15.0    | 49   |
| 2.1.4 PISA scales in reading, maths, & science.....          | 462.8   | 41   |
| 2.1.5 Pupil-teacher ratio, secondary <sup>Ⓞ</sup> .....      | 11.1    | 32   |
| 2.2 Tertiary education.....                                  | 38.2    | 53   |
| 2.2.1 Tertiary enrolment, % gross <sup>Ⓞ</sup> .....         | 52.9    | 51   |
| 2.2.2 Graduates in science & engineering, %.....             | 20.5    | 51   |
| 2.2.3 Tertiary inbound mobility, % <sup>Ⓞ</sup> .....        | 5.6     | 33   |
| 2.3 Research & development (R&D).....                        | 16.4    | 48   |
| 2.3.1 Researchers, FTE/mn pop.....                           | 2,654.8 | 31   |
| 2.3.2 Gross expenditure on R&D, % GDP.....                   | 1.2     | 31   |
| 2.3.3 Global R&D companies, avg. expend. top 3, mn \$US..... | 0.0     | 43 ○ |
| 2.3.4 QS university ranking, average score top 3*.....       | 6.1     | 68   |

**3 Infrastructure..... 55.3 35**

|  |         |      |
|--|---------|------|
| 3.1 Information & communication technologies (ICTs).....     | 58.6    | 63   |
| 3.1.1 ICT access*.....                                       | 72.2    | 45   |
| 3.1.2 ICT use*.....  | 63.8    | 30   |
| 3.1.3 Government's online service*.....                      | 44.2    | 95 ○ |
| 3.1.4 E-participation*.....                                  | 54.2    | 80   |
| 3.2 General infrastructure.....                              | 40.9    | 50   |
| 3.2.1 Electricity output, kWh/cap.....                       | 4,787.3 | 44   |
| 3.2.2 Logistics performance*.....                            | 58.9    | 40   |
| 3.2.3 Gross capital formation, % GDP.....                    | 22.8    | 58   |
| 3.3 Ecological sustainability.....                           | 66.4    | 5 ●  |
| 3.3.1 GDP/unit of energy use.....                            | 9.1     | 59   |
| 3.3.2 Environmental performance*.....                        | 85.4    | 24   |
| 3.3.3 ISO 14001 environmental certificates/bn PPP\$ GDP..... | 14.1    | 3 ●  |

**4 Market sophistication..... 45.8 67**

|   |      |     |
|---|------|-----|
| 4.1 Credit.....                                     | 42.8 | 45  |
| 4.1.1 Ease of getting credit*.....                  | 65.0 | 40  |
| 4.1.2 Domestic credit to private sector, % GDP..... | 53.5 | 66  |
| 4.1.3 Microfinance gross loans, % GDP.....          | n/a  | n/a |

|   |       |       |
|---|-------|-------|
| 4.2 Investment.....                                     | 27.6  | 119 ○ |
| 4.2.1 Ease of protecting minority investors*.....       | 53.3  | 80 ○  |
| 4.2.2 Market capitalization, % GDP <sup>Ⓞ</sup> .....   | 4.9   | 82 ○  |
| 4.2.3 Venture capital deals/bn PPP\$ GDP.....           | 0.0   | 83 ○  |
| 4.3 Trade, competition, & market scale.....             | 67.1  | 46    |
| 4.3.1 Applied tariff rate, weighted mean, %.....        | 1.6   | 23    |
| 4.3.2 Intensity of local competition <sup>†</sup> ..... | 75.4  | 24    |
| 4.3.3 Domestic market scale, bn PPP\$.....              | 169.1 | 63    |

**5 Business sophistication..... 38.3 38**

|   |      |       |
|---|------|-------|
| 5.1 Knowledge workers.....  | 42.1 | 51    |
| 5.1.1 Knowledge-intensive employment, %.....                        | 31.9 | 44    |
| 5.1.2 Firms offering formal training, % firms.....                  | 43.5 | 27    |
| 5.1.3 GERD performed by business, % of GDP.....                     | 0.3  | 43    |
| 5.1.4 GERD financed by business, %.....                             | 25.1 | 57    |
| 5.1.5 Females employed w/advanced degrees, % total.....             | 12.5 | 53    |
| 5.2 Innovation linkages.....  | 38.7 | 34    |
| 5.2.1 University/industry research collaboration <sup>†</sup> ..... | 38.6 | 78    |
| 5.2.2 State of cluster development <sup>†</sup> .....               | 48.5 | 49    |
| 5.2.3 GERD financed by abroad, %.....                               | 39.4 | 12 ●  |
| 5.2.4 JV-strategic alliance deals/bn PPP\$ GDP.....                 | 0.0  | 110 ○ |
| 5.2.5 Patent families 2+ offices/bn PPP\$ GDP.....                  | 0.3  | 44    |
| 5.3 Knowledge absorption.....                                       | 34.0 | 60    |
| 5.3.1 Intellectual property payments, % total trade.....            | 0.7  | 50    |
| 5.3.2 High-tech imports less re-imports, % total trade.....         | 15.6 | 13 ●  |
| 5.3.3 ICT services imports, % total trade.....                      | 0.9  | 74    |
| 5.3.4 FDI net inflows, % GDP.....                                   | 0.7  | 112 ○ |
| 5.3.5 Research talent, % in business enterprise.....                | 19.4 | 56    |

**6 Knowledge & technology outputs..... 33.5 30**

|   |      |      |
|---|------|------|
| 6.1 Knowledge creation.....                                 | 26.5 | 35   |
| 6.1.1 Patents by origin/bn PPP\$ GDP.....                   | 1.7  | 50   |
| 6.1.2 PCT patent applications/bn PPP\$ GDP.....             | 0.3  | 48   |
| 6.1.3 Utility models by origin/bn PPP\$ GDP.....            | 2.3  | 10 ● |
| 6.1.4 Scientific & technical articles/bn PPP\$ GDP.....     | 19.6 | 39   |
| 6.1.5 Citable documents H index.....                        | 15.5 | 42   |
| 6.2 Knowledge impact.....                                   | 50.0 | 11 ● |
| 6.2.1 Growth rate of PPP\$ GDP/worker, %.....               | 1.6  | 41   |
| 6.2.2 New businesses/th pop. 15–64.....                     | 3.1  | 37   |
| 6.2.3 Computer software spending, % GDP.....                | 0.3  | 43   |
| 6.2.4 ISO 9001 quality certificates/bn PPP\$ GDP.....       | 35.2 | 4 ●  |
| 6.2.5 High- & medium-high-tech manufactures, %.....         | 0.6  | 4 ●  |
| 6.3 Knowledge diffusion.....                                | 24.1 | 56   |
| 6.3.1 Intellectual property receipts, % total trade.....    | 0.0  | 75 ○ |
| 6.3.2 High-tech exports less re-exports, % total trade..... | 9.3  | 20 ● |
| 6.3.3 ICT services exports, % total trade.....              | 1.1  | 80   |
| 6.3.4 FDI net outflows, % GDP.....                          | 1.0  | 52   |

**7 Creative outputs..... 40.8 35**

|   |      |      |
|---|------|------|
| 7.1 Intangible assets.....  | 48.3 | 46   |
| 7.1.1 Trademarks by origin/bn PPP\$ GDP.....                                    | 66.0 | 30   |
| 7.1.2 Industrial designs by origin/bn PPP\$ GDP.....                            | 2.1  | 43   |
| 7.1.3 ICTs & business model creation <sup>†</sup> .....                         | 67.1 | 40   |
| 7.1.4 ICTs & organizational model creation <sup>†</sup> .....                   | 62.7 | 31   |
| 7.2 Creative goods & services.....  | 38.3 | 14 ● |
| 7.2.1 Cultural & creative services exports, % of total trade <sup>Ⓞ</sup> ..... | 0.3  | 34   |
| 7.2.2 National feature films/mn pop. 15–69.....                                 | 6.3  | 30   |
| 7.2.3 Global ent. & media market/th pop. 15–69.....                             | n/a  | n/a  |
| 7.2.4 Printing & publishing manufactures, %.....                                | 0.6  | 86 ○ |
| 7.2.5 Creative goods exports, % total trade.....                                | 9.3  | 6 ●  |
| 7.3 Online creativity.....  | 28.5 | 41   |
| 7.3.1 Generic top-level domains (TLDs)/th pop. 15–69.....                       | 3.1  | 64   |
| 7.3.2 Country-code TLDs/th pop. 15–69.....                                      | 25.5 | 24 ● |
| 7.3.3 Wikipedia edits/mn pop. 15–69.....  | 6.1  | 38   |
| 7.3.4 Video uploads on YouTube/pop. 15–69.....                                  | 26.6 | 48   |

NOTES: ● indicates a strength; ○ a weakness; \* an index; † a survey question.

Ⓞ indicates that the country's data are older than the base year; see Appendix II for details, including the year of the data, at <http://globalinnovationindex.org>.

Square brackets indicate that the data minimum coverage (DMC) requirements were not met at the sub-pillar or pillar level; see page 181 of this appendix for details.

## Slovenia

## Key indicators

|                            |             |
|----------------------------|-------------|
| Population (millions)..... | 2.1         |
| GDP (US\$ billions).....   | 44.1        |
| GDP per capita, PPP\$..... | 31,007.4    |
| Income group.....          | High income |
| Region.....                | Europe      |

|  | Score 0–100<br>or value (hard data) | Rank      |
|--|-------------------------------------|-----------|
| <b>Global Innovation Index (out of 127).....</b> | <b>45.8</b>                         | <b>32</b> |
| Innovation Output Sub-Index.....                 | 37.2                                | 34        |
| Innovation Input Sub-Index.....                  | 54.4                                | 30        |
| Innovation Efficiency Ratio.....                 | 0.7                                 | 44        |
| Global Innovation Index 2016 (out of 128).....   | 46.0                                | 32        |

|  |             |             |
|--|-------------|-------------|
| <b>1 Institutions.....</b>                                     | <b>80.9</b> | <b>22</b>   |
| 1.1 Political environment.....                                 | 76.7        | 28          |
| 1.1.1 Political stability & safety*.....                       | 86.1        | 23          |
| 1.1.2 Government effectiveness*.....                           | 67.2        | 36          |
| 1.2 Regulatory environment.....                                | 78.7        | 28          |
| 1.2.1 Regulatory quality*.....                                 | 58.0        | 44          |
| 1.2.2 Rule of law*.....  | 67.3        | 31          |
| 1.2.3 Cost of redundancy dismissal, salary weeks.....          | 10.7        | 37          |
| 1.3 Business environment.....                                  | 87.3        | 14 ●        |
| 1.3.1 Ease of starting a business*.....                        | 91.4        | 42          |
| 1.3.2 Ease of resolving insolvency*.....                       | 84.0        | 11 ●        |
| 1.3.3 Ease of paying taxes*.....                               | 86.6        | 22          |
| <b>2 Human capital &amp; research.....</b>                     | <b>49.2</b> | <b>24</b>   |
| 2.1 Education.....   | 61.8        | 16          |
| 2.1.1 Expenditure on education, % GDP.....                     | 5.5         | 33          |
| 2.1.2 Gov't expenditure/pupil, secondary, % GDP/cap.....       | 25.9        | 25          |
| 2.1.3 School life expectancy, years.....                       | 17.3        | 14          |
| 2.1.4 PISA scales in reading, maths, & science.....            | 509.3       | 9           |
| 2.1.5 Pupil-teacher ratio, secondary <sup>Ⓐ</sup> .....        | 10.1        | 25          |
| 2.2 Tertiary education.....                                    | 45.7        | 30          |
| 2.2.1 Tertiary enrolment, % gross <sup>Ⓐ</sup> .....           | 82.9        | 10 ●        |
| 2.2.2 Graduates in science & engineering, % <sup>Ⓐ</sup> ..... | 24.7        | 31          |
| 2.2.3 Tertiary inbound mobility, % <sup>Ⓐ</sup> .....          | 2.7         | 62          |
| 2.3 Research & development (R&D).....                          | 40.1        | 27          |
| 2.3.1 Researchers, FTE/mn pop.....                             | 3,821.0     | 24          |
| 2.3.2 Gross expenditure on R&D, % GDP.....                     | 2.2         | 14          |
| 2.3.3 Global R&D companies, avg. expend. top 3, mn \$US.....   | 51.4        | 28          |
| 2.3.4 QS university ranking, average score top 3*.....         | 11.6        | 61          |
| <b>3 Infrastructure.....</b>                                   | <b>55.4</b> | <b>34</b>   |
| 3.1 Information & communication technologies (ICTs).....       | 73.5        | 29          |
| 3.1.1 ICT access*.....   | 79.3        | 26          |
| 3.1.2 ICT use*.....  | 57.1        | 44          |
| 3.1.3 Government's online service*.....                        | 84.8        | 19          |
| 3.1.4 E-participation*.....                                    | 72.9        | 37          |
| 3.2 General infrastructure.....                                | 36.8        | 65          |
| 3.2.1 Electricity output, kWh/cap.....                         | 7,153.1     | 28          |
| 3.2.2 Logistics performance*.....                              | 51.9        | 49          |
| 3.2.3 Gross capital formation, % GDP.....                      | 18.8        | 94 ○        |
| 3.3 Ecological sustainability.....                             | 55.9        | 27          |
| 3.3.1 GDP/unit of energy use.....                              | 8.8         | 61          |
| 3.3.2 Environmental performance*.....                          | 89.0        | 5 ●         |
| 3.3.3 ISO 14001 environmental certificates/bn PPP\$ GDP.....   | 5.6         | 19          |
| <b>4 Market sophistication.....</b>                            | <b>43.1</b> | <b>82 ○</b> |
| 4.1 Credit.....  | 27.2        | 90 ○        |
| 4.1.1 Ease of getting credit*.....                             | 35.0        | 104 ○       |
| 4.1.2 Domestic credit to private sector, % GDP.....            | 50.2        | 71          |
| 4.1.3 Microfinance gross loans, % GDP.....                     | n/a         | n/a         |

|   |      |      |
|---|------|------|
| 4.2 Investment.....                                     | 41.4 | 59   |
| 4.2.1 Ease of protecting minority investors*.....       | 75.0 | 9 ●  |
| 4.2.2 Market capitalization, % GDP.....                 | 14.1 | 70 ○ |
| 4.2.3 Venture capital deals/bn PPP\$ GDP.....           | 0.0  | 41   |
| 4.3 Trade, competition, & market scale.....             | 60.8 | 64   |
| 4.3.1 Applied tariff rate, weighted mean, %.....        | 1.6  | 23   |
| 4.3.2 Intensity of local competition <sup>†</sup> ..... | 70.5 | 54   |
| 4.3.3 Domestic market scale, bn PPP\$.....              | 66.1 | 87 ○ |

|   |             |           |
|---|-------------|-----------|
| <b>5 Business sophistication.....</b>                               | <b>43.4</b> | <b>30</b> |
| 5.1 Knowledge workers.....  | 62.9        | 19        |
| 5.1.1 Knowledge-intensive employment, %.....                        | 41.7        | 21        |
| 5.1.2 Firms offering formal training, % firms.....                  | 41.5        | 31        |
| 5.1.3 GERD performed by business, % of GDP.....                     | 1.7         | 12        |
| 5.1.4 GERD financed by business, %.....                             | 69.2        | 5 ●       |
| 5.1.5 Females employed w/advanced degrees, % total.....             | 20.1        | 23        |
| 5.2 Innovation linkages.....  | 28.7        | 61        |
| 5.2.1 University/industry research collaboration <sup>†</sup> ..... | 46.0        | 41        |
| 5.2.2 State of cluster development <sup>†</sup> .....               | 41.5        | 79 ○      |
| 5.2.3 GERD financed by abroad, %.....                               | 10.6        | 46        |
| 5.2.4 JV-strategic alliance deals/bn PPP\$ GDP.....                 | 0.0         | 33        |
| 5.2.5 Patent families 2+ offices/bn PPP\$ GDP.....                  | 2.0         | 24        |
| 5.3 Knowledge absorption.....                                       | 38.5        | 39        |
| 5.3.1 Intellectual property payments, % total trade.....            | 0.7         | 48        |
| 5.3.2 High-tech imports less re-imports, % total trade.....         | 6.0         | 97 ○      |
| 5.3.3 ICT services imports, % total trade.....                      | 1.9         | 25        |
| 5.3.4 FDI net inflows, % GDP.....                                   | 2.1         | 82 ○      |
| 5.3.5 Research talent, % in business enterprise.....                | 53.1        | 20        |

|  |             |           |
|--|-------------|-----------|
| <b>6 Knowledge &amp; technology outputs.....</b>               | <b>28.0</b> | <b>43</b> |
| 6.1 Knowledge creation.....                                    | 20.7        | 45        |
| 6.1.1 Patents by origin/bn PPP\$ GDP.....                      | 1.9         | 48        |
| 6.1.2 PCT patent applications/bn PPP\$ GDP.....                | 1.0         | 27        |
| 6.1.3 Utility models by origin/bn PPP\$ GDP <sup>Ⓐ</sup> ..... | 0.2         | 43 ○      |
| 6.1.4 Scientific & technical articles/bn PPP\$ GDP.....        | 55.5        | 4 ●       |
| 6.1.5 Citable documents H index.....                           | 16.4        | 40        |
| 6.2 Knowledge impact.....                                      | 41.6        | 25        |
| 6.2.1 Growth rate of PPP\$ GDP/worker, %.....                  | 1.4         | 42        |
| 6.2.2 New businesses/th pop. 15–64.....                        | 4.4         | 27        |
| 6.2.3 Computer software spending, % GDP.....                   | 0.1         | 92 ○      |
| 6.2.4 ISO 9001 quality certificates/bn PPP\$ GDP.....          | 23.2        | 14 ●      |
| 6.2.5 High- & medium-high-tech manufactures, %.....            | 0.5         | 10 ●      |
| 6.3 Knowledge diffusion.....                                   | 21.8        | 65        |
| 6.3.1 Intellectual property receipts, % total trade.....       | 0.2         | 40        |
| 6.3.2 High-tech exports less re-exports, % total trade.....    | 5.0         | 35        |
| 6.3.3 ICT services exports, % total trade.....                 | 1.8         | 56        |
| 6.3.4 FDI net outflows, % GDP.....                             | 0.4         | 73        |

|   |             |           |
|---|-------------|-----------|
| <b>7 Creative outputs.....</b>  | <b>46.4</b> | <b>23</b> |
| 7.1 Intangible assets.....  | 59.3        | 17        |
| 7.1.1 Trademarks by origin/bn PPP\$ GDP <sup>Ⓐ</sup> .....                      | 111.2       | 9 ●       |
| 7.1.2 Industrial designs by origin/bn PPP\$ GDP.....                            | n/a         | n/a       |
| 7.1.3 ICTs & business model creation <sup>†</sup> .....                         | 62.1        | 54        |
| 7.1.4 ICTs & organizational model creation <sup>†</sup> .....                   | 58.9        | 42        |
| 7.2 Creative goods & services.....  | 32.0        | 26        |
| 7.2.1 Cultural & creative services exports, % of total trade <sup>Ⓐ</sup> ..... | 0.9         | 18        |
| 7.2.2 National feature films/mn pop. 15–69.....                                 | 13.4        | 9 ●       |
| 7.2.3 Global ent. & media market/th pop. 15–69.....                             | n/a         | n/a       |
| 7.2.4 Printing & publishing manufactures, %.....                                | 1.8         | 28        |
| 7.2.5 Creative goods exports, % total trade.....                                | 0.9         | 45        |
| 7.3 Online creativity.....  | 34.8        | 33        |
| 7.3.1 Generic top-level domains (TLDs)/th pop. 15–69.....                       | 21.1        | 28        |
| 7.3.2 Country-code TLDs/th pop. 15–69.....                                      | 24.4        | 25        |
| 7.3.3 Wikipedia edits/mn pop. 15–69.....  | 6.7         | 20        |
| 7.3.4 Video uploads on YouTube/pop. 15–69.....                                  | 28.9        | 45 ○      |

NOTES: ● indicates a strength; ○ a weakness; \* an index; † a survey question.

Ⓐ indicates that the country's data are older than the base year; see Appendix II for details, including the year of the data, at <http://globalinnovationindex.org>.

Square brackets indicate that the data minimum coverage (DMC) requirements were not met at the sub-pillar or pillar level; see page 181 of this appendix for details.

## Key indicators

|                       |                     |
|-----------------------|---------------------|
| Population (millions) | 55.0                |
| GDP (US\$ billions)   | 280.4               |
| GDP per capita, PPP\$ | 13,165.2            |
| Income group          | Upper-middle income |
| Region                | Sub-Saharan Africa  |

|   | Score 0–100<br>or value (hard data) | Rank      |
|---|-------------------------------------|-----------|
| <b>Global Innovation Index (out of 127)</b> | <b>35.8</b>                         | <b>57</b> |
| Innovation Output Sub-Index                 | 24.7                                | 69        |
| Innovation Input Sub-Index                  | 46.9                                | 49        |
| Innovation Efficiency Ratio                 | 0.5                                 | 97        |
| Global Innovation Index 2016 (out of 128)   | 35.8                                | 54        |

## 1 Institutions ..... 66.3 54

|       |  |      |      |
|-------|--|------|------|
| 1.1   | Political environment                      | 54.3 | 58   |
| 1.1.1 | Political stability & safety*              | 59.6 | 74   |
| 1.1.2 | Government effectiveness*                  | 49.0 | 52   |
| 1.2   | Regulatory environment                     | 71.4 | 42   |
| 1.2.1 | Regulatory quality*                        | 49.9 | 59   |
| 1.2.2 | Rule of law*                               | 41.0 | 57   |
| 1.2.3 | Cost of redundancy dismissal, salary weeks | 9.3  | 27 ● |
| 1.3   | Business environment                       | 73.2 | 58   |
| 1.3.1 | Ease of starting a business*               | 80.5 | 98 ○ |
| 1.3.2 | Ease of resolving insolvency*              | 57.9 | 47   |
| 1.3.3 | Ease of paying taxes*                      | 81.1 | 44   |

## 2 Human capital & research ..... 32.8 60

|       |  |       |      |
|-------|--|-------|------|
| 2.1   | Education  | 44.1  | 75   |
| 2.1.1 | Expenditure on education, % GDP                            | 6.1   | 20 ● |
| 2.1.2 | Gov't expenditure/pupil, secondary, % GDP/cap <sup>Ⓔ</sup> | 20.9  | 50   |
| 2.1.3 | School life expectancy, years <sup>Ⓔ</sup>                 | 12.8  | 79   |
| 2.1.4 | PISA scales in reading, maths, & science                   | n/a   | n/a  |
| 2.1.5 | Pupil-teacher ratio, secondary <sup>Ⓔ</sup>                | 25.0  | 93 ○ |
| 2.2   | Tertiary education   | 27.3  | 89   |
| 2.2.1 | Tertiary enrolment, % gross <sup>Ⓔ</sup>                   | 19.4  | 93 ○ |
| 2.2.2 | Graduates in science & engineering, %                      | 19.0  | 64   |
| 2.2.3 | Tertiary inbound mobility, % <sup>Ⓔ</sup>                  | 4.2   | 46   |
| 2.3   | Research & development (R&D)                               | 27.1  | 39   |
| 2.3.1 | Researchers, FTE/mn pop. <sup>Ⓔ</sup>                      | 437.1 | 65   |
| 2.3.2 | Gross expenditure on R&D, % GDP <sup>Ⓔ</sup>               | 0.7   | 48   |
| 2.3.3 | Global R&D companies, avg. expend. top 3, mn \$US          | 49.6  | 31   |
| 2.3.4 | QS university ranking, average score top 3*                | 37.0  | 33   |

## 3 Infrastructure ..... 43.4 75

|       |   |         |       |
|-------|---|---------|-------|
| 3.1   | Information & communication technologies (ICTs)   | 51.6    | 76    |
| 3.1.1 | ICT access*                                       | 54.6    | 76    |
| 3.1.2 | ICT use*  | 40.0    | 68    |
| 3.1.3 | Government's online service*                      | 55.8    | 75    |
| 3.1.4 | E-participation*                                  | 55.9    | 74    |
| 3.2   | General infrastructure                            | 42.3    | 46    |
| 3.2.1 | Electricity output, kWh/cap.                      | 4,619.8 | 46    |
| 3.2.2 | Logistics performance*                            | 79.2    | 20 ●  |
| 3.2.3 | Gross capital formation, % GDP                    | 19.6    | 85    |
| 3.3   | Ecological sustainability                         | 36.3    | 98 ○  |
| 3.3.1 | GDP/unit of energy use                            | 4.5     | 110 ○ |
| 3.3.2 | Environmental performance*                        | 70.5    | 74    |
| 3.3.3 | ISO 14001 environmental certificates/bn PPP\$ GDP | 1.6     | 54    |

## 4 Market sophistication ..... 57.4 21 ●

|       |  |       |      |
|-------|--|-------|------|
| 4.1   | Credit                                   | 40.0  | 49   |
| 4.1.1 | Ease of getting credit*                  | 60.0  | 55   |
| 4.1.2 | Domestic credit to private sector, % GDP | 149.2 | 9 ●  |
| 4.1.3 | Microfinance gross loans, % GDP          | 0.0   | 74 ○ |

|       |   |       |      |
|-------|---|-------|------|
| 4.2   | Investment                                  | 61.6  | 17 ● |
| 4.2.1 | Ease of protecting minority investors*      | 70.0  | 22 ● |
| 4.2.2 | Market capitalization, % GDP                | 234.0 | 1 ●  |
| 4.2.3 | Venture capital deals/bn PPP\$ GDP          | 0.0   | 51   |
| 4.3   | Trade, competition, & market scale          | 70.5  | 34   |
| 4.3.1 | Applied tariff rate, weighted mean, %       | 4.2   | 82   |
| 4.3.2 | Intensity of local competition <sup>†</sup> | 74.3  | 29   |
| 4.3.3 | Domestic market scale, bn PPP\$             | 736.3 | 29 ● |

## 5 Business sophistication ..... 34.4 57

|       |   |      |      |
|-------|---|------|------|
| 5.1   | Knowledge workers   | 36.8 | 67   |
| 5.1.1 | Knowledge-intensive employment, %                         | 22.5 | 64   |
| 5.1.2 | Firms offering formal training, % firms <sup>Ⓔ</sup>      | 36.8 | 35   |
| 5.1.3 | GERD performed by business, % of GDP <sup>Ⓔ</sup>         | 0.3  | 42   |
| 5.1.4 | GERD financed by business, % <sup>Ⓔ</sup>                 | 41.4 | 31   |
| 5.1.5 | Females employed w/advanced degrees, % total <sup>Ⓔ</sup> | 10.2 | 64   |
| 5.2   | Innovation linkages                                       | 33.4 | 50   |
| 5.2.1 | University/industry research collaboration <sup>†</sup>   | 57.4 | 26 ● |
| 5.2.2 | State of cluster development <sup>†</sup>                 | 56.4 | 29   |
| 5.2.3 | GERD financed by abroad, % <sup>Ⓔ</sup>                   | 12.9 | 36   |
| 5.2.4 | JV-strategic alliance deals/bn PPP\$ GDP                  | 0.0  | 36   |
| 5.2.5 | Patent families 2+ offices/bn PPP\$ GDP                   | 0.7  | 33   |
| 5.3   | Knowledge absorption                                      | 33.0 | 62   |
| 5.3.1 | Intellectual property payments, % total trade             | 1.7  | 14 ● |
| 5.3.2 | High-tech imports less re-imports, % total trade          | 10.0 | 44   |
| 5.3.3 | ICT services imports, % total trade                       | 1.1  | 63   |
| 5.3.4 | FDI net inflows, % GDP                                    | 1.5  | 98 ○ |
| 5.3.5 | Research talent, % in business enterprise <sup>Ⓔ</sup>    | 19.4 | 55   |

## 6 Knowledge & technology outputs ..... 21.5 65

|       |   |       |       |
|-------|---|-------|-------|
| 6.1   | Knowledge creation                                    | 15.6  | 52    |
| 6.1.1 | Patents by origin/bn PPP\$ GDP                        | 1.2   | 60    |
| 6.1.2 | PCT patent applications/bn PPP\$ GDP                  | 0.4   | 42    |
| 6.1.3 | Utility models by origin/bn PPP\$ GDP                 | n/a   | n/a   |
| 6.1.4 | Scientific & technical articles/bn PPP\$ GDP          | 17.2  | 44    |
| 6.1.5 | Citable documents H index                             | 27.2  | 33    |
| 6.2   | Knowledge impact                                      | 26.5  | 84    |
| 6.2.1 | Growth rate of PPP\$ GDP/worker, % (2.5)              | (2.5) | 105 ○ |
| 6.2.2 | New businesses/th pop. 15–64 <sup>Ⓔ</sup>             | 6.5   | 18 ●  |
| 6.2.3 | Computer software spending, % GDP                     | 0.4   | 30    |
| 6.2.4 | ISO 9001 quality certificates/bn PPP\$ GDP            | 6.0   | 57    |
| 6.2.5 | High- & medium-high-tech manufactures, % <sup>Ⓔ</sup> | 0.3   | 44    |
| 6.3   | Knowledge diffusion                                   | 22.4  | 63    |
| 6.3.1 | Intellectual property receipts, % total trade         | 0.1   | 50    |
| 6.3.2 | High-tech exports less re-exports, % total trade      | 2.3   | 52    |
| 6.3.3 | ICT services exports, % total trade                   | 0.6   | 97 ○  |
| 6.3.4 | FDI net outflows, % GDP                               | 1.9   | 34    |

## 7 Creative outputs ..... 28.0 78

|       |  |      |      |
|-------|--|------|------|
| 7.1   | Intangible assets                                      | 40.5 | 72   |
| 7.1.1 | Trademarks by origin/bn PPP\$ GDP                      | 29.7 | 73   |
| 7.1.2 | Industrial designs by origin/bn PPP\$ GDP              | 1.0  | 63   |
| 7.1.3 | ICTs & business model creation <sup>†</sup>            | 65.5 | 45   |
| 7.1.4 | ICTs & organizational model creation <sup>†</sup>      | 59.0 | 41   |
| 7.2   | Creative goods & services                              | 17.9 | 64   |
| 7.2.1 | Cultural & creative services exports, % of total trade | 0.2  | 48   |
| 7.2.2 | National feature films/mn pop. 15–69                   | 0.6  | 89 ○ |
| 7.2.3 | Global ent. & media market/th pop. 15–69               | 8.6  | 37   |
| 7.2.4 | Printing & publishing manufactures, % <sup>Ⓔ</sup>     | 2.4  | 15 ● |
| 7.2.5 | Creative goods exports, % total trade                  | 0.6  | 55   |
| 7.3   | Online creativity                                      | 12.8 | 91   |
| 7.3.1 | Generic top-level domains (TLDs)/th pop. 15–69         | 3.2  | 62   |
| 7.3.2 | Country-code TLDs/th pop. 15–69                        | 8.9  | 41   |
| 7.3.3 | Wikipedia edits/mn pop. 15–69                          | 3.8  | 89   |
| 7.3.4 | Video uploads on YouTube/pop. 15–69                    | 2.9  | 67 ○ |

NOTES: ● indicates a strength; ○ a weakness; \* an index; † a survey question.

Ⓔ indicates that the country's data are older than the base year; see Appendix II for details, including the year of the data, at <http://globalinnovationindex.org>.

Square brackets indicate that the data minimum coverage (DMC) requirements were not met at the sub-pillar or pillar level; see page 181 of this appendix for details.



## Key indicators

|                            |             |
|----------------------------|-------------|
| Population (millions)..... | 46.1        |
| GDP (US\$ billions).....   | 1,252.2     |
| GDP per capita, PPP\$..... | 34,819.5    |
| Income group.....          | High income |
| Region.....                | Europe      |

|  | Score 0–100<br>or value (hard data) | Rank      |
|--|-------------------------------------|-----------|
| <b>Global Innovation Index (out of 127).....</b> | <b>48.8</b>                         | <b>28</b> |
| Innovation Output Sub-Index.....                 | 40.3                                | 26        |
| Innovation Input Sub-Index.....                  | 57.3                                | 25        |
| Innovation Efficiency Ratio.....                 | 0.7                                 | 36        |
| Global Innovation Index 2016 (out of 128).....   | 49.2                                | 28        |

|   |             |           |
|---|-------------|-----------|
| <b>1 Institutions.....</b>                            | <b>75.9</b> | <b>32</b> |
| 1.1 Political environment.....                        | 71.6        | 39        |
| 1.1.1 Political stability & safety*.....              | 70.8        | 47        |
| 1.1.2 Government effectiveness*.....                  | 72.4        | 26        |
| 1.2 Regulatory environment.....                       | 72.7        | 39        |
| 1.2.1 Regulatory quality*.....                        | 62.2        | 39        |
| 1.2.2 Rule of law*.....                               | 65.6        | 32        |
| 1.2.3 Cost of redundancy dismissal, salary weeks..... | 17.4        | 74 ○      |
| 1.3 Business environment.....                         | 83.3        | 23        |
| 1.3.1 Ease of starting a business*.....               | 86.6        | 69 ○      |
| 1.3.2 Ease of resolving insolvency*.....              | 79.6        | 17        |
| 1.3.3 Ease of paying taxes*.....                      | 83.8        | 33        |

|  |             |           |
|--|-------------|-----------|
| <b>2 Human capital &amp; research.....</b>                     | <b>48.9</b> | <b>27</b> |
| 2.1 Education.....   | 56.2        | 38        |
| 2.1.1 Expenditure on education, % GDP.....                     | 4.3         | 71 ○      |
| 2.1.2 Gov't expenditure/pupil, secondary, % GDP/cap.....       | 22.5        | 42        |
| 2.1.3 School life expectancy, years.....                       | 17.9        | 11 ●      |
| 2.1.4 PISA scales in reading, maths, & science.....            | 491.4       | 27        |
| 2.1.5 Pupil-teacher ratio, secondary.....                      | 12.0        | 39        |
| 2.2 Tertiary education.....                                    | 44.6        | 34        |
| 2.2.1 Tertiary enrolment, % gross.....                         | 89.7        | 4 ●       |
| 2.2.2 Graduates in science & engineering, % <sup>Ⓔ</sup> ..... | 22.2        | 42        |
| 2.2.3 Tertiary inbound mobility, % <sup>Ⓔ</sup> .....          | 2.9         | 58 ○      |
| 2.3 Research & development (R&D).....                          | 45.8        | 22        |
| 2.3.1 Researchers, FTE/mn pop.....                             | 2,654.7     | 32        |
| 2.3.2 Gross expenditure on R&D, % GDP.....                     | 1.2         | 30        |
| 2.3.3 Global R&D companies, avg. expend. top 3, mn \$US.....   | 74.9        | 13 ●      |
| 2.3.4 QS university ranking, average score top 3*.....         | 48.2        | 23        |

|  |             |             |
|--|-------------|-------------|
| <b>3 Infrastructure.....</b>                                 | <b>64.3</b> | <b>10 ●</b> |
| 3.1 Information & communication technologies (ICTs).....     | 83.3        | 15          |
| 3.1.1 ICT access*.....                                       | 79.2        | 28          |
| 3.1.2 ICT use*.....  | 69.3        | 23          |
| 3.1.3 Government's online service*.....                      | 91.3        | 11 ●        |
| 3.1.4 E-participation*.....                                  | 93.2        | 7 ●         |
| 3.2 General infrastructure.....                              | 44.5        | 40          |
| 3.2.1 Electricity output, kWh/cap.....                       | 5,940.7     | 35          |
| 3.2.2 Logistics performance*.....                            | 77.0        | 23          |
| 3.2.3 Gross capital formation, % GDP.....                    | 21.0        | 74 ○        |
| 3.3 Ecological sustainability.....                           | 65.1        | 6 ●         |
| 3.3.1 GDP/unit of energy use.....                            | 12.5        | 23          |
| 3.3.2 Environmental performance*.....                        | 88.9        | 6 ●         |
| 3.3.3 ISO 14001 environmental certificates/bn PPP\$ GDP..... | 8.2         | 11 ●        |

|   |             |           |
|---|-------------|-----------|
| <b>4 Market sophistication.....</b>                 | <b>59.0</b> | <b>18</b> |
| 4.1 Credit.....                                     | 53.7        | 20        |
| 4.1.1 Ease of getting credit*.....                  | 60.0        | 55 ○      |
| 4.1.2 Domestic credit to private sector, % GDP..... | 118.9       | 20        |
| 4.1.3 Microfinance gross loans, % GDP.....          | n/a         | n/a       |

|   |         |      |
|---|---------|------|
| 4.2 Investment.....                                     | 43.9    | 43   |
| 4.2.1 Ease of protecting minority investors*.....       | 65.0    | 31   |
| 4.2.2 Market capitalization, % GDP.....                 | 65.7    | 24   |
| 4.2.3 Venture capital deals/bn PPP\$ GDP.....           | 0.1     | 27   |
| 4.3 Trade, competition, & market scale.....             | 79.3    | 11 ● |
| 4.3.1 Applied tariff rate, weighted mean, %.....        | 1.6     | 23   |
| 4.3.2 Intensity of local competition <sup>†</sup> ..... | 77.3    | 17   |
| 4.3.3 Domestic market scale, bn PPP\$.....              | 1,689.7 | 15   |

**5 Business sophistication.....38.4 37**

|   |      |      |
|---|------|------|
| 5.1 Knowledge workers.....  | 51.1 | 33   |
| 5.1.1 Knowledge-intensive employment, %.....                        | 32.9 | 42   |
| 5.1.2 Firms offering formal training, % firms.....                  | n/a  | n/a  |
| 5.1.3 GERD performed by business, % of GDP.....                     | 0.6  | 30   |
| 5.1.4 GERD financed by business, % <sup>Ⓔ</sup> .....               | 46.4 | 24   |
| 5.1.5 Females employed w/advanced degrees, % total.....             | 21.7 | 19   |
| 5.2 Innovation linkages.....  | 27.2 | 67 ○ |
| 5.2.1 University/industry research collaboration <sup>†</sup> ..... | 41.8 | 55   |
| 5.2.2 State of cluster development <sup>†</sup> .....               | 54.2 | 32   |
| 5.2.3 GERD financed by abroad, % <sup>Ⓔ</sup> .....                 | 7.4  | 52 ○ |
| 5.2.4 JV-strategic alliance deals/bn PPP\$ GDP.....                 | 0.0  | 60 ○ |
| 5.2.5 Patent families 2+ offices/bn PPP\$ GDP.....                  | 0.8  | 30   |
| 5.3 Knowledge absorption.....                                       | 36.9 | 46   |
| 5.3.1 Intellectual property payments, % total trade.....            | 1.2  | 25   |
| 5.3.2 High-tech imports less re-imports, % total trade.....         | 7.3  | 74 ○ |
| 5.3.3 ICT services imports, % total trade.....                      | 1.7  | 31   |
| 5.3.4 FDI net inflows, % GDP.....                                   | 2.8  | 65   |
| 5.3.5 Research talent, % in business enterprise.....                | 36.9 | 37   |

**6 Knowledge & technology outputs.....36.3 24**

|   |      |      |
|---|------|------|
| 6.1 Knowledge creation.....                                 | 31.6 | 29   |
| 6.1.1 Patents by origin/bn PPP\$ GDP.....                   | 2.7  | 38   |
| 6.1.2 PCT patent applications/bn PPP\$ GDP.....             | 0.9  | 28   |
| 6.1.3 Utility models by origin/bn PPP\$ GDP.....            | 1.4  | 20   |
| 6.1.4 Scientific & technical articles/bn PPP\$ GDP.....     | 32.1 | 23   |
| 6.1.5 Citable documents H index.....                        | 57.9 | 12 ● |
| 6.2 Knowledge impact.....                                   | 41.0 | 28   |
| 6.2.1 Growth rate of PPP\$ GDP/worker, %.....               | 0.3  | 78 ○ |
| 6.2.2 New businesses/th pop. 15–64.....                     | 3.0  | 38   |
| 6.2.3 Computer software spending, % GDP.....                | 0.7  | 7 ●  |
| 6.2.4 ISO 9001 quality certificates/bn PPP\$ GDP.....       | 20.2 | 19   |
| 6.2.5 High- & medium-high-tech manufactures, %.....         | 0.3  | 33   |
| 6.3 Knowledge diffusion.....                                | 36.2 | 27   |
| 6.3.1 Intellectual property receipts, % total trade.....    | 0.4  | 26   |
| 6.3.2 High-tech exports less re-exports, % total trade..... | 4.0  | 39   |
| 6.3.3 ICT services exports, % total trade.....              | 2.9  | 35   |
| 6.3.4 FDI net outflows, % GDP.....                          | 3.4  | 17   |

**7 Creative outputs.....44.4 28**

|   |      |      |
|---|------|------|
| 7.1 Intangible assets.....  | 56.5 | 23   |
| 7.1.1 Trademarks by origin/bn PPP\$ GDP.....                      | 59.2 | 36   |
| 7.1.2 Industrial designs by origin/bn PPP\$ GDP.....              | 12.8 | 10 ● |
| 7.1.3 ICTs & business model creation <sup>†</sup> .....           | 73.7 | 25   |
| 7.1.4 ICTs & organizational model creation <sup>†</sup> .....     | 59.4 | 39   |
| 7.2 Creative goods & services.....                                | 23.9 | 48   |
| 7.2.1 Cultural & creative services exports, % of total trade..... | n/a  | n/a  |
| 7.2.2 National feature films/mn pop. 15–69.....                   | 7.7  | 19   |
| 7.2.3 Global ent. & media market/th pop. 15–69.....               | 26.0 | 24   |
| 7.2.4 Printing & publishing manufactures, %.....                  | 1.5  | 35   |
| 7.2.5 Creative goods exports, % total trade.....                  | 0.9  | 46   |
| 7.3 Online creativity.....  | 40.8 | 27   |
| 7.3.1 Generic top-level domains (TLDs)/th pop. 15–69.....         | 28.1 | 22   |
| 7.3.2 Country-code TLDs/th pop. 15–69.....                        | 16.6 | 32   |
| 7.3.3 Wikipedia edits/mn pop. 15–69.....                          | 6.8  | 18   |
| 7.3.4 Video uploads on YouTube/pop. 15–69.....                    | 53.3 | 15   |

NOTES: ● indicates a strength; ○ a weakness; \* an index; † a survey question.

Ⓔ indicates that the country's data are older than the base year; see Appendix II for details, including the year of the data, at <http://globalinnovationindex.org>.

Square brackets indicate that the data minimum coverage (DMC) requirements were not met at the sub-pillar or pillar level; see page 181 of this appendix for details.



## Key indicators

|                            |                           |
|----------------------------|---------------------------|
| Population (millions)..... | 20.8                      |
| GDP (US\$ billions).....   | 82.2                      |
| GDP per capita, PPP\$..... | 10,566.2                  |
| Income group.....          | Lower-middle income       |
| Region.....                | Central and Southern Asia |

|  | Score 0–100<br>or value (hard data) | Rank      |
|--|-------------------------------------|-----------|
| <b>Global Innovation Index (out of 127).....</b> | <b>29.9</b>                         | <b>90</b> |
| Innovation Output Sub-Index.....                 | 23.4                                | 77        |
| Innovation Input Sub-Index.....                  | 36.3                                | 94        |
| Innovation Efficiency Ratio.....                 | 0.6                                 | 58        |
| Global Innovation Index 2016 (out of 128).....   | 28.9                                | 91        |

|  |             |            |   |
|--|-------------|------------|---|
| <b>1 Institutions.....</b>                                   | <b>45.3</b> | <b>111</b> | ○ |
| 1.1 Political environment.....                               | 52.7        | 62         |   |
| 1.1.1 Political stability & safety*.....                     | 63.1        | 63         |   |
| 1.1.2 Government effectiveness*.....                         | 42.4        | 70         |   |
| 1.2 Regulatory environment.....                              | 20.6        | 125        | ○ |
| 1.2.1 Regulatory quality*.....                               | 40.8        | 74         |   |
| 1.2.2 Rule of law*.....                                      | 41.4        | 56         |   |
| 1.2.3 Cost of redundancy dismissal, salary weeks.....        | 58.5        | 126        | ○ |
| 1.3 Business environment.....                                | 62.5        | 84         |   |
| 1.3.1 Ease of starting a business*.....                      | 87.5        | 61         |   |
| 1.3.2 Ease of resolving insolvency*.....                     | 46.7        | 69         |   |
| 1.3.3 Ease of paying taxes*.....                             | 53.2        | 110        | ○ |
| <b>2 Human capital &amp; research.....</b>                   | <b>18.6</b> | <b>105</b> |   |
| 2.1 Education.....   | 30.5        | 107        |   |
| 2.1.1 Expenditure on education, % GDP.....                   | 2.2         | 110        | ○ |
| 2.1.2 Gov't expenditure/pupil, secondary, % GDP/cap.....     | 6.3         | 102        | ○ |
| 2.1.3 School life expectancy, years <sup>Ⓐ</sup> .....       | 14.0        | 63         |   |
| 2.1.4 PISA scales in reading, maths, & science.....          | n/a         | n/a        |   |
| 2.1.5 Pupil-teacher ratio, secondary <sup>Ⓐ</sup> .....      | 17.3        | 75         |   |
| 2.2 Tertiary education.....                                  | 23.4        | 97         |   |
| 2.2.1 Tertiary enrolment, % gross.....                       | 19.8        | 91         |   |
| 2.2.2 Graduates in science & engineering, %.....             | 19.9        | 58         |   |
| 2.2.3 Tertiary inbound mobility, %.....                      | 0.3         | 95         | ○ |
| 2.3 Research & development (R&D).....                        | 2.0         | 93         |   |
| 2.3.1 Researchers, FTE/mn pop. <sup>Ⓐ</sup> .....            | 110.9       | 85         |   |
| 2.3.2 Gross expenditure on R&D, % GDP <sup>Ⓐ</sup> .....     | 0.1         | 102        | ○ |
| 2.3.3 Global R&D companies, avg. expend. top 3, mn \$US..... | 0.0         | 43         | ○ |
| 2.3.4 QS university ranking, average score top 3*.....       | 4.9         | 72         |   |
| <b>3 Infrastructure.....</b>                                 | <b>47.3</b> | <b>63</b>  |   |
| 3.1 Information & communication technologies (ICTs).....     | 48.4        | 83         |   |
| 3.1.1 ICT access*.....                                       | 45.1        | 92         |   |
| 3.1.2 ICT use*.....  | 17.0        | 102        |   |
| 3.1.3 Government's online service*.....                      | 65.2        | 53         |   |
| 3.1.4 E-participation*.....                                  | 66.1        | 49         |   |
| 3.2 General infrastructure.....                              | 36.0        | 70         |   |
| 3.2.1 Electricity output, kWh/cap.....                       | 603.7       | 104        | ○ |
| 3.2.2 Logistics performance <sup>Ⓐ</sup> .....               | 29.2        | 83         |   |
| 3.2.3 Gross capital formation, % GDP.....                    | 28.3        | 26         | ● |
| 3.3 Ecological sustainability.....                           | 57.5        | 23         | ● |
| 3.3.1 GDP/unit of energy use.....                            | 20.0        | 2          | ● |
| 3.3.2 Environmental performance*.....                        | 65.6        | 92         |   |
| 3.3.3 ISO 14001 environmental certificates/bn PPP\$ GDP..... | 0.9         | 68         |   |
| <b>4 Market sophistication.....</b>                          | <b>42.2</b> | <b>86</b>  |   |
| 4.1 Credit.....  | 18.7        | 115        | ○ |
| 4.1.1 Ease of getting credit*.....                           | 40.0        | 98         |   |
| 4.1.2 Domestic credit to private sector, % GDP.....          | 40.7        | 82         |   |
| 4.1.3 Microfinance gross loans, % GDP.....                   | 0.0         | 63         |   |

|  |       |     |   |
|--|-------|-----|---|
| 4.2 Investment.....  | 45.8  | 39  | ● |
| 4.2.1 Ease of protecting minority investors*.....              | 63.3  | 41  | ● |
| 4.2.2 Market capitalization, % GDP.....                        | 25.3  | 57  |   |
| 4.2.3 Venture capital deals/bn PPP\$ GDP.....                  | n/a   | n/a |   |
| 4.3 Trade, competition, & market scale.....                    | 62.1  | 61  |   |
| 4.3.1 Applied tariff rate, weighted mean, % <sup>Ⓐ</sup> ..... | 5.3   | 93  |   |
| 4.3.2 Intensity of local competition <sup>†</sup> .....        | 69.7  | 65  |   |
| 4.3.3 Domestic market scale, bn PPP\$.....                     | 237.8 | 57  |   |

**5 Business sophistication.....28.0 83**

|   |      |     |   |
|---|------|-----|---|
| 5.1 Knowledge workers.....  | 25.2 | 97  |   |
| 5.1.1 Knowledge-intensive employment, % <sup>Ⓐ</sup> .....            | 16.9 | 82  |   |
| 5.1.2 Firms offering formal training, % firms <sup>Ⓐ</sup> .....      | 18.4 | 80  | ○ |
| 5.1.3 GERD performed by business, % of GDP <sup>Ⓐ</sup> .....         | 0.0  | 71  |   |
| 5.1.4 GERD financed by business, % <sup>Ⓐ</sup> .....                 | 40.7 | 34  | ● |
| 5.1.5 Females employed w/advanced degrees, % total <sup>Ⓐ</sup> ..... | 8.8  | 68  |   |
| 5.2 Innovation linkages.....  | 24.4 | 79  |   |
| 5.2.1 University/industry research collaboration <sup>†</sup> .....   | 43.8 | 49  |   |
| 5.2.2 State of cluster development <sup>†</sup> .....                 | 46.3 | 57  |   |
| 5.2.3 GERD financed by abroad, % <sup>Ⓐ</sup> .....                   | 5.0  | 64  |   |
| 5.2.4 JV-strategic alliance deals/bn PPP\$ GDP.....                   | 0.0  | 31  | ● |
| 5.2.5 Patent families 2+ offices/bn PPP\$ GDP.....                    | 0.0  | 84  |   |
| 5.3 Knowledge absorption.....   | 34.6 | 56  |   |
| 5.3.1 Intellectual property payments, % total trade.....              | n/a  | n/a |   |
| 5.3.2 High-tech imports less re-imports, % total trade.....           | 6.0  | 94  |   |
| 5.3.3 ICT services imports, % total trade.....                        | 2.1  | 19  | ● |
| 5.3.4 FDI net inflows, % GDP.....                                     | 1.1  | 103 |   |
| 5.3.5 Research talent, % in business enterprise <sup>Ⓐ</sup> .....    | 30.7 | 43  |   |

**6 Knowledge & technology outputs.....21.0 68**

|   |      |     |   |
|---|------|-----|---|
| 6.1 Knowledge creation.....                                       | 4.7  | 89  |   |
| 6.1.1 Patents by origin/bn PPP\$ GDP.....                         | 1.0  | 64  |   |
| 6.1.2 PCT patent applications/bn PPP\$ GDP.....                   | 0.1  | 70  |   |
| 6.1.3 Utility models by origin/bn PPP\$ GDP.....                  | n/a  | n/a |   |
| 6.1.4 Scientific & technical articles/bn PPP\$ GDP.....           | 3.5  | 105 |   |
| 6.1.5 Citable documents H index.....                              | 8.5  | 73  |   |
| 6.2 Knowledge impact.....   | 33.6 | 53  |   |
| 6.2.1 Growth rate of PPP\$ GDP/worker, %.....                     | 4.3  | 11  | ● |
| 6.2.2 New businesses/th pop. 15–64 <sup>Ⓐ</sup> .....             | 0.5  | 88  |   |
| 6.2.3 Computer software spending, % GDP.....                      | 0.3  | 33  | ● |
| 6.2.4 ISO 9001 quality certificates/bn PPP\$ GDP.....             | 3.6  | 72  |   |
| 6.2.5 High- & medium-high-tech manufactures, % <sup>Ⓐ</sup> ..... | 0.1  | 92  | ○ |
| 6.3 Knowledge diffusion.....                                      | 24.8 | 53  |   |
| 6.3.1 Intellectual property receipts, % total trade.....          | n/a  | n/a |   |
| 6.3.2 High-tech exports less re-exports, % total trade.....       | 0.3  | 92  |   |
| 6.3.3 ICT services exports, % total trade.....                    | 4.0  | 19  | ● |
| 6.3.4 FDI net outflows, % GDP.....                                | 0.1  | 95  |   |

**7 Creative outputs.....25.8 86**

|   |      |     |   |
|---|------|-----|---|
| 7.1 Intangible assets.....  | 37.8 | 84  |   |
| 7.1.1 Trademarks by origin/bn PPP\$ GDP.....                      | 26.8 | 75  |   |
| 7.1.2 Industrial designs by origin/bn PPP\$ GDP.....              | 1.7  | 46  |   |
| 7.1.3 ICTs & business model creation <sup>†</sup> .....           | 60.6 | 62  |   |
| 7.1.4 ICTs & organizational model creation <sup>†</sup> .....     | 53.6 | 63  |   |
| 7.2 Creative goods & services.....                                | 14.1 | 76  |   |
| 7.2.1 Cultural & creative services exports, % of total trade..... | n/a  | n/a |   |
| 7.2.2 National feature films/mn pop. 15–69 <sup>Ⓐ</sup> .....     | 1.0  | 77  |   |
| 7.2.3 Global ent. & media market/th pop. 15–69.....               | n/a  | n/a |   |
| 7.2.4 Printing & publishing manufactures, % <sup>Ⓐ</sup> .....    | 1.7  | 31  | ● |
| 7.2.5 Creative goods exports, % total trade.....                  | 0.3  | 69  |   |
| 7.3 Online creativity.....  | 13.6 | 85  |   |
| 7.3.1 Generic top-level domains (TLDs)/th pop. 15–69.....         | 0.8  | 99  |   |
| 7.3.2 Country-code TLDs/th pop. 15–69.....                        | 0.2  | 102 |   |
| 7.3.3 Wikipedia edits/mn pop. 15–69 <sup>Ⓐ</sup> .....            | 4.1  | 77  |   |
| 7.3.4 Video uploads on YouTube/pop. 15–69.....                    | n/a  | n/a |   |

NOTES: ● indicates a strength; ○ a weakness; \* an index; † a survey question.

Ⓐ indicates that the country's data are older than the base year; see Appendix II for details, including the year of the data, at <http://globalinnovationindex.org>.

Square brackets indicate that the data minimum coverage (DMC) requirements were not met at the sub-pillar or pillar level; see page 181 of this appendix for details.

## Key indicators

|                            |             |
|----------------------------|-------------|
| Population (millions)..... | 9.9         |
| GDP (US\$ billions).....   | 517.4       |
| GDP per capita, PPP\$..... | 47,922.2    |
| Income group.....          | High income |
| Region.....                | Europe      |

|  | Score 0–100<br>or value (hard data) | Rank       |
|--|-------------------------------------|------------|
| <b>Global Innovation Index (out of 127).....</b>             | <b>63.8</b>                         | <b>2 ●</b> |
| Innovation Output Sub-Index.....                             | 57.9                                | 3 ●        |
| Innovation Input Sub-Index.....                              | 69.7                                | 2 ●        |
| Innovation Efficiency Ratio.....                             | 0.8                                 | 12         |
| Global Innovation Index 2016 (out of 128).....               | 63.6                                | 2          |
| <b>1 Institutions.....</b>                                   | <b>88.3</b>                         | <b>10</b>  |
| 1.1 Political environment.....                               | 88.0                                | 9          |
| 1.1.1 Political stability & safety*.....                     | 87.3                                | 17         |
| 1.1.2 Government effectiveness*.....                         | 88.7                                | 9          |
| 1.2 Regulatory environment.....                              | 90.5                                | 12         |
| 1.2.1 Regulatory quality*.....                               | 88.4                                | 7          |
| 1.2.2 Rule of law*.....                                      | 99.2                                | 2 ●        |
| 1.2.3 Cost of redundancy dismissal, salary weeks.....        | 14.4                                | 57 ○       |
| 1.3 Business environment.....                                | 86.5                                | 17         |
| 1.3.1 Ease of starting a business*.....                      | 94.6                                | 14         |
| 1.3.2 Ease of resolving insolvency*.....                     | 79.4                                | 18         |
| 1.3.3 Ease of paying taxes*.....                             | 85.3                                | 26         |
| <b>2 Human capital &amp; research.....</b>                   | <b>63.7</b>                         | <b>4 ●</b> |
| 2.1 Education.....   | 67.7                                | 10         |
| 2.1.1 Expenditure on education, % GDP.....                   | 7.7                                 | 7          |
| 2.1.2 Gov't expenditure/pupil, secondary, % GDP/cap.....     | 24.6                                | 32         |
| 2.1.3 School life expectancy, years.....                     | 18.2                                | 8          |
| 2.1.4 PISA scales in reading, maths, & science.....          | 495.8                               | 23         |
| 2.1.5 Pupil-teacher ratio, secondary <sup>Ⓔ</sup> .....      | 12.3                                | 44 ○       |
| 2.2 Tertiary education.....                                  | 46.3                                | 28         |
| 2.2.1 Tertiary enrolment, % gross <sup>Ⓔ</sup> .....         | 62.4                                | 41         |
| 2.2.2 Graduates in science & engineering, %.....             | 25.7                                | 25         |
| 2.2.3 Tertiary inbound mobility, % <sup>Ⓔ</sup> .....        | 5.9                                 | 32         |
| 2.3 Research & development (R&D).....                        | 77.1                                | 5          |
| 2.3.1 Researchers, FTE/mn pop.....                           | 7,021.9                             | 4 ●        |
| 2.3.2 Gross expenditure on R&D, % GDP.....                   | 3.3                                 | 4 ●        |
| 2.3.3 Global R&D companies, avg. expend. top 3, mn \$US..... | 82.0                                | 11         |
| 2.3.4 QS university ranking, average score top 3*.....       | 65.0                                | 14         |
| <b>3 Infrastructure.....</b>                                 | <b>69.1</b>                         | <b>3 ●</b> |
| 3.1 Information & communication technologies (ICTs).....     | 83.6                                | 13         |
| 3.1.1 ICT access*.....                                       | 86.9                                | 13         |
| 3.1.2 ICT use*.....  | 83.6                                | 6          |
| 3.1.3 Government's online service*.....                      | 87.7                                | 15         |
| 3.1.4 E-participation*.....                                  | 76.3                                | 27         |
| 3.2 General infrastructure.....                              | 64.7                                | 5          |
| 3.2.1 Electricity output, kWh/cap.....                       | 16,520.7                            | 7          |
| 3.2.2 Logistics performance*.....                            | 99.0                                | 3 ●        |
| 3.2.3 Gross capital formation, % GDP.....                    | 25.6                                | 41         |
| 3.3 Ecological sustainability.....                           | 59.0                                | 20         |
| 3.3.1 GDP/unit of energy use.....                            | 8.6                                 | 62 ○       |
| 3.3.2 Environmental performance*.....                        | 90.4                                | 3 ●        |
| 3.3.3 ISO 14001 environmental certificates/bn PPP\$ GDP..... | 7.8                                 | 13         |
| <b>4 Market sophistication.....</b>                          | <b>64.9</b>                         | <b>10</b>  |
| 4.1 Credit.....  | 53.3                                | 21         |
| 4.1.1 Ease of getting credit*.....                           | 55.0                                | 67 ○       |
| 4.1.2 Domestic credit to private sector, % GDP.....          | 128.9                               | 16         |
| 4.1.3 Microfinance gross loans, % GDP.....                   | n/a                                 | n/a        |

|   |             |            |
|---|-------------|------------|
| 4.2 Investment.....   | 68.4        | 7          |
| 4.2.1 Ease of protecting minority investors*.....                               | 71.7        | 19         |
| 4.2.2 Market capitalization, % GDP.....   | n/a         | n/a        |
| 4.2.3 Venture capital deals/bn PPP\$ GDP.....                                   | 0.2         | 8          |
| 4.3 Trade, competition, & market scale.....                                     | 72.9        | 28         |
| 4.3.1 Applied tariff rate, weighted mean, %.....                                | 1.6         | 23 ○       |
| 4.3.2 Intensity of local competition <sup>†</sup> .....                         | 76.5        | 21         |
| 4.3.3 Domestic market scale, bn PPP\$.....                                      | 498.1       | 36         |
| <b>5 Business sophistication.....</b>   | <b>62.6</b> | <b>4 ●</b> |
| 5.1 Knowledge workers.....  | 80.7        | 2 ●        |
| 5.1.1 Knowledge-intensive employment, %.....                                    | 50.4        | 5          |
| 5.1.2 Firms offering formal training, % firms.....                              | 70.3        | 2 ●        |
| 5.1.3 GERD performed by business, % of GDP.....                                 | 2.3         | 4          |
| 5.1.4 GERD financed by business, % <sup>Ⓔ</sup> .....                           | 61.0        | 11         |
| 5.1.5 Females employed w/advanced degrees, % total.....                         | 24.1        | 10         |
| 5.2 Innovation linkages.....  | 52.4        | 6          |
| 5.2.1 University/industry research collaboration <sup>†</sup> .....             | 69.3        | 12         |
| 5.2.2 State of cluster development <sup>†</sup> .....                           | 66.4        | 15         |
| 5.2.3 GERD financed by abroad, % <sup>Ⓔ</sup> .....                             | 6.7         | 58 ○       |
| 5.2.4 JV-strategic alliance deals/bn PPP\$ GDP.....                             | 0.1         | 9          |
| 5.2.5 Patent families 2+ offices/bn PPP\$ GDP.....                              | 8.8         | 5          |
| 5.3 Knowledge absorption.....   | 54.6        | 7          |
| 5.3.1 Intellectual property payments, % total trade.....                        | 2.1         | 10         |
| 5.3.2 High-tech imports less re-imports, % total trade.....                     | 9.3         | 51 ○       |
| 5.3.3 ICT services imports, % total trade.....                                  | 3.3         | 6          |
| 5.3.4 FDI net inflows, % GDP.....   | 0.7         | 110 ○      |
| 5.3.5 Research talent, % in business enterprise.....                            | 68.6        | 6          |
| <b>6 Knowledge &amp; technology outputs.....</b>                                | <b>62.5</b> | <b>3 ●</b> |
| 6.1 Knowledge creation.....   | 74.9        | 3 ●        |
| 6.1.1 Patents by origin/bn PPP\$ GDP.....                                       | 12.4        | 9          |
| 6.1.2 PCT patent applications/bn PPP\$ GDP.....                                 | 7.5         | 1 ●        |
| 6.1.3 Utility models by origin/bn PPP\$ GDP.....                                | n/a         | n/a        |
| 6.1.4 Scientific & technical articles/bn PPP\$ GDP.....                         | 52.8        | 6          |
| 6.1.5 Citable documents H index.....  | 59.5        | 11         |
| 6.2 Knowledge impact.....   | 50.5        | 10         |
| 6.2.1 Growth rate of PPP\$ GDP/worker, %.....                                   | 2.6         | 28         |
| 6.2.2 New businesses/th pop. 15–64.....   | 6.9         | 16         |
| 6.2.3 Computer software spending, % GDP.....                                    | 0.6         | 16         |
| 6.2.4 ISO 9001 quality certificates/bn PPP\$ GDP.....                           | 9.1         | 39         |
| 6.2.5 High- & medium-high-tech manufactures, %.....                             | 0.5         | 11         |
| 6.3 Knowledge diffusion.....  | 62.1        | 5          |
| 6.3.1 Intellectual property receipts, % total trade.....                        | 4.2         | 3 ●        |
| 6.3.2 High-tech exports less re-exports, % total trade.....                     | 9.0         | 23         |
| 6.3.3 ICT services exports, % total trade.....                                  | 7.1         | 8          |
| 6.3.4 FDI net outflows, % GDP.....  | 3.4         | 18         |
| <b>7 Creative outputs.....</b>  | <b>53.3</b> | <b>11</b>  |
| 7.1 Intangible assets.....  | 58.7        | 18         |
| 7.1.1 Trademarks by origin/bn PPP\$ GDP.....                                    | 55.7        | 40 ○       |
| 7.1.2 Industrial designs by origin/bn PPP\$ GDP.....                            | 5.0         | 26         |
| 7.1.3 ICTs & business model creation <sup>†</sup> .....                         | 83.0        | 5          |
| 7.1.4 ICTs & organizational model creation <sup>†</sup> .....                   | 80.5        | 4 ●        |
| 7.2 Creative goods & services.....  | 35.8        | 18         |
| 7.2.1 Cultural & creative services exports, % of total trade <sup>Ⓔ</sup> ..... | 0.9         | 19         |
| 7.2.2 National feature films/mn pop. 15–69.....                                 | 7.4         | 20         |
| 7.2.3 Global ent. & media market/th pop. 15–69.....                             | 71.5        | 6          |
| 7.2.4 Printing & publishing manufactures, %.....                                | 1.3         | 40 ○       |
| 7.2.5 Creative goods exports, % total trade.....                                | 1.6         | 32         |
| 7.3 Online creativity.....  | 60.2        | 9          |
| 7.3.1 Generic top-level domains (TLDs)/th pop. 15–69.....                       | 43.0        | 17         |
| 7.3.2 Country-code TLDs/th pop. 15–69.....                                      | 63.6        | 9          |
| 7.3.3 Wikipedia edits/mn pop. 15–69.....  | 7.4         | 4 ●        |
| 7.3.4 Video uploads on YouTube/pop. 15–69.....                                  | 63.2        | 6          |

NOTES: ● indicates a strength; ○ a weakness; \* an index; † a survey question.

Ⓔ indicates that the country's data are older than the base year; see Appendix II for details, including the year of the data, at <http://globalinnovationindex.org>.

Square brackets indicate that the data minimum coverage (DMC) requirements were not met at the sub-pillar or pillar level; see page 181 of this appendix for details.

## Key indicators

|                             |             |
|-----------------------------|-------------|
| Population (millions) ..... | 8.4         |
| GDP (US\$ billions) .....   | 662.5       |
| GDP per capita, PPP\$ ..... | 58,551.5    |
| Income group .....          | High income |
| Region .....                | Europe      |

|  | Score 0–100<br>or value (hard data) | Rank       |
|--|-------------------------------------|------------|
| <b>Global Innovation Index (out of 127).....</b>                       | <b>67.7</b>                         | <b>1</b> ● |
| Innovation Output Sub-Index .....                                      | 65.8                                | 1 ●        |
| Innovation Input Sub-Index.....  | 69.6                                | 3 ●        |
| Innovation Efficiency Ratio.....                                       | 0.9                                 | 2 ●        |
| Global Innovation Index 2016 (out of 128) .....                        | 66.3                                | 1          |
| <b>1 Institutions.....</b>   | <b>89.5</b>                         | <b>8</b>   |
| 1.1 Political environment .....  | 94.7                                | 3 ●        |
| 1.1.1 Political stability & safety*.....                               | 95.6                                | 3 ●        |
| 1.1.2 Government effectiveness*.....                                   | 93.8                                | 2 ●        |
| 1.2 Regulatory environment.....  | 93.9                                | 8          |
| 1.2.1 Regulatory quality*.....   | 87.0                                | 10         |
| 1.2.2 Rule of law*.....  | 96.9                                | 6          |
| 1.2.3 Cost of redundancy dismissal, salary weeks.....                  | 10.1                                | 33         |
| 1.3 Business environment.....  | 79.8                                | 33         |
| 1.3.1 Ease of starting a business*.....                                | 88.4                                | 58 ○       |
| 1.3.2 Ease of resolving insolvency*.....                               | 62.6                                | 42         |
| 1.3.3 Ease of paying taxes*.....                                       | 88.5                                | 17         |
| <b>2 Human capital &amp; research.....</b>                             | <b>63.3</b>                         | <b>7</b>   |
| 2.1 Education.....   | 58.6                                | 28         |
| 2.1.1 Expenditure on education, % GDP.....                             | 5.1                                 | 46         |
| 2.1.2 Gov't expenditure/pupil, secondary, % GDP/cap <sup>Ⓢ</sup> ..... | 26.1                                | 23         |
| 2.1.3 School life expectancy, years.....                               | 16.0                                | 30         |
| 2.1.4 PISA scales in reading, maths, & science.....                    | 506.3                               | 13         |
| 2.1.5 Pupil-teacher ratio, secondary <sup>Ⓢ</sup> .....                | 9.3                                 | 17         |
| 2.2 Tertiary education.....  | 55.9                                | 12         |
| 2.2.1 Tertiary enrolment, % gross <sup>Ⓢ</sup> .....                   | 57.2                                | 45         |
| 2.2.2 Graduates in science & engineering, %.....                       | 22.1                                | 45 ○       |
| 2.2.3 Tertiary inbound mobility, % <sup>Ⓢ</sup> .....                  | 17.1                                | 9          |
| 2.3 Research & development (R&D).....                                  | 75.4                                | 6          |
| 2.3.1 Researchers, FTE/mn pop. <sup>Ⓢ</sup> .....                      | 4,481.1                             | 17         |
| 2.3.2 Gross expenditure on R&D, % GDP <sup>Ⓢ</sup> .....               | 3.0                                 | 7          |
| 2.3.3 Global R&D companies, avg. expend. top 3, mn \$US.....           | 94.3                                | 3 ●        |
| 2.3.4 QS university ranking, average score top 3*.....                 | 84.4                                | 3 ●        |
| <b>3 Infrastructure.....</b>   | <b>65.1</b>                         | <b>6</b>   |
| 3.1 Information & communication technologies (ICTs).....               | 73.5                                | 30         |
| 3.1.1 ICT access*.....   | 89.5                                | 9          |
| 3.1.2 ICT use*.....  | 86.7                                | 2 ●        |
| 3.1.3 Government's online service*.....                                | 60.1                                | 64 ○       |
| 3.1.4 E-participation*.....  | 57.6                                | 70 ○       |
| 3.2 General infrastructure.....  | 51.7                                | 18         |
| 3.2.1 Electricity output, kWh/cap.....                                 | 7,975.4                             | 19         |
| 3.2.2 Logistics performance*.....                                      | 89.0                                | 11         |
| 3.2.3 Gross capital formation, % GDP.....                              | 23.1                                | 55 ○       |
| 3.3 Ecological sustainability.....                                     | 70.1                                | 2 ●        |
| 3.3.1 GDP/unit of energy use.....                                      | 17.5                                | 4          |
| 3.3.2 Environmental performance*.....                                  | 86.9                                | 16         |
| 3.3.3 ISO 14001 environmental certificates/bn PPP\$ GDP.....           | 6.7                                 | 15         |
| <b>4 Market sophistication.....</b>                                    | <b>67.5</b>                         | <b>7</b>   |
| 4.1 Credit.....  | 64.7                                | 9          |
| 4.1.1 Ease of getting credit*.....                                     | 60.0                                | 55 ○       |
| 4.1.2 Domestic credit to private sector, % GDP.....                    | 172.6                               | 6          |
| 4.1.3 Microfinance gross loans, % GDP.....                             | n/a                                 | n/a        |

|   |             |            |
|---|-------------|------------|
| 4.2 Investment.....   | 63.5        | 14         |
| 4.2.1 Ease of protecting minority investors*.....                   | 50.0        | 89 ○       |
| 4.2.2 Market capitalization, % GDP.....                             | 226.5       | 3 ●        |
| 4.2.3 Venture capital deals/bn PPP\$ GDP.....                       | 0.2         | 10         |
| 4.3 Trade, competition, & market scale.....                         | 74.4        | 23         |
| 4.3.1 Applied tariff rate, weighted mean, %.....                    | 0.0         | 1 ●        |
| 4.3.2 Intensity of local competition <sup>†</sup> .....             | 73.2        | 38         |
| 4.3.3 Domestic market scale, bn PPP\$.....                          | 494.3       | 37         |
| <b>5 Business sophistication.....</b>                               | <b>62.6</b> | <b>3</b> ● |
| 5.1 Knowledge workers.....  | 74.6        | 3 ●        |
| 5.1.1 Knowledge-intensive employment, %.....                        | 53.0        | 3 ●        |
| 5.1.2 Firms offering formal training, % firms.....                  | n/a         | n/a        |
| 5.1.3 GERD performed by business, % of GDP <sup>Ⓢ</sup> .....       | 2.1         | 6          |
| 5.1.4 GERD financed by business, % <sup>Ⓢ</sup> .....               | 60.8        | 12         |
| 5.1.5 Females employed w/advanced degrees, % total.....             | 17.8        | 28         |
| 5.2 Innovation linkages.....  | 57.0        | 4          |
| 5.2.1 University/industry research collaboration <sup>†</sup> ..... | 80.0        | 1 ●        |
| 5.2.2 State of cluster development <sup>†</sup> .....               | 68.9        | 13         |
| 5.2.3 GERD financed by abroad, % <sup>Ⓢ</sup> .....                 | 12.1        | 43         |
| 5.2.4 JV-strategic alliance deals/bn PPP\$ GDP.....                 | 0.1         | 10         |
| 5.2.5 Patent families 2+ offices/bn PPP\$ GDP.....                  | 10.6        | 1 ●        |
| 5.3 Knowledge absorption.....                                       | 56.3        | 5          |
| 5.3.1 Intellectual property payments, % total trade.....            | 3.3         | 4          |
| 5.3.2 High-tech imports less re-imports, % total trade.....         | 8.2         | 63 ○       |
| 5.3.3 ICT services imports, % total trade.....                      | 3.7         | 4          |
| 5.3.4 FDI net inflows, % GDP.....                                   | 5.6         | 25         |
| 5.3.5 Research talent, % in business enterprise <sup>Ⓢ</sup> .....  | 46.2        | 30         |
| <b>6 Knowledge &amp; technology outputs.....</b>                    | <b>69.1</b> | <b>1</b> ● |
| 6.1 Knowledge creation.....   | 85.8        | 1 ●        |
| 6.1.1 Patents by origin/bn PPP\$ GDP.....                           | 17.7        | 5          |
| 6.1.2 PCT patent applications/bn PPP\$ GDP.....                     | 8.8         | 1 ●        |
| 6.1.3 Utility models by origin/bn PPP\$ GDP.....                    | n/a         | n/a        |
| 6.1.4 Scientific & technical articles/bn PPP\$ GDP.....             | 58.1        | 3 ●        |
| 6.1.5 Citable documents H index.....                                | 66.8        | 9          |
| 6.2 Knowledge impact.....   | 49.1        | 13         |
| 6.2.1 Growth rate of PPP\$ GDP/worker, %.....                       | (0.6)       | 94 ○       |
| 6.2.2 New businesses/th pop. 15–64 <sup>Ⓢ</sup> .....               | 2.5         | 40         |
| 6.2.3 Computer software spending, % GDP.....                        | 0.7         | 5          |
| 6.2.4 ISO 9001 quality certificates/bn PPP\$ GDP.....               | 25.3        | 13         |
| 6.2.5 High- & medium-high-tech manufactures, %.....                 | 0.6         | 1 ●        |
| 6.3 Knowledge diffusion.....  | 72.3        | 3 ●        |
| 6.3.1 Intellectual property receipts, % total trade.....            | 3.8         | 4          |
| 6.3.2 High-tech exports less re-exports, % total trade.....         | 14.4        | 12         |
| 6.3.3 ICT services exports, % total trade.....                      | 3.7         | 21         |
| 6.3.4 FDI net outflows, % GDP.....                                  | 7.0         | 8          |
| <b>7 Creative outputs.....</b>                                      | <b>62.5</b> | <b>3</b> ● |
| 7.1 Intangible assets.....  | 65.0        | 5          |
| 7.1.1 Trademarks by origin/bn PPP\$ GDP.....                        | 79.8        | 21         |
| 7.1.2 Industrial designs by origin/bn PPP\$ GDP.....                | 10.1        | 13         |
| 7.1.3 ICTs & business model creation <sup>†</sup> .....             | 83.3        | 2 ●        |
| 7.1.4 ICTs & organizational model creation <sup>†</sup> .....       | 76.2        | 10         |
| 7.2 Creative goods & services.....                                  | 51.5        | 3 ●        |
| 7.2.1 Cultural & creative services exports, % of total trade.....   | n/a         | n/a        |
| 7.2.2 National feature films/mn pop. 15–69.....                     | 16.9        | 7          |
| 7.2.3 Global ent. & media market/th pop. 15–69.....                 | 98.7        | 2 ●        |
| 7.2.4 Printing & publishing manufactures, %.....                    | 1.1         | 58 ○       |
| 7.2.5 Creative goods exports, % total trade.....                    | 3.8         | 14         |
| 7.3 Online creativity.....  | 68.6        | 5          |
| 7.3.1 Generic top-level domains (TLDs)/th pop. 15–69.....           | 60.5        | 12         |
| 7.3.2 Country-code TLDs/th pop. 15–69.....                          | 100.0       | 1 ●        |
| 7.3.3 Wikipedia edits/mn pop. 15–69.....                            | 6.7         | 21         |
| 7.3.4 Video uploads on YouTube/pop. 15–69.....                      | 49.2        | 16         |

NOTES: ● indicates a strength; ○ a weakness; \* an index; † a survey question.

Ⓢ indicates that the country's data are older than the base year; see Appendix II for details, including the year of the data, at <http://globalinnovationindex.org>.

Square brackets indicate that the data minimum coverage (DMC) requirements were not met at the sub-pillar or pillar level; see page 181 of this appendix for details.

## Tajikistan

## Key indicators

|                            |                           |
|----------------------------|---------------------------|
| Population (millions)..... | 8.7                       |
| GDP (US\$ billions).....   | 6.6                       |
| GDP per capita, PPP\$..... | 2,749.4                   |
| Income group.....          | Lower-middle income       |
| Region.....                | Central and Southern Asia |

|  | Score 0–100<br>or value (hard data) | Rank      |
|--|-------------------------------------|-----------|
| <b>Global Innovation Index (out of 127).....</b> | <b>28.2</b>                         | <b>94</b> |
| Innovation Output Sub-Index.....                 | 20.8                                | 88        |
| Innovation Input Sub-Index.....                  | 35.5                                | 100       |
| Innovation Efficiency Ratio.....                 | 0.6                                 | 83        |
| Global Innovation Index 2016 (out of 128).....   | 29.6                                | 86        |

**1 Institutions.....46.4 108**

|   |      |      |
|---|------|------|
| 1.1 Political environment.....                        | 32.0 | 112  |
| 1.1.1 Political stability & safety*.....              | 42.8 | 101  |
| 1.1.2 Government effectiveness*.....                  | 21.1 | 116  |
| 1.2 Regulatory environment.....                       | 49.1 | 102  |
| 1.2.1 Regulatory quality*.....                        | 16.4 | 122  |
| 1.2.2 Rule of law*.....                               | 9.9  | 120  |
| 1.2.3 Cost of redundancy dismissal, salary weeks..... | 15.5 | 63 ● |
| 1.3 Business environment.....                         | 58.0 | 105  |
| 1.3.1 Ease of starting a business*.....               | 86.6 | 69   |
| 1.3.2 Ease of resolving insolvency*.....              | 28.7 | 117  |
| 1.3.3 Ease of paying taxes*.....                      | 58.8 | 98   |

**2 Human capital & research.....28.5 80**

|  |      |      |
|--|------|------|
| 2.1 Education.....   | 50.0 | 54 ● |
| 2.1.1 Expenditure on education, % GDP.....                   | 5.2  | 43 ● |
| 2.1.2 Gov't expenditure/pupil, secondary, % GDP/cap.....     | n/a  | n/a  |
| 2.1.3 School life expectancy, years <sup>Ⓐ</sup> .....       | 11.3 | 91   |
| 2.1.4 PISA scales in reading, maths, & science.....          | n/a  | n/a  |
| 2.1.5 Pupil-teacher ratio, secondary <sup>Ⓐ</sup> .....      | 15.4 | 65   |
| 2.2 Tertiary education.....                                  | 34.6 | 67   |
| 2.2.1 Tertiary enrolment, % gross.....                       | 28.9 | 80   |
| 2.2.2 Graduates in science & engineering, %.....             | 28.1 | 14 ● |
| 2.2.3 Tertiary inbound mobility, %.....                      | 0.6  | 87   |
| 2.3 Research & development (R&D).....                        | 0.8  | 107  |
| 2.3.1 Researchers, FTE/mn pop.....                           | n/a  | n/a  |
| 2.3.2 Gross expenditure on R&D, % GDP <sup>Ⓐ</sup> .....     | 0.1  | 101  |
| 2.3.3 Global R&D companies, avg. expend. top 3, mn \$US..... | 0.0  | 43 ○ |
| 2.3.4 QS university ranking, average score top 3*.....       | 0.0  | 75 ○ |

**3 Infrastructure.....24.8 120**

|  |         |       |
|--|---------|-------|
| 3.1 Information & communication technologies (ICTs).....     | 16.3    | 122   |
| 3.1.1 ICT access*.....                                       | n/a     | n/a   |
| 3.1.2 ICT use*.....  | n/a     | n/a   |
| 3.1.3 Government's online service*.....                      | 12.3    | 121   |
| 3.1.4 E-participation*.....                                  | 20.3    | 113   |
| 3.2 General infrastructure.....                              | 18.2    | 122   |
| 3.2.1 Electricity output, kWh/cap.....                       | 1,984.6 | 77    |
| 3.2.2 Logistics performance*.....                            | 0.0     | 127 ○ |
| 3.2.3 Gross capital formation, % GDP.....                    | 17.9    | 99    |
| 3.3 Ecological sustainability.....                           | 39.9    | 82    |
| 3.3.1 GDP/unit of energy use.....                            | 7.5     | 79    |
| 3.3.2 Environmental performance*.....                        | 73.1    | 66    |
| 3.3.3 ISO 14001 environmental certificates/bn PPP\$ GDP..... | 0.1     | 117   |

**4 Market sophistication.....53.6 29 ●**

|   |      |      |
|---|------|------|
| 4.1 Credit.....                                     | 49.4 | 29 ● |
| 4.1.1 Ease of getting credit*.....                  | 40.0 | 98   |
| 4.1.2 Domestic credit to private sector, % GDP..... | 22.7 | 108  |
| 4.1.3 Microfinance gross loans, % GDP.....          | 5.6  | 1 ●  |

|   |      |      |
|---|------|------|
| 4.2 Investment.....                                     | 66.7 | [11] |
| 4.2.1 Ease of protecting minority investors*.....       | 66.7 | 26 ● |
| 4.2.2 Market capitalization, % GDP.....                 | n/a  | n/a  |
| 4.2.3 Venture capital deals/bn PPP\$ GDP.....           | n/a  | n/a  |
| 4.3 Trade, competition, & market scale.....             | 44.9 | 115  |
| 4.3.1 Applied tariff rate, weighted mean, %.....        | 7.2  | 105  |
| 4.3.2 Intensity of local competition <sup>†</sup> ..... | 62.2 | 92   |
| 4.3.3 Domestic market scale, bn PPP\$.....              | 25.8 | 114  |

**5 Business sophistication.....24.2 107**

|  |      |       |
|--|------|-------|
| 5.1 Knowledge workers.....   | 26.8 | [94]  |
| 5.1.1 Knowledge-intensive employment, %.....                           | n/a  | n/a   |
| 5.1.2 Firms offering formal training, % firms.....                     | 33.1 | 41 ●  |
| 5.1.3 GERD performed by business, % of GDP.....                        | n/a  | n/a   |
| 5.1.4 GERD financed by business, % <sup>Ⓐ</sup> .....                  | 1.6  | 84    |
| 5.1.5 Females employed w/advanced degrees, % total.....                | n/a  | n/a   |
| 5.2 Innovation linkages.....   | 20.6 | 102   |
| 5.2.1 University/industry research collaboration <sup>†</sup> .....    | 55.2 | 30 ●  |
| 5.2.2 State of cluster development <sup>†</sup> .....                  | 33.6 | 108   |
| 5.2.3 GERD financed by abroad, % <sup>Ⓐ</sup> .....                    | 0.2  | 95    |
| 5.2.4 JV-strategic alliance deals/bn PPP\$ GDP.....                    | n/a  | n/a   |
| 5.2.5 Patent families 2+ offices/bn PPP\$ GDP <sup>Ⓐ</sup> .....       | 0.1  | 78    |
| 5.3 Knowledge absorption.....  | 25.3 | 96    |
| 5.3.1 Intellectual property payments, % total trade <sup>Ⓐ</sup> ..... | 0.0  | 116 ○ |
| 5.3.2 High-tech imports less re-imports, % total trade.....            | n/a  | n/a   |
| 5.3.3 ICT services imports, % total trade.....                         | 0.5  | 101   |
| 5.3.4 FDI net inflows, % GDP.....                                      | 3.4  | 49 ●  |
| 5.3.5 Research talent, % in business enterprise.....                   | n/a  | n/a   |

**6 Knowledge & technology outputs.....22.4 58 ●**

|  |       |       |
|--|-------|-------|
| 6.1 Knowledge creation.....  | 34.1  | 26 ●  |
| 6.1.1 Patents by origin/bn PPP\$ GDP.....                              | 0.1   | 109   |
| 6.1.2 PCT patent applications/bn PPP\$ GDP.....                        | n/a   | n/a   |
| 6.1.3 Utility models by origin/bn PPP\$ GDP.....                       | 3.7   | 7 ●   |
| 6.1.4 Scientific & technical articles/bn PPP\$ GDP.....                | 2.6   | 116   |
| 6.1.5 Citable documents H index.....                                   | 0.0   | 127 ○ |
| 6.2 Knowledge impact.....  | 25.8  | 86    |
| 6.2.1 Growth rate of PPP\$ GDP/worker, %.....                          | 3.8   | 17 ●  |
| 6.2.2 New businesses/th pop. 15–64 <sup>Ⓐ</sup> .....                  | 0.3   | 93    |
| 6.2.3 Computer software spending, % GDP.....                           | 0.1   | 95    |
| 6.2.4 ISO 9001 quality certificates/bn PPP\$ GDP.....                  | 0.2   | 124 ○ |
| 6.2.5 High- & medium-high-tech manufactures, % <sup>Ⓐ</sup> .....      | 0.0   | 100 ○ |
| 6.3 Knowledge diffusion.....   | 7.3   | 126 ○ |
| 6.3.1 Intellectual property receipts, % total trade <sup>Ⓐ</sup> ..... | 0.0   | 89    |
| 6.3.2 High-tech exports less re-exports, % total trade.....            | n/a   | n/a   |
| 6.3.3 ICT services exports, % total trade.....                         | 0.6   | 98    |
| 6.3.4 FDI net outflows, % GDP.....                                     | (1.9) | 123 ○ |

**7 Creative outputs.....19.2 106**

|  |      |       |
|--|------|-------|
| 7.1 Intangible assets.....   | 26.8 | 115   |
| 7.1.1 Trademarks by origin/bn PPP\$ GDP.....                       | 9.2  | 105   |
| 7.1.2 Industrial designs by origin/bn PPP\$ GDP <sup>Ⓐ</sup> ..... | 0.0  | 110 ○ |
| 7.1.3 ICTs & business model creation <sup>†</sup> .....            | 47.3 | 111   |
| 7.1.4 ICTs & organizational model creation <sup>†</sup> .....      | 42.1 | 102   |
| 7.2 Creative goods & services.....                                 | 12.7 | [79]  |
| 7.2.1 Cultural & creative services exports, % of total trade.....  | n/a  | n/a   |
| 7.2.2 National feature films/mn pop. 15–69 <sup>Ⓐ</sup> .....      | 1.8  | 64    |
| 7.2.3 Global ent. & media market/th pop. 15–69.....                | n/a  | n/a   |
| 7.2.4 Printing & publishing manufactures, % <sup>Ⓐ</sup> .....     | 1.2  | 53    |
| 7.2.5 Creative goods exports, % total trade.....                   | n/a  | n/a   |
| 7.3 Online creativity.....   | 10.7 | 98    |
| 7.3.1 Generic top-level domains (TLDs)/th pop. 15–69.....          | 0.0  | 123 ○ |
| 7.3.2 Country-code TLDs/th pop. 15–69.....                         | 0.4  | 95    |
| 7.3.3 Wikipedia edits/mn pop. 15–69 <sup>Ⓐ</sup> .....             | 3.3  | 97    |
| 7.3.4 Video uploads on YouTube/pop. 15–69.....                     | n/a  | n/a   |

NOTES: ● indicates a strength; ○ a weakness; \* an index; † a survey question.

Ⓐ indicates that the country's data are older than the base year; see Appendix II for details, including the year of the data, at <http://globalinnovationindex.org>.

Square brackets indicate that the data minimum coverage (DMC) requirements were not met at the sub-pillar or pillar level; see page 181 of this appendix for details.

## Key indicators

|                             |                    |
|-----------------------------|--------------------|
| Population (millions) ..... | 55.2               |
| GDP (US\$ billions) .....   | 46.7               |
| GDP per capita, PPP\$ ..... | 2,904.0            |
| Income group .....          | Low income         |
| Region .....                | Sub-Saharan Africa |

|  | Score 0–100<br>or value (hard data) | Rank      |
|--|-------------------------------------|-----------|
| <b>Global Innovation Index (out of 127).....</b> | <b>28.0</b>                         | <b>96</b> |
| Innovation Output Sub-Index .....                | 23.6                                | 76        |
| Innovation Input Sub-Index .....                 | 32.3                                | 109       |
| Innovation Efficiency Ratio .....                | 0.7                                 | 29 ●      |
| Global Innovation Index 2016 (out of 128) .....  | 26.4                                | 105       |

**1 Institutions..... 53.9 83**

|  |      |      |
|--|------|------|
| 1.1 Political environment .....                        | 39.9 | 97   |
| 1.1.1 Political stability & safety* .....              | 53.0 | 85   |
| 1.1.2 Government effectiveness* .....                  | 26.8 | 100  |
| 1.2 Regulatory environment .....                       | 63.6 | 66 ● |
| 1.2.1 Regulatory quality* .....                        | 32.8 | 92   |
| 1.2.2 Rule of law* .....                               | 27.0 | 87   |
| 1.2.3 Cost of redundancy dismissal, salary weeks ..... | 9.3  | 27 ● |
| 1.3 Business environment .....                         | 58.1 | 104  |
| 1.3.1 Ease of starting a business* .....               | 79.1 | 102  |
| 1.3.2 Ease of resolving insolvency* .....              | 41.0 | 89   |
| 1.3.3 Ease of paying taxes* .....                      | 54.1 | 107  |

**2 Human capital & research..... 9.5 125 ○**

|  |      |       |
|--|------|-------|
| 2.1 Education .....  | 22.9 | 121   |
| 2.1.1 Expenditure on education, % GDP .....                            | 3.5  | 92    |
| 2.1.2 Gov't expenditure/pupil, secondary, % GDP/cap <sup>Ⓢ</sup> ..... | 12.3 | 90    |
| 2.1.3 School life expectancy, years <sup>Ⓢ</sup> .....                 | 8.4  | 111   |
| 2.1.4 PISA scales in reading, maths, & science .....                   | n/a  | n/a   |
| 2.1.5 Pupil-teacher ratio, secondary <sup>Ⓢ</sup> .....                | 26.4 | 97    |
| 2.2 Tertiary education .....   | 2.5  | [123] |
| 2.2.1 Tertiary enrolment, % gross <sup>Ⓢ</sup> .....                   | 3.6  | 119 ○ |
| 2.2.2 Graduates in science & engineering, % .....                      | n/a  | n/a   |
| 2.2.3 Tertiary inbound mobility, % .....                               | n/a  | n/a   |
| 2.3 Research & development (R&D) .....                                 | 3.0  | 87    |
| 2.3.1 Researchers, FTE/mn pop. <sup>Ⓢ</sup> .....                      | 18.5 | 100 ○ |
| 2.3.2 Gross expenditure on R&D, % GDP <sup>Ⓢ</sup> .....               | 0.5  | 62    |
| 2.3.3 Global R&D companies, avg. expend. top 3, mn \$US .....          | 0.0  | 43 ○  |
| 2.3.4 QS university ranking, average score top 3* .....                | 0.0  | 75 ○  |

**3 Infrastructure..... 36.1 100**

|   |       |       |
|---|-------|-------|
| 3.1 Information & communication technologies (ICTs) .....     | 36.5  | 97    |
| 3.1.1 ICT access* .....                                       | 26.5  | 117   |
| 3.1.2 ICT use* .....  | 3.0   | 125 ○ |
| 3.1.3 Government's online service* .....                      | 57.2  | 72    |
| 3.1.4 E-participation* .....                                  | 59.3  | 65    |
| 3.2 General infrastructure .....                              | 41.7  | 47 ●  |
| 3.2.1 Electricity output, kWh/cap .....                       | 120.0 | 115   |
| 3.2.2 Logistics performance* .....                            | 42.9  | 60 ●  |
| 3.2.3 Gross capital formation, % GDP .....                    | 30.7  | 16 ●  |
| 3.3 Ecological sustainability .....                           | 30.0  | 116   |
| 3.3.1 GDP/unit of energy use .....                            | 4.8   | 105   |
| 3.3.2 Environmental performance* .....                        | 58.3  | 103   |
| 3.3.3 ISO 14001 environmental certificates/bn PPP\$ GDP ..... | 0.2   | 105   |

**4 Market sophistication ..... 36.0 110**

|  |      |      |
|--|------|------|
| 4.1 Credit .....                                     | 24.7 | 100  |
| 4.1.1 Ease of getting credit* .....                  | 65.0 | 40 ● |
| 4.1.2 Domestic credit to private sector, % GDP ..... | 15.2 | 116  |
| 4.1.3 Microfinance gross loans, % GDP .....          | 0.2  | 48   |

|   |       |      |
|---|-------|------|
| 4.2 Investment .....                                    | 27.3  | 120  |
| 4.2.1 Ease of protecting minority investors* .....      | 40.0  | 111  |
| 4.2.2 Market capitalization, % GDP .....                | n/a   | n/a  |
| 4.2.3 Venture capital deals/bn PPP\$ GDP .....          | 0.0   | 79   |
| 4.3 Trade, competition, & market scale .....            | 55.9  | 88   |
| 4.3.1 Applied tariff rate, weighted mean, % .....       | 6.5   | 102  |
| 4.3.2 Intensity of local competition <sup>†</sup> ..... | 62.0  | 94   |
| 4.3.3 Domestic market scale, bn PPP\$ .....             | 150.6 | 68 ● |

**5 Business sophistication ..... 26.1 97**

|  |      |       |
|--|------|-------|
| 5.1 Knowledge workers .....  | 14.2 | 119   |
| 5.1.1 Knowledge-intensive employment, % <sup>Ⓢ</sup> .....             | 3.4  | 107 ○ |
| 5.1.2 Firms offering formal training, % firms .....                    | 30.7 | 51    |
| 5.1.3 GERD performed by business, % of GDP .....                       | n/a  | n/a   |
| 5.1.4 GERD financed by business, % <sup>Ⓢ</sup> .....                  | 0.1  | 94 ○  |
| 5.1.5 Females employed w/advanced degrees, % total <sup>Ⓢ</sup> .....  | 1.3  | 85    |
| 5.2 Innovation linkages .....  | 39.7 | 31 ●  |
| 5.2.1 University/industry research collaboration <sup>†</sup> .....    | 42.3 | 53 ●  |
| 5.2.2 State of cluster development <sup>†</sup> .....                  | 44.8 | 67    |
| 5.2.3 GERD financed by abroad, % <sup>Ⓢ</sup> .....                    | 42.0 | 8 ●   |
| 5.2.4 JV-strategic alliance deals/bn PPP\$ GDP .....                   | 0.0  | 73    |
| 5.2.5 Patent families 2+ offices/bn PPP\$ GDP .....                    | 0.0  | 113   |
| 5.3 Knowledge absorption .....   | 24.4 | 99    |
| 5.3.1 Intellectual property payments, % total trade <sup>Ⓢ</sup> ..... | 0.0  | 113   |
| 5.3.2 High-tech imports less re-imports, % total trade .....           | 7.2  | 76    |
| 5.3.3 ICT services imports, % total trade <sup>Ⓢ</sup> .....           | 0.4  | 109   |
| 5.3.4 FDI net inflows, % GDP .....                                     | 4.4  | 32 ●  |
| 5.3.5 Research talent, % in business enterprise .....                  | n/a  | n/a   |

**6 Knowledge & technology outputs ..... 16.6 94**

|  |      |       |
|--|------|-------|
| 6.1 Knowledge creation .....   | 4.2  | 97    |
| 6.1.1 Patents by origin/bn PPP\$ GDP .....                             | 0.0  | 124 ○ |
| 6.1.2 PCT patent applications/bn PPP\$ GDP <sup>Ⓢ</sup> .....          | 0.0  | 102   |
| 6.1.3 Utility models by origin/bn PPP\$ GDP .....                      | n/a  | n/a   |
| 6.1.4 Scientific & technical articles/bn PPP\$ GDP .....               | 6.2  | 87    |
| 6.1.5 Citable documents H index .....                                  | 8.7  | 72    |
| 6.2 Knowledge impact .....   | 33.1 | 57 ●  |
| 6.2.1 Growth rate of PPP\$ GDP/worker, % .....                         | 4.1  | 14 ●  |
| 6.2.2 New businesses/th pop. 15–64 .....                               | n/a  | n/a   |
| 6.2.3 Computer software spending, % GDP .....                          | 0.0  | 123 ○ |
| 6.2.4 ISO 9001 quality certificates/bn PPP\$ GDP .....                 | 0.8  | 113   |
| 6.2.5 High- & medium-high-tech manufactures, % <sup>Ⓢ</sup> .....      | 0.1  | 82    |
| 6.3 Knowledge diffusion .....  | 12.6 | 123   |
| 6.3.1 Intellectual property receipts, % total trade <sup>Ⓢ</sup> ..... | 0.0  | 108 ○ |
| 6.3.2 High-tech exports less re-exports, % total trade .....           | 0.1  | 112   |
| 6.3.3 ICT services exports, % total trade <sup>Ⓢ</sup> .....           | 0.4  | 104   |
| 6.3.4 FDI net outflows, % GDP .....                                    | 0.0  | 109   |

**7 Creative outputs ..... 30.6 64 ●**

|  |      |      |
|--|------|------|
| 7.1 Intangible assets .....  | 48.3 | 45 ● |
| 7.1.1 Trademarks by origin/bn PPP\$ GDP .....                      | n/a  | n/a  |
| 7.1.2 Industrial designs by origin/bn PPP\$ GDP .....              | n/a  | n/a  |
| 7.1.3 ICTs & business model creation <sup>†</sup> .....            | 51.8 | 94   |
| 7.1.4 ICTs & organizational model creation <sup>†</sup> .....      | 44.7 | 93   |
| 7.2 Creative goods & services .....                                | 22.5 | [51] |
| 7.2.1 Cultural & creative services exports, % of total trade ..... | n/a  | n/a  |
| 7.2.2 National feature films/mn pop. 15–69 .....                   | n/a  | n/a  |
| 7.2.3 Global ent. & media market/th pop. 15–69 .....               | n/a  | n/a  |
| 7.2.4 Printing & publishing manufactures, % <sup>Ⓢ</sup> .....     | 2.8  | 10 ● |
| 7.2.5 Creative goods exports, % total trade <sup>Ⓢ</sup> .....     | 0.1  | 101  |
| 7.3 Online creativity .....  | 3.5  | 114  |
| 7.3.1 Generic top-level domains (TLDs)/th pop. 15–69 .....         | 0.2  | 117  |
| 7.3.2 Country-code TLDs/th pop. 15–69 .....                        | 0.1  | 106  |
| 7.3.3 Wikipedia edits/mn pop. 15–69 <sup>Ⓢ</sup> .....             | 1.0  | 115  |
| 7.3.4 Video uploads on YouTube/pop. 15–69 .....                    | n/a  | n/a  |

NOTES: ● indicates a strength; ○ a weakness; \* an index; † a survey question.

Ⓢ indicates that the country's data are older than the base year; see Appendix II for details, including the year of the data, at <http://globalinnovationindex.org>.

Square brackets indicate that the data minimum coverage (DMC) requirements were not met at the sub-pillar or pillar level; see page 181 of this appendix for details.



## Thailand

## Key indicators

|                            |   |
|----------------------------|---|
| Population (millions)..... | 68.1                                    |
| GDP (US\$ billions).....   | 390.6                                   |
| GDP per capita, PPP\$..... | 16,097.4                                |
| Income group.....          | Upper-middle income                     |
| Region.....                | South East Asia, East Asia, and Oceania |

|  | Score 0–100<br>or value (hard data) | Rank      |
|--|-------------------------------------|-----------|
| <b>Global Innovation Index (out of 127).....</b> | <b>37.6</b>                         | <b>51</b> |
| Innovation Output Sub-Index.....                 | 32.2                                | 43        |
| Innovation Input Sub-Index.....                  | 42.9                                | 65        |
| Innovation Efficiency Ratio.....                 | 0.8                                 | 24        |
| Global Innovation Index 2016 (out of 128).....   | 36.5                                | 52        |

|   |             |           |
|---|-------------|-----------|
| <b>1 Institutions.....</b>                            | <b>55.8</b> | <b>75</b> |
| 1.1 Political environment.....                        | 46.0        | 79        |
| 1.1.1 Political stability & safety*.....              | 40.7        | 108 ○     |
| 1.1.2 Government effectiveness*.....                  | 51.3        | 50        |
| 1.2 Regulatory environment.....                       | 43.8        | 110 ○     |
| 1.2.1 Regulatory quality*.....                        | 49.8        | 60        |
| 1.2.2 Rule of law*.....                               | 36.3        | 65        |
| 1.2.3 Cost of redundancy dismissal, salary weeks..... | 36.0        | 121 ○     |
| 1.3 Business environment.....                         | 77.6        | 37        |
| 1.3.1 Ease of starting a business*.....               | 87.0        | 64        |
| 1.3.2 Ease of resolving insolvency*.....              | 77.1        | 21 ●      |
| 1.3.3 Ease of paying taxes*.....                      | 68.7        | 80        |

|  |             |           |
|--|-------------|-----------|
| <b>2 Human capital &amp; research.....</b>                   | <b>30.8</b> | <b>72</b> |
| 2.1 Education.....   | 40.6        | 85        |
| 2.1.1 Expenditure on education, % GDP.....                   | 4.1         | 77        |
| 2.1.2 Gov't expenditure/pupil, secondary, % GDP/cap.....     | 17.8        | 63        |
| 2.1.3 School life expectancy, years.....                     | 16.0        | 32        |
| 2.1.4 PISA scales in reading, maths, & science.....          | 415.3       | 56        |
| 2.1.5 Pupil-teacher ratio, secondary.....                    | 28.2        | 101 ○     |
| 2.2 Tertiary education.....                                  | 26.7        | 90        |
| 2.2.1 Tertiary enrolment, % gross.....                       | 48.9        | 54        |
| 2.2.2 Graduates in science & engineering, %.....             | n/a         | n/a       |
| 2.2.3 Tertiary inbound mobility, %.....                      | 2.1         | 66        |
| 2.3 Research & development (R&D).....                        | 25.2        | 40        |
| 2.3.1 Researchers, FTE/mn pop.....                           | 874.3       | 51        |
| 2.3.2 Gross expenditure on R&D, % GDP.....                   | 0.6         | 52        |
| 2.3.3 Global R&D companies, avg. expend. top 3, mn \$US..... | 42.7        | 36        |
| 2.3.4 QS university ranking, average score top 3*.....       | 33.4        | 37        |

|  |             |           |
|--|-------------|-----------|
| <b>3 Infrastructure.....</b>                                 | <b>45.0</b> | <b>71</b> |
| 3.1 Information & communication technologies (ICTs).....     | 53.2        | 71        |
| 3.1.1 ICT access*.....                                       | 55.0        | 75        |
| 3.1.2 ICT use*.....  | 43.3        | 63        |
| 3.1.3 Government's online service*.....                      | 55.1        | 77        |
| 3.1.4 E-participation*.....                                  | 59.3        | 65        |
| 3.2 General infrastructure.....                              | 39.8        | 51        |
| 3.2.1 Electricity output, kWh/cap.....                       | 2,563.6     | 69        |
| 3.2.2 Logistics performance*.....                            | 55.1        | 44        |
| 3.2.3 Gross capital formation, % GDP.....                    | 24.4        | 48        |
| 3.3 Ecological sustainability.....                           | 42.0        | 77        |
| 3.3.1 GDP/unit of energy use.....                            | 7.4         | 80        |
| 3.3.2 Environmental performance*.....                        | 69.5        | 81        |
| 3.3.3 ISO 14001 environmental certificates/bn PPP\$ GDP..... | 2.7         | 41        |

|  |             |           |
|--|-------------|-----------|
| <b>4 Market sophistication.....</b>                      | <b>51.2</b> | <b>42</b> |
| 4.1 Credit.....  | 36.9        | 58        |
| 4.1.1 Ease of getting credit*.....                       | 50.0        | 72        |
| 4.1.2 Domestic credit to private sector, % GDP.....      | 151.3       | 8 ●       |
| 4.1.3 Microfinance gross loans, % GDP <sup>Ⓐ</sup> ..... | 0.0         | 81 ○      |

|   |         |      |
|---|---------|------|
| 4.2 Investment.....                                     | 43.3    | 50   |
| 4.2.1 Ease of protecting minority investors*.....       | 66.7    | 26   |
| 4.2.2 Market capitalization, % GDP.....                 | 88.3    | 14 ● |
| 4.2.3 Venture capital deals/bn PPP\$ GDP.....           | 0.0     | 77 ○ |
| 4.3 Trade, competition, & market scale.....             | 73.3    | 26   |
| 4.3.1 Applied tariff rate, weighted mean, %.....        | 3.5     | 77   |
| 4.3.2 Intensity of local competition <sup>†</sup> ..... | 71.9    | 43   |
| 4.3.3 Domestic market scale, bn PPP\$.....              | 1,161.3 | 20 ● |

|   |             |           |
|---|-------------|-----------|
| <b>5 Business sophistication.....</b>                                 | <b>31.8</b> | <b>68</b> |
| 5.1 Knowledge workers.....  | 29.2        | 85        |
| 5.1.1 Knowledge-intensive employment, % <sup>Ⓐ</sup> .....            | 13.8        | 91 ○      |
| 5.1.2 Firms offering formal training, % firms.....                    | 18.0        | 81 ○      |
| 5.1.3 GERD performed by business, % of GDP.....                       | 0.4         | 36        |
| 5.1.4 GERD financed by business, %.....                               | 66.2        | 6 ●       |
| 5.1.5 Females employed w/advanced degrees, % total <sup>Ⓐ</sup> ..... | 7.5         | 71        |
| 5.2 Innovation linkages.....  | 22.1        | 85        |
| 5.2.1 University/industry research collaboration <sup>†</sup> .....   | 46.2        | 40        |
| 5.2.2 State of cluster development <sup>†</sup> .....                 | 46.2        | 58        |
| 5.2.3 GERD financed by abroad, %.....                                 | 1.5         | 81 ○      |
| 5.2.4 JV-strategic alliance deals/bn PPP\$ GDP.....                   | 0.0         | 47        |
| 5.2.5 Patent families 2+ offices/bn PPP\$ GDP.....                    | 0.1         | 77        |
| 5.3 Knowledge absorption.....   | 44.1        | 22        |
| 5.3.1 Intellectual property payments, % total trade.....              | 1.6         | 18 ●      |
| 5.3.2 High-tech imports less re-imports, % total trade.....           | 15.6        | 12 ●      |
| 5.3.3 ICT services imports, % total trade.....                        | 0.2         | 117 ○     |
| 5.3.4 FDI net inflows, % GDP.....                                     | 2.4         | 73        |
| 5.3.5 Research talent, % in business enterprise.....                  | 50.9        | 21        |

|   |             |           |
|---|-------------|-----------|
| <b>6 Knowledge &amp; technology outputs.....</b>                  | <b>29.8</b> | <b>40</b> |
| 6.1 Knowledge creation.....                                       | 19.6        | 47        |
| 6.1.1 Patents by origin/bn PPP\$ GDP <sup>Ⓐ</sup> .....           | 0.9         | 66        |
| 6.1.2 PCT patent applications/bn PPP\$ GDP.....                   | 0.1         | 60        |
| 6.1.3 Utility models by origin/bn PPP\$ GDP.....                  | 1.9         | 16        |
| 6.1.4 Scientific & technical articles/bn PPP\$ GDP.....           | 6.5         | 84        |
| 6.1.5 Citable documents H index.....                              | 19.3        | 38        |
| 6.2 Knowledge impact.....   | 39.7        | 35        |
| 6.2.1 Growth rate of PPP\$ GDP/worker, %.....                     | 3.0         | 19 ●      |
| 6.2.2 New businesses/th pop. 15–64.....                           | 0.9         | 75        |
| 6.2.3 Computer software spending, % GDP.....                      | 0.3         | 47        |
| 6.2.4 ISO 9001 quality certificates/bn PPP\$ GDP.....             | 7.8         | 44        |
| 6.2.5 High- & medium-high-tech manufactures, % <sup>Ⓐ</sup> ..... | 0.4         | 19        |
| 6.3 Knowledge diffusion.....                                      | 30.1        | 39        |
| 6.3.1 Intellectual property receipts, % total trade.....          | 0.1         | 60        |
| 6.3.2 High-tech exports less re-exports, % total trade.....       | 15.2        | 9 ●       |
| 6.3.3 ICT services exports, % total trade.....                    | 0.2         | 117 ○     |
| 6.3.4 FDI net outflows, % GDP.....                                | 1.9         | 35        |

|   |             |           |
|---|-------------|-----------|
| <b>7 Creative outputs.....</b>                                    | <b>34.6</b> | <b>53</b> |
| 7.1 Intangible assets.....  | 42.6        | 62        |
| 7.1.1 Trademarks by origin/bn PPP\$ GDP.....                      | 30.0        | 72        |
| 7.1.2 Industrial designs by origin/bn PPP\$ GDP.....              | 3.0         | 37        |
| 7.1.3 ICTs & business model creation <sup>†</sup> .....           | 67.1        | 39        |
| 7.1.4 ICTs & organizational model creation <sup>†</sup> .....     | 58.9        | 43        |
| 7.2 Creative goods & services.....                                | 34.4        | 20 ●      |
| 7.2.1 Cultural & creative services exports, % of total trade..... | n/a         | n/a       |
| 7.2.2 National feature films/mn pop. 15–69 <sup>Ⓐ</sup> .....     | 1.0         | 78        |
| 7.2.3 Global ent. & media market/th pop. 15–69.....               | 5.5         | 43        |
| 7.2.4 Printing & publishing manufactures, % <sup>Ⓐ</sup> .....    | 0.8         | 76        |
| 7.2.5 Creative goods exports, % total trade.....                  | 9.5         | 5 ●       |
| 7.3 Online creativity.....  | 18.8        | 67        |
| 7.3.1 Generic top-level domains (TLDs)/th pop. 15–69.....         | 5.4         | 54        |
| 7.3.2 Country-code TLDs/th pop. 15–69.....                        | 0.4         | 94        |
| 7.3.3 Wikipedia edits/mn pop. 15–69.....                          | 4.3         | 75        |
| 7.3.4 Video uploads on YouTube/pop. 15–69.....                    | 28.2        | 46        |

NOTES: ● indicates a strength; ○ a weakness; \* an index; † a survey question.

Ⓐ indicates that the country's data are older than the base year; see Appendix II for details, including the year of the data, at <http://globalinnovationindex.org>.

Square brackets indicate that the data minimum coverage (DMC) requirements were not met at the sub-pillar or pillar level; see page 181 of this appendix for details.



## Key indicators

|                            |                     |
|----------------------------|---------------------|
| Population (millions)..... | 2.1                 |
| GDP (US\$ billions).....   | 10.5                |
| GDP per capita, PPP\$..... | 14,009.1            |
| Income group.....          | Upper-middle income |
| Region.....                | Europe              |

|  | Score 0–100<br>or value (hard data) | Rank      |
|--|-------------------------------------|-----------|
| <b>Global Innovation Index (out of 127).....</b> | <b>35.4</b>                         | <b>61</b> |
| Innovation Output Sub-Index.....                 | 26.3                                | 63        |
| Innovation Input Sub-Index.....                  | 44.5                                | 53        |
| Innovation Efficiency Ratio.....                 | 0.6                                 | 80        |
| Global Innovation Index 2016 (out of 128).....   | 35.4                                | 58        |

## 1 Institutions.....68.9 45

|   |      |      |
|---|------|------|
| 1.1 Political environment.....                        | 52.2 | 63   |
| 1.1.1 Political stability & safety*.....              | 59.0 | 75   |
| 1.1.2 Government effectiveness*.....                  | 45.4 | 63   |
| 1.2 Regulatory environment.....                       | 67.0 | 52   |
| 1.2.1 Regulatory quality*.....                        | 53.5 | 53   |
| 1.2.2 Rule of law*.....                               | 34.3 | 70   |
| 1.2.3 Cost of redundancy dismissal, salary weeks..... | 13.0 | 47   |
| 1.3 Business environment.....                         | 87.4 | 12 ● |
| 1.3.1 Ease of starting a business*.....               | 98.1 | 4 ●  |
| 1.3.2 Ease of resolving insolvency*.....              | 72.4 | 30 ● |
| 1.3.3 Ease of paying taxes*.....                      | 91.7 | 9 ●  |

## 2 Human capital & research.....29.7 77

|  |       |      |
|--|-------|------|
| 2.1 Education.....   | 51.5  | 51   |
| 2.1.1 Expenditure on education, % GDP.....                   | n/a   | n/a  |
| 2.1.2 Gov't expenditure/pupil, secondary, % GDP/cap.....     | n/a   | n/a  |
| 2.1.3 School life expectancy, years.....                     | 12.8  | 76   |
| 2.1.4 PISA scales in reading, maths, & science.....          | 368.9 | 68 ○ |
| 2.1.5 Pupil-teacher ratio, secondary <sup>Ⓐ</sup> .....      | 9.6   | 21 ● |
| 2.2 Tertiary education.....                                  | 32.4  | 75   |
| 2.2.1 Tertiary enrolment, % gross <sup>Ⓐ</sup> .....         | 39.6  | 66   |
| 2.2.2 Graduates in science & engineering, %.....             | 21.2  | 48   |
| 2.2.3 Tertiary inbound mobility, % <sup>Ⓐ</sup> .....        | 2.8   | 59   |
| 2.3 Research & development (R&D).....                        | 5.1   | 75   |
| 2.3.1 Researchers, FTE/mn pop.....                           | 858.8 | 52   |
| 2.3.2 Gross expenditure on R&D, % GDP.....                   | 0.4   | 69   |
| 2.3.3 Global R&D companies, avg. expend. top 3, mn \$US..... | 0.0   | 43 ○ |
| 2.3.4 QS university ranking, average score top 3*.....       | 0.0   | 75 ○ |

## 3 Infrastructure.....42.2 80

|  |         |       |
|--|---------|-------|
| 3.1 Information & communication technologies (ICTs).....     | 60.1    | 61    |
| 3.1.1 ICT access*.....                                       | 66.8    | 60    |
| 3.1.2 ICT use*.....  | 51.7    | 56    |
| 3.1.3 Government's online service*.....                      | 60.9    | 62    |
| 3.1.4 E-participation*.....                                  | 61.0    | 63    |
| 3.2 General infrastructure.....                              | 15.0    | 124 ○ |
| 3.2.1 Electricity output, kWh/cap.....                       | 2,583.7 | 66    |
| 3.2.2 Logistics performance*.....                            | 20.7    | 100 ○ |
| 3.2.3 Gross capital formation, % GDP.....                    | n/a     | n/a   |
| 3.3 Ecological sustainability.....                           | 51.5    | 43    |
| 3.3.1 GDP/unit of energy use.....                            | 10.0    | 48    |
| 3.3.2 Environmental performance*.....                        | 78.0    | 49    |
| 3.3.3 ISO 14001 environmental certificates/bn PPP\$ GDP..... | 4.3     | 22 ●  |

## 4 Market sophistication.....47.4 59

|   |      |      |
|---|------|------|
| 4.1 Credit.....                                     | 35.2 | 64   |
| 4.1.1 Ease of getting credit*.....                  | 80.0 | 15 ● |
| 4.1.2 Domestic credit to private sector, % GDP..... | 50.9 | 68   |
| 4.1.3 Microfinance gross loans, % GDP.....          | 0.3  | 40   |

|   |      |       |
|---|------|-------|
| 4.2 Investment.....                                     | 49.7 | 30 ●  |
| 4.2.1 Ease of protecting minority investors*.....       | 73.3 | 13 ●  |
| 4.2.2 Market capitalization, % GDP <sup>Ⓐ</sup> .....   | 5.7  | 81 ○  |
| 4.2.3 Venture capital deals/bn PPP\$ GDP.....           | n/a  | n/a   |
| 4.3 Trade, competition, & market scale.....             | 57.4 | 81    |
| 4.3.1 Applied tariff rate, weighted mean, %.....        | 1.1  | 16 ●  |
| 4.3.2 Intensity of local competition <sup>†</sup> ..... | 73.0 | 40    |
| 4.3.3 Domestic market scale, bn PPP\$.....              | 30.1 | 108 ○ |

## 5 Business sophistication.....34.5 56

|   |      |      |
|---|------|------|
| 5.1 Knowledge workers.....  | 41.4 | 54   |
| 5.1.1 Knowledge-intensive employment, %.....                        | 27.3 | 51   |
| 5.1.2 Firms offering formal training, % firms.....                  | 46.9 | 25   |
| 5.1.3 GERD performed by business, % of GDP <sup>Ⓐ</sup> .....       | 0.0  | 75 ○ |
| 5.1.4 GERD financed by business, %.....                             | n/a  | n/a  |
| 5.1.5 Females employed w/advanced degrees, % total.....             | 12.9 | 49   |
| 5.2 Innovation linkages.....  | 33.9 | 48   |
| 5.2.1 University/industry research collaboration <sup>†</sup> ..... | 40.7 | 67   |
| 5.2.2 State of cluster development <sup>†</sup> .....               | 47.3 | 52   |
| 5.2.3 GERD financed by abroad, %.....                               | n/a  | n/a  |
| 5.2.4 JV-strategic alliance deals/bn PPP\$ GDP.....                 | n/a  | n/a  |
| 5.2.5 Patent families 2+ offices/bn PPP\$ GDP.....                  | 0.0  | 86   |
| 5.3 Knowledge absorption.....                                       | 28.1 | 86   |
| 5.3.1 Intellectual property payments, % total trade.....            | 1.0  | 31   |
| 5.3.2 High-tech imports less re-imports, % total trade.....         | 6.4  | 89   |
| 5.3.3 ICT services imports, % total trade.....                      | 1.6  | 37   |
| 5.3.4 FDI net inflows, % GDP.....                                   | 2.4  | 75   |
| 5.3.5 Research talent, % in business enterprise <sup>Ⓐ</sup> .....  | 11.7 | 63   |

## 6 Knowledge & technology outputs.....18.9 83

|   |       |       |
|---|-------|-------|
| 6.1 Knowledge creation.....                                       | 6.4   | 79    |
| 6.1.1 Patents by origin/bn PPP\$ GDP <sup>Ⓐ</sup> .....           | 0.0   | 119 ○ |
| 6.1.2 PCT patent applications/bn PPP\$ GDP.....                   | 0.1   | 64    |
| 6.1.3 Utility models by origin/bn PPP\$ GDP.....                  | n/a   | n/a   |
| 6.1.4 Scientific & technical articles/bn PPP\$ GDP.....           | 14.2  | 53    |
| 6.1.5 Citable documents H index.....                              | 4.9   | 95 ○  |
| 6.2 Knowledge impact.....   | 31.2  | 63    |
| 6.2.1 Growth rate of PPP\$ GDP/worker, %.....                     | 1.3   | 45    |
| 6.2.2 New businesses/th pop. 15–64.....                           | 3.7   | 32    |
| 6.2.3 Computer software spending, % GDP.....                      | 0.1   | 80    |
| 6.2.4 ISO 9001 quality certificates/bn PPP\$ GDP.....             | 12.5  | 29 ●  |
| 6.2.5 High- & medium-high-tech manufactures, % <sup>Ⓐ</sup> ..... | 0.2   | 59    |
| 6.3 Knowledge diffusion.....                                      | 19.2  | 86    |
| 6.3.1 Intellectual property receipts, % total trade.....          | 0.2   | 44    |
| 6.3.2 High-tech exports less re-exports, % total trade.....       | 2.2   | 54    |
| 6.3.3 ICT services exports, % total trade.....                    | 2.5   | 43    |
| 6.3.4 FDI net outflows, % GDP.....                                | (0.1) | 115 ○ |

## 7 Creative outputs.....33.7 56

|   |      |      |
|---|------|------|
| 7.1 Intangible assets.....  | 45.4 | 56   |
| 7.1.1 Trademarks by origin/bn PPP\$ GDP.....                      | n/a  | n/a  |
| 7.1.2 Industrial designs by origin/bn PPP\$ GDP.....              | 1.6  | 49   |
| 7.1.3 ICTs & business model creation <sup>†</sup> .....           | 57.9 | 73   |
| 7.1.4 ICTs & organizational model creation <sup>†</sup> .....     | 51.2 | 70   |
| 7.2 Creative goods & services.....                                | 20.9 | 55   |
| 7.2.1 Cultural & creative services exports, % of total trade..... | 0.2  | 43   |
| 7.2.2 National feature films/mn pop. 15–69.....                   | 6.4  | 29   |
| 7.2.3 Global ent. & media market/th pop. 15–69.....               | n/a  | n/a  |
| 7.2.4 Printing & publishing manufactures, % <sup>Ⓐ</sup> .....    | 2.6  | 12 ● |
| 7.2.5 Creative goods exports, % total trade.....                  | 0.2  | 81   |
| 7.3 Online creativity.....  | 23.1 | 56   |
| 7.3.1 Generic top-level domains (TLDs)/th pop. 15–69.....         | 6.6  | 50   |
| 7.3.2 Country-code TLDs/th pop. 15–69.....                        | 1.4  | 71   |
| 7.3.3 Wikipedia edits/mn pop. 15–69 <sup>Ⓐ</sup> .....            | 6.2  | 36   |
| 7.3.4 Video uploads on YouTube/pop. 15–69.....                    | 25.1 | 50   |

NOTES: ● indicates a strength; ○ a weakness; \* an index; † a survey question.

Ⓐ indicates that the country's data are older than the base year; see Appendix II for details, including the year of the data, at <http://globalinnovationindex.org>.

Square brackets indicate that the data minimum coverage (DMC) requirements were not met at the sub-pillar or pillar level; see page 181 of this appendix for details.

## Key indicators

|                            |                    |
|----------------------------|--------------------|
| Population (millions)..... | 7.5                |
| GDP (US\$ billions).....   | 4.5                |
| GDP per capita, PPP\$..... | 1,483.4            |
| Income group.....          | Low income         |
| Region.....                | Sub-Saharan Africa |

|  | Score 0–100<br>or value (hard data) | Rank         |
|--|-------------------------------------|--------------|
| <b>Global Innovation Index (out of 127).....</b> | <b>18.4</b>                         | <b>125</b> ○ |
| Innovation Output Sub-Index.....                 | 8.0                                 | 127 ○        |
| Innovation Input Sub-Index.....                  | 28.8                                | 119          |
| Innovation Efficiency Ratio.....                 | 0.3                                 | 126 ○        |
| Global Innovation Index 2016 (out of 128).....   | 18.4                                | 126          |

|   |             |           |
|---|-------------|-----------|
| <b>1 Institutions.....</b>                            | <b>49.4</b> | <b>96</b> |
| 1.1 Political environment.....                        | 35.7        | 106       |
| 1.1.1 Political stability & safety*.....              | 59.6        | 73 ●      |
| 1.1.2 Government effectiveness*.....                  | 11.9        | 125 ○     |
| 1.2 Regulatory environment.....                       | 54.2        | 88        |
| 1.2.1 Regulatory quality*.....                        | 21.1        | 113       |
| 1.2.2 Rule of law*.....                               | 16.1        | 109       |
| 1.2.3 Cost of redundancy dismissal, salary weeks..... | 13.1        | 51 ●      |
| 1.3 Business environment.....                         | 58.2        | 103       |
| 1.3.1 Ease of starting a business*.....               | 81.7        | 94        |
| 1.3.2 Ease of resolving insolvency*.....              | 44.7        | 79        |
| 1.3.3 Ease of paying taxes*.....                      | 48.2        | 116       |

|  |             |            |
|--|-------------|------------|
| <b>2 Human capital &amp; research.....</b>                             | <b>15.7</b> | <b>111</b> |
| 2.1 Education.....   | 37.4        | 96         |
| 2.1.1 Expenditure on education, % GDP.....                             | 5.3         | 37 ●       |
| 2.1.2 Gov't expenditure/pupil, secondary, % GDP/cap <sup>Ⓔ</sup> ..... | 15.6        | 77         |
| 2.1.3 School life expectancy, years <sup>Ⓔ</sup> .....                 | 12.0        | 88         |
| 2.1.4 PISA scales in reading, maths, & science.....                    | n/a         | n/a        |
| 2.1.5 Pupil-teacher ratio, secondary <sup>Ⓔ</sup> .....                | 26.2        | 96         |
| 2.2 Tertiary education.....  | 8.0         | 116        |
| 2.2.1 Tertiary enrolment, % gross.....                                 | 10.6        | 102        |
| 2.2.2 Graduates in science & engineering, %.....                       | n/a         | n/a        |
| 2.2.3 Tertiary inbound mobility, % <sup>Ⓔ</sup> .....                  | 1.4         | 78         |
| 2.3 Research & development (R&D).....                                  | 1.6         | 97         |
| 2.3.1 Researchers, FTE/mn pop. <sup>Ⓔ</sup> .....                      | 38.2        | 96         |
| 2.3.2 Gross expenditure on R&D, % GDP <sup>Ⓔ</sup> .....               | 0.3         | 82         |
| 2.3.3 Global R&D companies, avg. expend. top 3, mn \$US.....           | 0.0         | 43 ○       |
| 2.3.4 QS university ranking, average score top 3*.....                 | 0.0         | 75 ○       |

|  |             |            |
|--|-------------|------------|
| <b>3 Infrastructure.....</b>                                 | <b>26.5</b> | <b>115</b> |
| 3.1 Information & communication technologies (ICTs).....     | 25.4        | 112        |
| 3.1.1 ICT access*.....                                       | 25.9        | 119        |
| 3.1.2 ICT use*.....  | 4.9         | 121        |
| 3.1.3 Government's online service*.....                      | 31.9        | 107        |
| 3.1.4 E-participation*.....                                  | 39.0        | 98         |
| 3.2 General infrastructure.....                              | 32.0        | 87         |
| 3.2.1 Electricity output, kWh/cap.....                       | 19.9        | 118 ○      |
| 3.2.2 Logistics performance*.....                            | 25.7        | 90         |
| 3.2.3 Gross capital formation, % GDP.....                    | 26.0        | 37 ●       |
| 3.3 Ecological sustainability.....                           | 22.0        | 123 ○      |
| 3.3.1 GDP/unit of energy use.....                            | 2.9         | 113        |
| 3.3.2 Environmental performance*.....                        | 46.1        | 114        |
| 3.3.3 ISO 14001 environmental certificates/bn PPP\$ GDP..... | 0.2         | 109        |

|   |             |            |
|---|-------------|------------|
| <b>4 Market sophistication.....</b>                 | <b>30.7</b> | <b>119</b> |
| 4.1 Credit.....                                     | 30.3        | 77         |
| 4.1.1 Ease of getting credit*.....                  | 30.0        | 108        |
| 4.1.2 Domestic credit to private sector, % GDP..... | 37.1        | 88         |
| 4.1.3 Microfinance gross loans, % GDP.....          | 2.7         | 14 ●       |

|   |      |       |
|---|------|-------|
| 4.2 Investment.....                                     | 40.0 | [64]  |
| 4.2.1 Ease of protecting minority investors*.....       | 40.0 | 111   |
| 4.2.2 Market capitalization, % GDP.....                 | n/a  | n/a   |
| 4.2.3 Venture capital deals/bn PPP\$ GDP.....           | n/a  | n/a   |
| 4.3 Trade, competition, & market scale.....             | 21.6 | 127 ○ |
| 4.3.1 Applied tariff rate, weighted mean, %.....        | 11.4 | 117   |
| 4.3.2 Intensity of local competition <sup>†</sup> ..... | n/a  | n/a   |
| 4.3.3 Domestic market scale, bn PPP\$.....              | 11.6 | 125 ○ |

|   |             |              |
|---|-------------|--------------|
| <b>5 Business sophistication.....</b>                                     | <b>21.9</b> | <b>[117]</b> |
| 5.1 Knowledge workers.....  | 36.4        | [69]         |
| 5.1.1 Knowledge-intensive employment, %.....                              | n/a         | n/a          |
| 5.1.2 Firms offering formal training, % firms <sup>Ⓔ</sup> .....          | 31.0        | 50 ●         |
| 5.1.3 GERD performed by business, % of GDP.....                           | n/a         | n/a          |
| 5.1.4 GERD financed by business, %.....                                   | n/a         | n/a          |
| 5.1.5 Females employed w/advanced degrees, % total.....                   | n/a         | n/a          |
| 5.2 Innovation linkages.....  | 9.3         | [126]        |
| 5.2.1 University/industry research collaboration <sup>†</sup> .....       | n/a         | n/a          |
| 5.2.2 State of cluster development <sup>†</sup> .....                     | n/a         | n/a          |
| 5.2.3 GERD financed by abroad, % <sup>Ⓔ</sup> .....                       | 5.5         | 63           |
| 5.2.4 JV-strategic alliance deals/bn PPP\$ GDP.....                       | n/a         | n/a          |
| 5.2.5 Patent families 2+ offices/bn PPP\$ GDP.....                        | n/a         | n/a          |
| 5.3 Knowledge absorption.....   | 19.9        | 122          |
| 5.3.1 Intellectual property payments, % total trade <sup>Ⓔ</sup> .....    | 0.1         | 96           |
| 5.3.2 High-tech imports less re-imports, % total trade <sup>Ⓔ</sup> ..... | 2.7         | 123 ○        |
| 5.3.3 ICT services imports, % total trade <sup>Ⓔ</sup> .....              | 0.8         | 77           |
| 5.3.4 FDI net inflows, % GDP.....   | 2.5         | 71 ●         |
| 5.3.5 Research talent, % in business enterprise.....                      | n/a         | n/a          |

|   |             |            |
|---|-------------|------------|
| <b>6 Knowledge &amp; technology outputs.....</b>                          | <b>12.5</b> | <b>116</b> |
| 6.1 Knowledge creation.....   | 3.7         | 102        |
| 6.1.1 Patents by origin/bn PPP\$ GDP <sup>Ⓔ</sup> .....                   | 0.3         | 88         |
| 6.1.2 PCT patent applications/bn PPP\$ GDP.....                           | n/a         | n/a        |
| 6.1.3 Utility models by origin/bn PPP\$ GDP.....                          | n/a         | n/a        |
| 6.1.4 Scientific & technical articles/bn PPP\$ GDP.....                   | 6.7         | 80         |
| 6.1.5 Citable documents H index.....                                      | 0.9         | 124 ○      |
| 6.2 Knowledge impact.....   | 4.0         | 121        |
| 6.2.1 Growth rate of PPP\$ GDP/worker, %.....                             | n/a         | n/a        |
| 6.2.2 New businesses/th pop. 15–64.....                                   | 0.3         | 93         |
| 6.2.3 Computer software spending, % GDP.....                              | 0.1         | 93         |
| 6.2.4 ISO 9001 quality certificates/bn PPP\$ GDP.....                     | 2.0         | 92         |
| 6.2.5 High- & medium-high-tech manufactures, %.....                       | n/a         | n/a        |
| 6.3 Knowledge diffusion.....  | 29.8        | 41 ●       |
| 6.3.1 Intellectual property receipts, % total trade <sup>Ⓔ</sup> .....    | 0.0         | 103        |
| 6.3.2 High-tech exports less re-exports, % total trade <sup>Ⓔ</sup> ..... | 0.0         | 121 ○      |
| 6.3.3 ICT services exports, % total trade <sup>Ⓔ</sup> .....              | 1.3         | 73 ●       |
| 6.3.4 FDI net outflows, % GDP.....  | 4.1         | 11 ●       |

|   |            |              |
|---|------------|--------------|
| <b>7 Creative outputs.....</b>  | <b>3.5</b> | <b>125</b> ○ |
| 7.1 Intangible assets.....  | 3.3        | 125 ○        |
| 7.1.1 Trademarks by origin/bn PPP\$ GDP.....                                    | 8.7        | 107          |
| 7.1.2 Industrial designs by origin/bn PPP\$ GDP.....                            | 0.4        | 86           |
| 7.1.3 ICTs & business model creation <sup>†</sup> .....                         | n/a        | n/a          |
| 7.1.4 ICTs & organizational model creation <sup>†</sup> .....                   | n/a        | n/a          |
| 7.2 Creative goods & services.....  | 4.4        | 111          |
| 7.2.1 Cultural & creative services exports, % of total trade <sup>Ⓔ</sup> ..... | 0.0        | 85           |
| 7.2.2 National feature films/mn pop. 15–69.....                                 | 4.6        | 42 ●         |
| 7.2.3 Global ent. & media market/th pop. 15–69.....                             | n/a        | n/a          |
| 7.2.4 Printing & publishing manufactures, %.....                                | n/a        | n/a          |
| 7.2.5 Creative goods exports, % total trade <sup>Ⓔ</sup> .....                  | 0.0        | 123 ○        |
| 7.3 Online creativity.....  | 3.3        | 118          |
| 7.3.1 Generic top-level domains (TLDs)/th pop. 15–69.....                       | 0.6        | 101          |
| 7.3.2 Country-code TLDs/th pop. 15–69.....                                      | 0.0        | 127 ○        |
| 7.3.3 Wikipedia edits/mn pop. 15–69 <sup>Ⓔ</sup> .....                          | 0.9        | 118          |
| 7.3.4 Video uploads on YouTube/pop. 15–69.....                                  | n/a        | n/a          |

NOTES: ● indicates a strength; ○ a weakness; \* an index; † a survey question.

Ⓔ indicates that the country's data are older than the base year; see Appendix II for details, including the year of the data, at <http://globalinnovationindex.org>.

Square brackets indicate that the data minimum coverage (DMC) requirements were not met at the sub-pillar or pillar level; see page 181 of this appendix for details.

## Key indicators

|                             |                                 |
|-----------------------------|---------------------------------|
| Population (millions) ..... | 1.4                             |
| GDP (US\$ billions) .....   | 22.8                            |
| GDP per capita, PPP\$ ..... | 32,635.5                        |
| Income group .....          | High income                     |
| Region .....                | Latin America and the Caribbean |

|   | Score 0–100<br>or value (hard data) | Rank      |
|---|-------------------------------------|-----------|
| <b>Global Innovation Index (out of 127)</b> ..... | <b>29.7</b>                         | <b>91</b> |
| Innovation Output Sub-Index .....                 | 21.3                                | 86        |
| Innovation Input Sub-Index .....                  | 38.2                                | 85        |
| Innovation Efficiency Ratio .....                 | 0.6                                 | 90        |
| Global Innovation Index 2016 (out of 128) .....   | n/a                                 | n/a       |

**1 Institutions ..... 60.7 65**

|  |      |     |   |
|--|------|-----|---|
| 1.1 Political environment .....                        | 59.3 | 49  | ● |
| 1.1.1 Political stability & safety* .....              | 70.4 | 49  | ● |
| 1.1.2 Government effectiveness* .....                  | 48.2 | 56  | ● |
| 1.2 Regulatory environment .....                       | 57.9 | 76  |   |
| 1.2.1 Regulatory quality* .....                        | 45.8 | 66  |   |
| 1.2.2 Rule of law* .....                               | 35.2 | 68  |   |
| 1.2.3 Cost of redundancy dismissal, salary weeks ..... | 20.5 | 84  |   |
| 1.3 Business environment .....                         | 64.9 | 77  |   |
| 1.3.1 Ease of starting a business* .....               | 88.6 | 57  | ● |
| 1.3.2 Ease of resolving insolvency* .....              | 48.7 | 65  |   |
| 1.3.3 Ease of paying taxes* .....                      | 57.3 | 101 |   |

**2 Human capital & research ..... 20.4 [99]**

|   |       |      |   |
|---|-------|------|---|
| 2.1 Education .....   | 40.4  | [87] |   |
| 2.1.1 Expenditure on education, % GDP .....                   | n/a   | n/a  |   |
| 2.1.2 Gov't expenditure/pupil, secondary, % GDP/cap .....     | n/a   | n/a  |   |
| 2.1.3 School life expectancy, years .....                     | n/a   | n/a  |   |
| 2.1.4 PISA scales in reading, maths, & science .....          | 423.0 | 50   |   |
| 2.1.5 Pupil-teacher ratio, secondary .....                    | n/a   | n/a  |   |
| 2.2 Tertiary education .....                                  | n/a   | n/a  |   |
| 2.2.1 Tertiary enrolment, % gross .....                       | n/a   | n/a  |   |
| 2.2.2 Graduates in science & engineering, % .....             | n/a   | n/a  |   |
| 2.2.3 Tertiary inbound mobility, % .....                      | n/a   | n/a  |   |
| 2.3 Research & development (R&D) .....                        | 0.5   | 109  |   |
| 2.3.1 Researchers, FTE/mn pop. .....                          | n/a   | n/a  |   |
| 2.3.2 Gross expenditure on R&D, % GDP <sup>Ⓢ</sup> .....      | 0.1   | 107  | ○ |
| 2.3.3 Global R&D companies, avg. expend. top 3, mn \$US ..... | 0.0   | 43   | ○ |
| 2.3.4 QS university ranking, average score top 3* .....       | 0.0   | 75   | ○ |

**3 Infrastructure ..... 35.9 101**

|   |         |     |   |
|---|---------|-----|---|
| 3.1 Information & communication technologies (ICTs) .....     | 53.1    | 72  |   |
| 3.1.1 ICT access* .....                                       | 70.3    | 50  | ● |
| 3.1.2 ICT use* .....  | 45.3    | 62  |   |
| 3.1.3 Government's online service* .....                      | 52.9    | 79  |   |
| 3.1.4 E-participation* .....                                  | 44.1    | 96  |   |
| 3.2 General infrastructure .....                              | 21.9    | 116 |   |
| 3.2.1 Electricity output, kWh/cap .....                       | 7,326.7 | 26  | ● |
| 3.2.2 Logistics performance* .....                            | 15.5    | 113 |   |
| 3.2.3 Gross capital formation, % GDP .....                    | 13.4    | 118 | ○ |
| 3.3 Ecological sustainability .....                           | 32.5    | 111 |   |
| 3.3.1 GDP/unit of energy use .....                            | 2.1     | 118 | ○ |
| 3.3.2 Environmental performance* .....                        | 74.3    | 58  |   |
| 3.3.3 ISO 14001 environmental certificates/bn PPP\$ GDP ..... | 0.5     | 81  |   |

**4 Market sophistication ..... 45.0 71**

|  |      |    |   |
|--|------|----|---|
| 4.1 Credit .....   | 26.3 | 95 |   |
| 4.1.1 Ease of getting credit* .....                      | 65.0 | 40 | ● |
| 4.1.2 Domestic credit to private sector, % GDP .....     | 37.1 | 87 |   |
| 4.1.3 Microfinance gross loans, % GDP <sup>Ⓢ</sup> ..... | 0.0  | 77 |   |

|  |      |      |
|--|------|------|
| 4.2 Investment .....   | 60.0 | [18] |
| 4.2.1 Ease of protecting minority investors* .....             | 60.0 | 52   |
| 4.2.2 Market capitalization, % GDP .....                       | n/a  | n/a  |
| 4.2.3 Venture capital deals/bn PPP\$ GDP .....                 | n/a  | n/a  |
| 4.3 Trade, competition, & market scale .....                   | 48.6 | 105  |
| 4.3.1 Applied tariff rate, weighted mean, % <sup>Ⓢ</sup> ..... | 8.3  | 108  |
| 4.3.2 Intensity of local competition <sup>†</sup> .....        | 70.3 | 57   |
| 4.3.3 Domestic market scale, bn PPP\$ .....                    | 43.6 | 94   |

**5 Business sophistication ..... 29.1 77**

|   |      |     |   |
|---|------|-----|---|
| 5.1 Knowledge workers .....   | 32.7 | 80  |   |
| 5.1.1 Knowledge-intensive employment, % .....                             | 28.4 | 49  |   |
| 5.1.2 Firms offering formal training, % firms <sup>Ⓢ</sup> .....          | 28.0 | 57  |   |
| 5.1.3 GERD performed by business, % of GDP <sup>Ⓢ</sup> .....             | 0.0  | 87  | ○ |
| 5.1.4 GERD financed by business, % .....                                  | n/a  | n/a |   |
| 5.1.5 Females employed w/advanced degrees, % total .....                  | n/a  | n/a |   |
| 5.2 Innovation linkages .....   | 28.8 | 59  |   |
| 5.2.1 University/industry research collaboration <sup>†</sup> .....       | 31.7 | 102 |   |
| 5.2.2 State of cluster development <sup>†</sup> .....                     | 41.5 | 78  |   |
| 5.2.3 GERD financed by abroad, % .....                                    | n/a  | n/a |   |
| 5.2.4 JV-strategic alliance deals/bn PPP\$ GDP .....                      | n/a  | n/a |   |
| 5.2.5 Patent families 2+ offices/bn PPP\$ GDP .....                       | 0.0  | 85  |   |
| 5.3 Knowledge absorption .....  | 25.9 | 93  |   |
| 5.3.1 Intellectual property payments, % total trade .....                 | n/a  | n/a |   |
| 5.3.2 High-tech imports less re-imports, % total trade <sup>Ⓢ</sup> ..... | 4.9  | 110 |   |
| 5.3.3 ICT services imports, % total trade <sup>Ⓢ</sup> .....              | 0.1  | 122 | ○ |
| 5.3.4 FDI net inflows, % GDP .....  | 8.0  | 17  | ● |
| 5.3.5 Research talent, % in business enterprise .....                     | n/a  | n/a |   |

**6 Knowledge & technology outputs ..... 22.5 56 ●**

|   |       |      |   |
|---|-------|------|---|
| 6.1 Knowledge creation .....  | 3.4   | 107  |   |
| 6.1.1 Patents by origin/bn PPP\$ GDP .....                                | 0.1   | 111  |   |
| 6.1.2 PCT patent applications/bn PPP\$ GDP .....                          | 0.9   | 29   | ● |
| 6.1.3 Utility models by origin/bn PPP\$ GDP <sup>Ⓢ</sup> .....            | 0.0   | 62   | ○ |
| 6.1.4 Scientific & technical articles/bn PPP\$ GDP .....                  | 3.3   | 107  |   |
| 6.1.5 Citable documents H index .....                                     | 4.4   | 98   |   |
| 6.2 Knowledge impact .....  | 23.0  | [97] |   |
| 6.2.1 Growth rate of PPP\$ GDP/worker, % .....                            | (1.0) | 98   |   |
| 6.2.2 New businesses/th pop. 15–64 .....                                  | n/a   | n/a  |   |
| 6.2.3 Computer software spending, % GDP .....                             | n/a   | n/a  |   |
| 6.2.4 ISO 9001 quality certificates/bn PPP\$ GDP .....                    | 2.6   | 84   |   |
| 6.2.5 High- & medium-high-tech manufactures, % .....                      | n/a   | n/a  |   |
| 6.3 Knowledge diffusion .....   | 41.2  | 20   | ● |
| 6.3.1 Intellectual property receipts, % total trade .....                 | n/a   | n/a  |   |
| 6.3.2 High-tech exports less re-exports, % total trade <sup>Ⓢ</sup> ..... | 0.0   | 120  | ○ |
| 6.3.3 ICT services exports, % total trade <sup>Ⓢ</sup> .....              | 0.1   | 123  | ○ |
| 6.3.4 FDI net outflows, % GDP .....                                       | 5.6   | 9    | ● |

**7 Creative outputs ..... 20.0 101**

|  |      |       |   |
|--|------|-------|---|
| 7.1 Intangible assets .....  | 30.9 | 101   |   |
| 7.1.1 Trademarks by origin/bn PPP\$ GDP .....                      | 17.3 | 87    |   |
| 7.1.2 Industrial designs by origin/bn PPP\$ GDP .....              | 0.4  | 83    |   |
| 7.1.3 ICTs & business model creation <sup>†</sup> .....            | 53.2 | 90    |   |
| 7.1.4 ICTs & organizational model creation <sup>†</sup> .....      | 45.6 | 89    |   |
| 7.2 Creative goods & services .....                                | 2.0  | [121] |   |
| 7.2.1 Cultural & creative services exports, % of total trade ..... | n/a  | n/a   |   |
| 7.2.2 National feature films/mn pop. 15–69 .....                   | n/a  | n/a   |   |
| 7.2.3 Global ent. & media market/th pop. 15–69 .....               | n/a  | n/a   |   |
| 7.2.4 Printing & publishing manufactures, % .....                  | n/a  | n/a   |   |
| 7.2.5 Creative goods exports, % total trade <sup>Ⓢ</sup> .....     | 0.1  | 103   |   |
| 7.3 Online creativity .....  | 16.1 | 77    |   |
| 7.3.1 Generic top-level domains (TLDs)/th pop. 15–69 .....         | 4.5  | 56    | ● |
| 7.3.2 Country-code TLDs/th pop. 15–69 .....                        | 1.5  | 69    |   |
| 7.3.3 Wikipedia edits/mn pop. 15–69 <sup>Ⓢ</sup> .....             | 4.4  | 71    |   |
| 7.3.4 Video uploads on YouTube/pop. 15–69 .....                    | n/a  | n/a   |   |

NOTES: ● indicates a strength; ○ a weakness; \* an index; † a survey question.

Ⓢ indicates that the country's data are older than the base year; see Appendix II for details, including the year of the data, at <http://globalinnovationindex.org>.

Square brackets indicate that the data minimum coverage (DMC) requirements were not met at the sub-pillar or pillar level; see page 181 of this appendix for details.

## Key indicators

|                             |                                  |
|-----------------------------|----------------------------------|
| Population (millions) ..... | 11.4                             |
| GDP (US\$ billions) .....   | 42.4                             |
| GDP per capita, PPP\$ ..... | 11,428.2                         |
| Income group .....          | Lower-middle income              |
| Region .....                | Northern Africa and Western Asia |

|  | Score 0–100<br>or value (hard data) | Rank      |
|--|-------------------------------------|-----------|
| <b>Global Innovation Index (out of 127).....</b> | <b>32.3</b>                         | <b>74</b> |
| Innovation Output Sub-Index .....                | 24.6                                | 71        |
| Innovation Input Sub-Index .....                 | 40.0                                | 81        |
| Innovation Efficiency Ratio .....                | 0.6                                 | 65        |
| Global Innovation Index 2016 (out of 128) .....  | 30.6                                | 77        |

|  |             |           |
|--|-------------|-----------|
| <b>1 Institutions.....</b>   | <b>54.9</b> | <b>77</b> |
| 1.1 Political environment .....  | 41.1        | 91        |
| 1.1.1 Political stability & safety* .....                              | 42.8        | 102       |
| 1.1.2 Government effectiveness* .....                                  | 39.5        | 78        |
| 1.2 Regulatory environment .....                                       | 54.0        | 90        |
| 1.2.1 Regulatory quality* .....  | 32.0        | 94        |
| 1.2.2 Rule of law* .....   | 37.9        | 60        |
| 1.2.3 Cost of redundancy dismissal, salary weeks .....                 | 21.6        | 89        |
| 1.3 Business environment .....   | 69.5        | 69        |
| 1.3.1 Ease of starting a business* .....                               | 85.0        | 78        |
| 1.3.2 Ease of resolving insolvency* .....                              | 54.5        | 55        |
| 1.3.3 Ease of paying taxes* .....                                      | 69.0        | 79        |
| <b>2 Human capital &amp; research.....</b>                             | <b>38.0</b> | <b>44</b> |
| 2.1 Education .....  | 49.9        | 55        |
| 2.1.1 Expenditure on education, % GDP <sup>Ⓔ</sup> .....               | 6.3         | 19 ●      |
| 2.1.2 Gov't expenditure/pupil, secondary, % GDP/cap <sup>Ⓔ</sup> ..... | 24.4        | 34 ●      |
| 2.1.3 School life expectancy, years .....                              | 14.8        | 55        |
| 2.1.4 PISA scales in reading, maths, & science .....                   | 371.4       | 67 ○      |
| 2.1.5 Pupil-teacher ratio, secondary <sup>Ⓔ</sup> .....                | 13.6        | 54        |
| 2.2 Tertiary education .....   | 55.0        | 14 ●      |
| 2.2.1 Tertiary enrolment, % gross .....                                | 34.6        | 75        |
| 2.2.2 Graduates in science & engineering, % .....                      | 44.1        | 3 ●       |
| 2.2.3 Tertiary inbound mobility, % .....                               | 2.0         | 69        |
| 2.3 Research & development (R&D) .....                                 | 9.1         | 61        |
| 2.3.1 Researchers, FTE/mn pop. .....                                   | 1,787.3     | 42        |
| 2.3.2 Gross expenditure on R&D, % GDP <sup>Ⓔ</sup> .....               | 0.7         | 51        |
| 2.3.3 Global R&D companies, avg. expend. top 3, mn \$US .....          | 0.0         | 43 ○      |
| 2.3.4 QS university ranking, average score top 3* .....                | 0.0         | 75 ○      |
| <b>3 Infrastructure.....</b>   | <b>45.2</b> | <b>70</b> |
| 3.1 Information & communication technologies (ICTs) .....              | 58.4        | 64        |
| 3.1.1 ICT access* .....  | 52.9        | 79        |
| 3.1.2 ICT use* .....   | 39.5        | 70        |
| 3.1.3 Government's online service* .....                               | 71.7        | 40        |
| 3.1.4 E-participation* .....   | 69.5        | 43        |
| 3.2 General infrastructure .....                                       | 27.3        | 101       |
| 3.2.1 Electricity output, kWh/cap .....                                | 1,729.5     | 81        |
| 3.2.2 Logistics performance* .....                                     | 20.1        | 104 ○     |
| 3.2.3 Gross capital formation, % GDP .....                             | 21.7        | 67        |
| 3.3 Ecological sustainability .....                                    | 49.8        | 48        |
| 3.3.1 GDP/unit of energy use .....                                     | 11.2        | 32 ●      |
| 3.3.2 Environmental performance* .....                                 | 77.3        | 52        |
| 3.3.3 ISO 14001 environmental certificates/bn PPP\$ GDP .....          | 1.8         | 50        |
| <b>4 Market sophistication .....</b>                                   | <b>38.7</b> | <b>98</b> |
| 4.1 Credit .....   | 27.4        | 88        |
| 4.1.1 Ease of getting credit* .....                                    | 45.0        | 84        |
| 4.1.2 Domestic credit to private sector, % GDP .....                   | 79.6        | 37 ●      |
| 4.1.3 Microfinance gross loans, % GDP .....                            | 0.3         | 41        |

|   |       |       |
|---|-------|-------|
| 4.2 Investment .....                                    | 29.2  | 117 ○ |
| 4.2.1 Ease of protecting minority investors* .....      | 46.7  | 95    |
| 4.2.2 Market capitalization, % GDP <sup>Ⓔ</sup> .....   | 21.1  | 61    |
| 4.2.3 Venture capital deals/bn PPP\$ GDP .....          | 0.0   | 32    |
| 4.3 Trade, competition, & market scale .....            | 59.5  | 73    |
| 4.3.1 Applied tariff rate, weighted mean, % .....       | 3.9   | 78    |
| 4.3.2 Intensity of local competition <sup>†</sup> ..... | 64.2  | 81    |
| 4.3.3 Domestic market scale, bn PPP\$ .....             | 130.8 | 71    |

**5 Business sophistication .....** **23.2** **112** ○

|  |      |       |
|--|------|-------|
| 5.1 Knowledge workers .....  | 27.7 | 91    |
| 5.1.1 Knowledge-intensive employment, % <sup>Ⓔ</sup> .....             | 21.0 | 70    |
| 5.1.2 Firms offering formal training, % firms .....                    | 28.9 | 53    |
| 5.1.3 GERD performed by business, % of GDP <sup>Ⓔ</sup> .....          | 0.1  | 61    |
| 5.1.4 GERD financed by business, % <sup>Ⓔ</sup> .....                  | 18.5 | 64    |
| 5.1.5 Females employed w/advanced degrees, % total .....               | n/a  | n/a   |
| 5.2 Innovation linkages .....  | 19.5 | 112 ○ |
| 5.2.1 University/industry research collaboration <sup>†</sup> .....    | 32.8 | 98    |
| 5.2.2 State of cluster development <sup>†</sup> .....                  | 36.3 | 97    |
| 5.2.3 GERD financed by abroad, % <sup>Ⓔ</sup> .....                    | 4.0  | 67    |
| 5.2.4 JV-strategic alliance deals/bn PPP\$ GDP .....                   | 0.0  | 30 ●  |
| 5.2.5 Patent families 2+ offices/bn PPP\$ GDP .....                    | 0.1  | 69    |
| 5.3 Knowledge absorption .....   | 22.3 | 113 ○ |
| 5.3.1 Intellectual property payments, % total trade <sup>Ⓔ</sup> ..... | 0.1  | 103 ○ |
| 5.3.2 High-tech imports less re-imports, % total trade .....           | 10.5 | 38 ●  |
| 5.3.3 ICT services imports, % total trade <sup>Ⓔ</sup> .....           | 0.4  | 106 ○ |
| 5.3.4 FDI net inflows, % GDP .....                                     | 2.2  | 77 ○  |
| 5.3.5 Research talent, % in business enterprise .....                  | 4.0  | 75 ○  |

**6 Knowledge & technology outputs .....** **21.0** **69**

|  |       |      |
|--|-------|------|
| 6.1 Knowledge creation .....   | 15.3  | 53   |
| 6.1.1 Patents by origin/bn PPP\$ GDP .....                             | 1.4   | 57   |
| 6.1.2 PCT patent applications/bn PPP\$ GDP .....                       | 0.0   | 84   |
| 6.1.3 Utility models by origin/bn PPP\$ GDP .....                      | n/a   | n/a  |
| 6.1.4 Scientific & technical articles/bn PPP\$ GDP .....               | 31.8  | 24 ● |
| 6.1.5 Citable documents H index .....                                  | 8.8   | 71   |
| 6.2 Knowledge impact .....   | 28.6  | 74   |
| 6.2.1 Growth rate of PPP\$ GDP/worker, % .....                         | (0.4) | 92 ○ |
| 6.2.2 New businesses/th pop. 15–64 <sup>Ⓔ</sup> .....                  | 1.5   | 55   |
| 6.2.3 Computer software spending, % GDP .....                          | 0.3   | 40 ● |
| 6.2.4 ISO 9001 quality certificates/bn PPP\$ GDP .....                 | 7.8   | 43   |
| 6.2.5 High- & medium-high-tech manufactures, % <sup>Ⓔ</sup> .....      | 0.3   | 34   |
| 6.3 Knowledge diffusion .....  | 19.0  | 89   |
| 6.3.1 Intellectual property receipts, % total trade <sup>Ⓔ</sup> ..... | 0.1   | 48   |
| 6.3.2 High-tech exports less re-exports, % total trade .....           | 4.3   | 37 ● |
| 6.3.3 ICT services exports, % total trade <sup>Ⓔ</sup> .....           | 1.6   | 64   |
| 6.3.4 FDI net outflows, % GDP .....                                    | 0.1   | 99   |

**7 Creative outputs .....** **28.3** **76**

|  |      |      |
|--|------|------|
| 7.1 Intangible assets .....  | 42.1 | 63   |
| 7.1.1 Trademarks by origin/bn PPP\$ GDP .....                      | n/a  | n/a  |
| 7.1.2 Industrial designs by origin/bn PPP\$ GDP .....              | 1.0  | 62   |
| 7.1.3 ICTs & business model creation <sup>†</sup> .....            | 58.9 | 69   |
| 7.1.4 ICTs & organizational model creation <sup>†</sup> .....      | 43.7 | 99   |
| 7.2 Creative goods & services .....                                | 17.7 | 66   |
| 7.2.1 Cultural & creative services exports, % of total trade ..... | n/a  | n/a  |
| 7.2.2 National feature films/mn pop. 15–69 .....                   | 1.4  | 72   |
| 7.2.3 Global ent. & media market/th pop. 15–69 .....               | 0.9  | 58 ○ |
| 7.2.4 Printing & publishing manufactures, % <sup>Ⓔ</sup> .....     | 0.7  | 80   |
| 7.2.5 Creative goods exports, % total trade .....                  | 2.1  | 24 ● |
| 7.3 Online creativity .....  | 11.2 | 96   |
| 7.3.1 Generic top-level domains (TLDs)/th pop. 15–69 .....         | 2.7  | 69   |
| 7.3.2 Country-code TLDs/th pop. 15–69 .....                        | 0.2  | 101  |
| 7.3.3 Wikipedia edits/mn pop. 15–69 <sup>Ⓔ</sup> .....             | 3.4  | 96   |
| 7.3.4 Video uploads on YouTube/pop. 15–69 .....                    | 9.2  | 63 ○ |

NOTES: ● indicates a strength; ○ a weakness; \* an index; † a survey question.

Ⓔ indicates that the country's data are older than the base year; see Appendix II for details, including the year of the data, at <http://globalinnovationindex.org>.

Square brackets indicate that the data minimum coverage (DMC) requirements were not met at the sub-pillar or pillar level; see page 181 of this appendix for details.

## Key indicators

|                            |                                  |
|----------------------------|----------------------------------|
| Population (millions)..... | 79.6                             |
| GDP (US\$ billions).....   | 735.7                            |
| GDP per capita, PPP\$..... | 20,437.8                         |
| Income group.....          | Upper-middle income              |
| Region.....                | Northern Africa and Western Asia |

|  | Score 0–100<br>or value (hard data) | Rank      |
|--|-------------------------------------|-----------|
| <b>Global Innovation Index (out of 127).....</b>               | <b>38.9</b>                         | <b>43</b> |
| Innovation Output Sub-Index.....                               | 35.5                                | 36        |
| Innovation Input Sub-Index.....                                | 42.3                                | 68        |
| Innovation Efficiency Ratio.....                               | 0.8                                 | 9 ●       |
| Global Innovation Index 2016 (out of 128).....                 | 39.0                                | 42        |
| <b>1 Institutions.....</b>                                     | <b>50.6</b>                         | <b>95</b> |
| 1.1 Political environment.....                                 | 40.5                                | 95        |
| 1.1.1 Political stability & safety*.....                       | 32.9                                | 117 ○     |
| 1.1.2 Government effectiveness*.....                           | 48.1                                | 57        |
| 1.2 Regulatory environment.....                                | 50.5                                | 97        |
| 1.2.1 Regulatory quality*.....                                 | 50.6                                | 58        |
| 1.2.2 Rule of law*.....  | 37.7                                | 62        |
| 1.2.3 Cost of redundancy dismissal, salary weeks.....          | 29.8                                | 116 ○     |
| 1.3 Business environment.....                                  | 60.9                                | 95        |
| 1.3.1 Ease of starting a business*.....                        | 87.0                                | 65        |
| 1.3.2 Ease of resolving insolvency*.....                       | 35.0                                | 106 ○     |
| 1.3.3 Ease of paying taxes*.....                               | 60.8                                | 92        |
| <b>2 Human capital &amp; research.....</b>                     | <b>38.1</b>                         | <b>43</b> |
| 2.1 Education.....   | 45.5                                | 72        |
| 2.1.1 Expenditure on education, % GDP.....                     | 4.8                                 | 59        |
| 2.1.2 Gov't expenditure/pupil, secondary, % GDP/cap.....       | 14.8                                | 84        |
| 2.1.3 School life expectancy, years <sup>Ⓐ</sup> .....         | 16.4                                | 24        |
| 2.1.4 PISA scales in reading, maths, & science.....            | 424.8                               | 49        |
| 2.1.5 Pupil-teacher ratio, secondary <sup>Ⓐ</sup> .....        | 20.1                                | 81        |
| 2.2 Tertiary education.....                                    | 39.8                                | 48        |
| 2.2.1 Tertiary enrolment, % gross <sup>Ⓐ</sup> .....           | 86.3                                | 8 ●       |
| 2.2.2 Graduates in science & engineering, % <sup>Ⓐ</sup> ..... | 20.9                                | 50        |
| 2.2.3 Tertiary inbound mobility, % <sup>Ⓐ</sup> .....          | 0.9                                 | 84        |
| 2.3 Research & development (R&D).....                          | 29.0                                | 38        |
| 2.3.1 Researchers, FTE/mn pop. <sup>Ⓐ</sup> .....              | 1,156.5                             | 46        |
| 2.3.2 Gross expenditure on R&D, % GDP <sup>Ⓐ</sup> .....       | 1.0                                 | 37        |
| 2.3.3 Global R&D companies, avg. expend. top 3, mn \$US.....   | 51.2                                | 29        |
| 2.3.4 QS university ranking, average score top 3*.....         | 28.0                                | 41        |
| <b>3 Infrastructure.....</b>                                   | <b>45.7</b>                         | <b>68</b> |
| 3.1 Information & communication technologies (ICTs).....       | 56.7                                | 67        |
| 3.1.1 ICT access*.....   | 62.0                                | 69        |
| 3.1.2 ICT use*.....  | 41.8                                | 67        |
| 3.1.3 Government's online service*.....                        | 60.1                                | 64        |
| 3.1.4 E-participation*.....                                    | 62.7                                | 59        |
| 3.2 General infrastructure.....                                | 34.6                                | 76        |
| 3.2.1 Electricity output, kWh/cap.....                         | 3,351.7                             | 58        |
| 3.2.2 Logistics performance*.....                              | 62.9                                | 33        |
| 3.2.3 Gross capital formation, % GDP.....                      | 17.4                                | 101 ○     |
| 3.3 Ecological sustainability.....                             | 45.7                                | 59        |
| 3.3.1 GDP/unit of energy use.....                              | 11.1                                | 37        |
| 3.3.2 Environmental performance*.....                          | 67.7                                | 87        |
| 3.3.3 ISO 14001 environmental certificates/bn PPP\$ GDP.....   | 1.8                                 | 51        |
| <b>4 Market sophistication.....</b>                            | <b>47.8</b>                         | <b>57</b> |
| 4.1 Credit.....  | 27.2                                | 89        |
| 4.1.1 Ease of getting credit*.....                             | 50.0                                | 72        |
| 4.1.2 Domestic credit to private sector, % GDP.....            | 80.0                                | 36        |
| 4.1.3 Microfinance gross loans, % GDP.....                     | 0.0                                 | 76 ○      |

|   |         |      |
|---|---------|------|
| 4.2 Investment.....                                     | 38.5    | 72   |
| 4.2.1 Ease of protecting minority investors*.....       | 70.0    | 22 ● |
| 4.2.2 Market capitalization, % GDP.....                 | 26.3    | 55   |
| 4.2.3 Venture capital deals/bn PPP\$ GDP.....           | 0.0     | 73   |
| 4.3 Trade, competition, & market scale.....             | 77.9    | 14 ● |
| 4.3.1 Applied tariff rate, weighted mean, %.....        | 3.2     | 70   |
| 4.3.2 Intensity of local competition <sup>†</sup> ..... | 81.3    | 11 ● |
| 4.3.3 Domestic market scale, bn PPP\$.....              | 1,669.9 | 17 ● |

**5 Business sophistication.....29.3 75**

|   |      |       |
|---|------|-------|
| 5.1 Knowledge workers.....  | 34.1 | 77    |
| 5.1.1 Knowledge-intensive employment, %.....                        | 20.5 | 72    |
| 5.1.2 Firms offering formal training, % firms.....                  | 28.4 | 54    |
| 5.1.3 GERD performed by business, % of GDP <sup>Ⓐ</sup> .....       | 0.5  | 34    |
| 5.1.4 GERD financed by business, % <sup>Ⓐ</sup> .....               | 50.9 | 19 ●  |
| 5.1.5 Females employed w/advanced degrees, % total.....             | 8.0  | 70 ○  |
| 5.2 Innovation linkages.....  | 21.2 | 96    |
| 5.2.1 University/industry research collaboration <sup>†</sup> ..... | 41.2 | 60    |
| 5.2.2 State of cluster development <sup>†</sup> .....               | 47.0 | 54    |
| 5.2.3 GERD financed by abroad, % <sup>Ⓐ</sup> .....                 | 1.1  | 85 ○  |
| 5.2.4 JV-strategic alliance deals/bn PPP\$ GDP.....                 | 0.0  | 79    |
| 5.2.5 Patent families 2+ offices/bn PPP\$ GDP.....                  | 0.5  | 35    |
| 5.3 Knowledge absorption.....                                       | 32.7 | 65    |
| 5.3.1 Intellectual property payments, % total trade.....            | 0.3  | 72    |
| 5.3.2 High-tech imports less re-imports, % total trade.....         | 10.3 | 39    |
| 5.3.3 ICT services imports, % total trade.....                      | 0.1  | 121 ○ |
| 5.3.4 FDI net inflows, % GDP.....                                   | 1.8  | 85    |
| 5.3.5 Research talent, % in business enterprise <sup>Ⓐ</sup> .....  | 46.7 | 28    |

**6 Knowledge & technology outputs.....27.6 46**

|   |      |       |
|---|------|-------|
| 6.1 Knowledge creation.....                                 | 28.8 | 33    |
| 6.1.1 Patents by origin/bn PPP\$ GDP.....                   | 3.6  | 29    |
| 6.1.2 PCT patent applications/bn PPP\$ GDP.....             | 0.6  | 32    |
| 6.1.3 Utility models by origin/bn PPP\$ GDP.....            | 2.2  | 12 ●  |
| 6.1.4 Scientific & technical articles/bn PPP\$ GDP.....     | 17.5 | 43    |
| 6.1.5 Citable documents H index.....                        | 25.0 | 36    |
| 6.2 Knowledge impact.....                                   | 34.6 | 47    |
| 6.2.1 Growth rate of PPP\$ GDP/worker, %.....               | 1.4  | 43    |
| 6.2.2 New businesses/th pop. 15–64.....                     | 1.1  | 64    |
| 6.2.3 Computer software spending, % GDP.....                | 0.5  | 18 ●  |
| 6.2.4 ISO 9001 quality certificates/bn PPP\$ GDP.....       | 5.4  | 61    |
| 6.2.5 High- & medium-high-tech manufactures, %.....         | 0.3  | 48    |
| 6.3 Knowledge diffusion.....                                | 19.2 | 85    |
| 6.3.1 Intellectual property receipts, % total trade.....    | n/a  | n/a   |
| 6.3.2 High-tech exports less re-exports, % total trade..... | 1.3  | 66    |
| 6.3.3 ICT services exports, % total trade.....              | 0.1  | 121 ○ |
| 6.3.4 FDI net outflows, % GDP.....                          | 0.7  | 64    |

**7 Creative outputs.....43.4 31**

|   |       |      |
|---|-------|------|
| 7.1 Intangible assets.....  | 64.7  | 6 ●  |
| 7.1.1 Trademarks by origin/bn PPP\$ GDP.....                      | 122.0 | 7 ●  |
| 7.1.2 Industrial designs by origin/bn PPP\$ GDP.....              | 24.3  | 1 ●  |
| 7.1.3 ICTs & business model creation <sup>†</sup> .....           | 63.2  | 51   |
| 7.1.4 ICTs & organizational model creation <sup>†</sup> .....     | 50.8  | 73   |
| 7.2 Creative goods & services.....                                | 20.7  | 56   |
| 7.2.1 Cultural & creative services exports, % of total trade..... | 0.0   | 79 ○ |
| 7.2.2 National feature films/mn pop. 15–69.....                   | 2.5   | 58   |
| 7.2.3 Global ent. & media market/th pop. 15–69.....               | 7.0   | 41   |
| 7.2.4 Printing & publishing manufactures, %.....                  | 0.9   | 67   |
| 7.2.5 Creative goods exports, % total trade.....                  | 3.1   | 17 ● |
| 7.3 Online creativity.....  | 23.5  | 53   |
| 7.3.1 Generic top-level domains (TLDs)/th pop. 15–69.....         | 12.2  | 36   |
| 7.3.2 Country-code TLDs/th pop. 15–69.....                        | 2.1   | 64   |
| 7.3.3 Wikipedia edits/mn pop. 15–69.....                          | 5.2   | 54   |
| 7.3.4 Video uploads on YouTube/pop. 15–69.....                    | 29.5  | 44   |

NOTES: ● indicates a strength; ○ a weakness; \* an index; † a survey question.

Ⓐ indicates that the country's data are older than the base year; see Appendix II for details, including the year of the data, at <http://globalinnovationindex.org>.

Square brackets indicate that the data minimum coverage (DMC) requirements were not met at the sub-pillar or pillar level; see page 181 of this appendix for details.



## Uganda

## Key indicators

|                       |                    |
|-----------------------|--------------------|
| Population (millions) | 40.3               |
| GDP (US\$ billions)   | 25.6               |
| GDP per capita, PPP\$ | 2,002.6            |
| Income group          | Low income         |
| Region                | Sub-Saharan Africa |

|   | Score 0–100<br>or value (hard data) | Rank       |
|---|-------------------------------------|------------|
| <b>Global Innovation Index (out of 127)</b> | <b>27.0</b>                         | <b>102</b> |
| Innovation Output Sub-Index                 | 17.2                                | 106        |
| Innovation Input Sub-Index                  | 36.7                                | 93         |
| Innovation Efficiency Ratio                 | 0.5                                 | 113        |
| Global Innovation Index 2016 (out of 128)   | 27.1                                | 99         |

**1 Institutions**..... 54.6 79

|       |  |      |      |
|-------|--|------|------|
| 1.1   | Political environment                      | 36.3 | 103  |
| 1.1.1 | Political stability & safety*              | 42.9 | 100  |
| 1.1.2 | Government effectiveness*                  | 29.7 | 94   |
| 1.2   | Regulatory environment                     | 65.7 | 60   |
| 1.2.1 | Regulatory quality*                        | 35.9 | 84   |
| 1.2.2 | Rule of law*                               | 29.5 | 79   |
| 1.2.3 | Cost of redundancy dismissal, salary weeks | 8.7  | 22 ● |
| 1.3   | Business environment                       | 61.8 | 89   |
| 1.3.1 | Ease of starting a business*               | 71.3 | 117  |
| 1.3.2 | Ease of resolving insolvency*              | 39.4 | 98   |
| 1.3.3 | Ease of paying taxes*                      | 74.7 | 61   |

**2 Human capital & research**..... 18.2 106

|       |   |      |       |
|-------|---|------|-------|
| 2.1   | Education   | 21.4 | 123 ○ |
| 2.1.1 | Expenditure on education, % GDP                   | 1.7  | 116 ○ |
| 2.1.2 | Gov't expenditure/pupil, secondary, % GDP/cap     | 10.7 | 94    |
| 2.1.3 | School life expectancy, years <sup>Ⓐ</sup>        | 10.0 | 102   |
| 2.1.4 | PISA scales in reading, maths, & science          | n/a  | n/a   |
| 2.1.5 | Pupil-teacher ratio, secondary <sup>Ⓐ</sup>       | 21.8 | 86    |
| 2.2   | Tertiary education                                | 29.6 | 82    |
| 2.2.1 | Tertiary enrolment, % gross <sup>Ⓐ</sup>          | 4.5  | 116 ○ |
| 2.2.2 | Graduates in science & engineering, %             | n/a  | n/a   |
| 2.2.3 | Tertiary inbound mobility, % <sup>Ⓐ</sup>         | 10.7 | 15 ●  |
| 2.3   | Research & development (R&D)                      | 3.5  | 84    |
| 2.3.1 | Researchers, FTE/mn pop. <sup>Ⓐ</sup>             | 38.1 | 97 ○  |
| 2.3.2 | Gross expenditure on R&D, % GDP <sup>Ⓐ</sup>      | 0.5  | 65    |
| 2.3.3 | Global R&D companies, avg. expend. top 3, mn \$US | 0.0  | 43 ○  |
| 2.3.4 | QS university ranking, average score top 3*       | 3.1  | 74    |

**3 Infrastructure**..... 40.5 84

|       |   |      |       |
|-------|---|------|-------|
| 3.1   | Information & communication technologies (ICTs)   | 33.9 | 102   |
| 3.1.1 | ICT access*                                       | 23.7 | 122 ○ |
| 3.1.2 | ICT use*  | 12.7 | 108   |
| 3.1.3 | Government's online service*                      | 50.0 | 85    |
| 3.1.4 | E-participation*                                  | 49.2 | 89    |
| 3.2   | General infrastructure                            | 48.6 | 31 ●  |
| 3.2.1 | Electricity output, kWh/cap                       | n/a  | n/a   |
| 3.2.2 | Logistics performance*                            | 45.3 | 57    |
| 3.2.3 | Gross capital formation, % GDP                    | 25.6 | 40 ●  |
| 3.3   | Ecological sustainability                         | 39.0 | 85    |
| 3.3.1 | GDP/unit of energy use                            | n/a  | n/a   |
| 3.3.2 | Environmental performance*                        | 57.6 | 105   |
| 3.3.3 | ISO 14001 environmental certificates/bn PPP\$ GDP | 0.3  | 96    |

**4 Market sophistication**..... 36.7 108

|       |  |      |       |
|-------|--|------|-------|
| 4.1   | Credit                                   | 24.6 | 101   |
| 4.1.1 | Ease of getting credit*                  | 65.0 | 40    |
| 4.1.2 | Domestic credit to private sector, % GDP | 14.6 | 118 ○ |
| 4.1.3 | Microfinance gross loans, % GDP          | 0.2  | 49    |

|       |   |      |      |
|-------|---|------|------|
| 4.2   | Investment                                      | 29.3 | 116  |
| 4.2.1 | Ease of protecting minority investors*          | 50.0 | 89   |
| 4.2.2 | Market capitalization, % GDP <sup>Ⓐ</sup>       | 31.0 | 45   |
| 4.2.3 | Venture capital deals/bn PPP\$ GDP <sup>Ⓐ</sup> | 0.0  | 63   |
| 4.3   | Trade, competition, & market scale              | 56.2 | 87   |
| 4.3.1 | Applied tariff rate, weighted mean, %           | 5.9  | 97   |
| 4.3.2 | Intensity of local competition <sup>†</sup>     | 71.8 | 44 ● |
| 4.3.3 | Domestic market scale, bn PPP\$                 | 84.9 | 79   |

**5 Business sophistication**..... 33.6 60

|       |   |      |       |
|-------|---|------|-------|
| 5.1   | Knowledge workers   | 17.8 | 113   |
| 5.1.1 | Knowledge-intensive employment, % <sup>Ⓐ</sup>            | 4.1  | 103 ○ |
| 5.1.2 | Firms offering formal training, % firms                   | 34.7 | 39 ●  |
| 5.1.3 | GERD performed by business, % of GDP <sup>Ⓐ</sup>         | 0.2  | 55    |
| 5.1.4 | GERD financed by business, % <sup>Ⓐ</sup>                 | 13.7 | 68    |
| 5.1.5 | Females employed w/advanced degrees, % total <sup>Ⓐ</sup> | 2.7  | 82    |
| 5.2   | Innovation linkages                                       | 46.7 | 14 ●  |
| 5.2.1 | University/industry research collaboration <sup>†</sup>   | 46.5 | 39 ●  |
| 5.2.2 | State of cluster development <sup>†</sup>                 | 41.3 | 81    |
| 5.2.3 | GERD financed by abroad, % <sup>Ⓐ</sup>                   | 57.3 | 2 ●   |
| 5.2.4 | JV-strategic alliance deals/bn PPP\$ GDP                  | 0.0  | 71    |
| 5.2.5 | Patent families 2+ offices/bn PPP\$ GDP                   | 0.0  | 118 ○ |
| 5.3   | Knowledge absorption                                      | 36.3 | 49 ●  |
| 5.3.1 | Intellectual property payments, % total trade             | 0.2  | 80    |
| 5.3.2 | High-tech imports less re-imports, % total trade          | 6.9  | 78    |
| 5.3.3 | ICT services imports, % total trade                       | 1.3  | 57    |
| 5.3.4 | FDI net inflows, % GDP                                    | 4.0  | 36 ●  |
| 5.3.5 | Research talent, % in business enterprise <sup>Ⓐ</sup>    | 50.6 | 22 ●  |

**6 Knowledge & technology outputs**..... 15.6 103

|       |   |       |       |
|-------|---|-------|-------|
| 6.1   | Knowledge creation                                | 6.7   | 77    |
| 6.1.1 | Patents by origin/bn PPP\$ GDP                    | 0.1   | 106   |
| 6.1.2 | PCT patent applications/bn PPP\$ GDP <sup>Ⓐ</sup> | 0.1   | 74    |
| 6.1.3 | Utility models by origin/bn PPP\$ GDP             | n/a   | n/a   |
| 6.1.4 | Scientific & technical articles/bn PPP\$ GDP      | 12.0  | 60    |
| 6.1.5 | Citable documents H index                         | 9.3   | 69    |
| 6.2   | Knowledge impact                                  | 25.7  | 88    |
| 6.2.1 | Growth rate of PPP\$ GDP/worker, %                | 2.2   | 36 ●  |
| 6.2.2 | New businesses/th pop. 15–64 <sup>Ⓐ</sup>         | 1.2   | 63    |
| 6.2.3 | Computer software spending, % GDP                 | 0.0   | 122 ○ |
| 6.2.4 | ISO 9001 quality certificates/bn PPP\$ GDP        | 1.1   | 105   |
| 6.2.5 | High- & medium-high-tech manufactures, %          | n/a   | n/a   |
| 6.3   | Knowledge diffusion                               | 14.3  | 114   |
| 6.3.1 | Intellectual property receipts, % total trade     | 0.1   | 64    |
| 6.3.2 | High-tech exports less re-exports, % total trade  | 0.2   | 105   |
| 6.3.3 | ICT services exports, % total trade               | 1.0   | 83    |
| 6.3.4 | FDI net outflows, % GDP                           | (0.0) | 113   |

**7 Creative outputs**..... 18.9 107

|       |  |      |       |
|-------|--|------|-------|
| 7.1   | Intangible assets                                      | 34.8 | 94    |
| 7.1.1 | Trademarks by origin/bn PPP\$ GDP                      | 13.1 | 96    |
| 7.1.2 | Industrial designs by origin/bn PPP\$ GDP              | n/a  | n/a   |
| 7.1.3 | ICTs & business model creation <sup>†</sup>            | 54.7 | 84    |
| 7.1.4 | ICTs & organizational model creation <sup>†</sup>      | 43.4 | 101   |
| 7.2   | Creative goods & services                              | 1.4  | [124] |
| 7.2.1 | Cultural & creative services exports, % of total trade | 0.0  | 80    |
| 7.2.2 | National feature films/mn pop. 15–69                   | n/a  | n/a   |
| 7.2.3 | Global ent. & media market/th pop. 15–69               | n/a  | n/a   |
| 7.2.4 | Printing & publishing manufactures, %                  | n/a  | n/a   |
| 7.2.5 | Creative goods exports, % total trade                  | 0.1  | 105   |
| 7.3   | Online creativity                                      | 4.6  | 112   |
| 7.3.1 | Generic top-level domains (TLDs)/th pop. 15–69         | 0.2  | 113   |
| 7.3.2 | Country-code TLDs/th pop. 15–69                        | 0.0  | 116   |
| 7.3.3 | Wikipedia edits/mn pop. 15–69 <sup>Ⓐ</sup>             | 1.9  | 107   |
| 7.3.4 | Video uploads on YouTube/pop. 15–69                    | 0.0  | 73 ○  |

NOTES: ● indicates a strength; ○ a weakness; \* an index; † a survey question.

Ⓐ indicates that the country's data are older than the base year; see Appendix II for details, including the year of the data, at <http://globalinnovationindex.org>.

Square brackets indicate that the data minimum coverage (DMC) requirements were not met at the sub-pillar or pillar level; see page 181 of this appendix for details.



## Key indicators

|                             |                     |
|-----------------------------|---------------------|
| Population (millions) ..... | 44.6                |
| GDP (US\$ billions) .....   | 87.2                |
| GDP per capita, PPP\$ ..... | 7,518.8             |
| Income group .....          | Lower-middle income |
| Region .....                | Europe              |

|  | Score 0–100<br>or value (hard data) | Rank      |
|--|-------------------------------------|-----------|
| <b>Global Innovation Index (out of 127).....</b> | <b>37.6</b>                         | <b>50</b> |
| Innovation Output Sub-Index .....                | 34.2                                | 40        |
| Innovation Input Sub-Index .....                 | 41.0                                | 77        |
| Innovation Efficiency Ratio .....                | 0.8                                 | 11 ●      |
| Global Innovation Index 2016 (out of 128) .....  | 35.7                                | 56        |

**1 Institutions.....47.9 101**

|  |      |       |
|--|------|-------|
| 1.1 Political environment .....                        | 23.0 | 122 ○ |
| 1.1.1 Political stability & safety* .....              | 17.0 | 124 ○ |
| 1.1.2 Government effectiveness* .....                  | 29.0 | 96    |
| 1.2 Regulatory environment .....                       | 55.9 | 82    |
| 1.2.1 Regulatory quality* .....                        | 27.3 | 105   |
| 1.2.2 Rule of law* .....                               | 16.0 | 110   |
| 1.2.3 Cost of redundancy dismissal, salary weeks ..... | 13.0 | 47    |
| 1.3 Business environment .....                         | 64.9 | 78    |
| 1.3.1 Ease of starting a business* .....               | 94.4 | 18 ●  |
| 1.3.2 Ease of resolving insolvency* .....              | 27.5 | 120 ○ |
| 1.3.3 Ease of paying taxes* .....                      | 72.7 | 66    |

**2 Human capital & research.....39.6 41**

|   |         |      |
|---|---------|------|
| 2.1 Education .....   | 58.3    | 30   |
| 2.1.1 Expenditure on education, % GDP .....                   | 6.0     | 22   |
| 2.1.2 Gov't expenditure/pupil, secondary, % GDP/cap .....     | 26.2    | 22   |
| 2.1.3 School life expectancy, years .....                     | 15.3    | 40   |
| 2.1.4 PISA scales in reading, maths, & science .....          | n/a     | n/a  |
| 2.1.5 Pupil-teacher ratio, secondary .....                    | 7.0     | 2 ●  |
| 2.2 Tertiary education .....                                  | 47.1    | 26   |
| 2.2.1 Tertiary enrolment, % gross <sup>Ⓜ</sup> .....          | 82.3    | 12 ● |
| 2.2.2 Graduates in science & engineering, % .....             | 25.5    | 28   |
| 2.2.3 Tertiary inbound mobility, % .....                      | 3.2     | 55   |
| 2.3 Research & development (R&D) .....                        | 13.4    | 51   |
| 2.3.1 Researchers, FTE/mn pop. .....                          | 1,006.0 | 49   |
| 2.3.2 Gross expenditure on R&D, % GDP .....                   | 0.6     | 54   |
| 2.3.3 Global R&D companies, avg. expend. top 3, mn \$US ..... | 0.0     | 43 ○ |
| 2.3.4 QS university ranking, average score top 3* .....       | 27.4    | 43   |

**3 Infrastructure.....39.3 90**

|   |         |       |
|---|---------|-------|
| 3.1 Information & communication technologies (ICTs) .....     | 55.9    | 68    |
| 3.1.1 ICT access* .....                                       | 64.8    | 64    |
| 3.1.2 ICT use* .....  | 25.7    | 93    |
| 3.1.3 Government's online service* .....                      | 58.7    | 70    |
| 3.1.4 E-participation* .....                                  | 74.6    | 32    |
| 3.2 General infrastructure .....                              | 25.5    | 108   |
| 3.2.1 Electricity output, kWh/cap .....                       | 4,011.7 | 53    |
| 3.2.2 Logistics performance* .....                            | 31.2    | 79    |
| 3.2.3 Gross capital formation, % GDP .....                    | 15.8    | 108 ○ |
| 3.3 Ecological sustainability .....                           | 36.5    | 95    |
| 3.3.1 GDP/unit of energy use .....                            | 3.3     | 112 ○ |
| 3.3.2 Environmental performance* .....                        | 79.7    | 44    |
| 3.3.3 ISO 14001 environmental certificates/bn PPP\$ GDP ..... | 0.5     | 85    |

**4 Market sophistication.....43.2 81**

|  |      |      |
|--|------|------|
| 4.1 Credit .....                                     | 32.4 | 71   |
| 4.1.1 Ease of getting credit* .....                  | 75.0 | 19   |
| 4.1.2 Domestic credit to private sector, % GDP ..... | 57.0 | 54   |
| 4.1.3 Microfinance gross loans, % GDP .....          | 0.0  | 80 ○ |

|   |       |     |
|---|-------|-----|
| 4.2 Investment .....                                    | 30.6  | 107 |
| 4.2.1 Ease of protecting minority investors* .....      | 56.7  | 67  |
| 4.2.2 Market capitalization, % GDP <sup>Ⓜ</sup> .....   | 15.7  | 66  |
| 4.2.3 Venture capital deals/bn PPP\$ GDP .....          | 0.0   | 75  |
| 4.3 Trade, competition, & market scale .....            | 66.5  | 48  |
| 4.3.1 Applied tariff rate, weighted mean, % .....       | 1.9   | 55  |
| 4.3.2 Intensity of local competition <sup>†</sup> ..... | 60.2  | 99  |
| 4.3.3 Domestic market scale, bn PPP\$ .....             | 349.8 | 47  |

**5 Business sophistication.....35.3 51**

|   |      |       |
|---|------|-------|
| 5.1 Knowledge workers .....   | 47.4 | 41    |
| 5.1.1 Knowledge-intensive employment, % .....                       | 37.6 | 30    |
| 5.1.2 Firms offering formal training, % firms .....                 | 22.6 | 68    |
| 5.1.3 GERD performed by business, % of GDP .....                    | 0.4  | 40    |
| 5.1.4 GERD financed by business, % .....                            | 40.3 | 35    |
| 5.1.5 Females employed w/advanced degrees, % total .....            | 29.7 | 3 ●   |
| 5.2 Innovation linkages .....                                       | 25.5 | 72    |
| 5.2.1 University/industry research collaboration <sup>†</sup> ..... | 41.8 | 55    |
| 5.2.2 State of cluster development <sup>†</sup> .....               | 32.5 | 114 ○ |
| 5.2.3 GERD financed by abroad, % .....                              | 18.2 | 23    |
| 5.2.4 JV-strategic alliance deals/bn PPP\$ GDP .....                | 0.0  | 76    |
| 5.2.5 Patent families 2+ offices/bn PPP\$ GDP .....                 | 0.6  | 34    |
| 5.3 Knowledge absorption .....                                      | 33.0 | 63    |
| 5.3.1 Intellectual property payments, % total trade .....           | 0.7  | 46    |
| 5.3.2 High-tech imports less re-imports, % total trade .....        | 8.0  | 65    |
| 5.3.3 ICT services imports, % total trade .....                     | 1.3  | 56    |
| 5.3.4 FDI net inflows, % GDP .....                                  | 2.2  | 78    |
| 5.3.5 Research talent, % in business enterprise .....               | 32.5 | 42    |

**6 Knowledge & technology outputs.....32.8 32**

|  |       |      |
|--|-------|------|
| 6.1 Knowledge creation .....                                 | 45.5  | 16 ● |
| 6.1.1 Patents by origin/bn PPP\$ GDP .....                   | 6.7   | 18 ● |
| 6.1.2 PCT patent applications/bn PPP\$ GDP .....             | 0.5   | 37   |
| 6.1.3 Utility models by origin/bn PPP\$ GDP .....            | 24.9  | 1 ●  |
| 6.1.4 Scientific & technical articles/bn PPP\$ GDP .....     | 12.2  | 59   |
| 6.1.5 Citable documents H index .....                        | 14.9  | 46   |
| 6.2 Knowledge impact .....                                   | 28.1  | 77   |
| 6.2.1 Growth rate of PPP\$ GDP/worker, % .....               | (0.9) | 97 ○ |
| 6.2.2 New businesses/th pop. 15–64 <sup>Ⓜ</sup> .....        | 0.9   | 74   |
| 6.2.3 Computer software spending, % GDP .....                | 0.7   | 6 ●  |
| 6.2.4 ISO 9001 quality certificates/bn PPP\$ GDP .....       | 3.1   | 78   |
| 6.2.5 High- & medium-high-tech manufactures, % .....         | 0.2   | 56   |
| 6.3 Knowledge diffusion .....                                | 24.6  | 54   |
| 6.3.1 Intellectual property receipts, % total trade .....    | 0.2   | 43   |
| 6.3.2 High-tech exports less re-exports, % total trade ..... | 3.1   | 46   |
| 6.3.3 ICT services exports, % total trade .....              | 4.4   | 15 ● |
| 6.3.4 FDI net outflows, % GDP .....                          | 0.2   | 81   |

**7 Creative outputs.....35.6 49**

|  |       |       |
|--|-------|-------|
| 7.1 Intangible assets .....  | 53.7  | 26    |
| 7.1.1 Trademarks by origin/bn PPP\$ GDP .....                      | 106.8 | 12 ●  |
| 7.1.2 Industrial designs by origin/bn PPP\$ GDP .....              | 12.6  | 11 ●  |
| 7.1.3 ICTs & business model creation <sup>†</sup> .....            | 47.0  | 112 ○ |
| 7.1.4 ICTs & organizational model creation <sup>†</sup> .....      | 52.2  | 66    |
| 7.2 Creative goods & services .....                                | 9.3   | 92    |
| 7.2.1 Cultural & creative services exports, % of total trade ..... | 0.1   | 53    |
| 7.2.2 National feature films/mn pop. 15–69 .....                   | 0.1   | 102 ○ |
| 7.2.3 Global ent. & media market/th pop. 15–69 .....               | n/a   | n/a   |
| 7.2.4 Printing & publishing manufactures, % .....                  | 1.0   | 66    |
| 7.2.5 Creative goods exports, % total trade .....                  | 0.4   | 63    |
| 7.3 Online creativity .....  | 25.8  | 47    |
| 7.3.1 Generic top-level domains (TLDs)/th pop. 15–69 .....         | 4.4   | 59    |
| 7.3.2 Country-code TLDs/th pop. 15–69 .....                        | 5.1   | 50    |
| 7.3.3 Wikipedia edits/mn pop. 15–69 .....                          | 6.1   | 39    |
| 7.3.4 Video uploads on YouTube/pop. 15–69 .....                    | 34.9  | 41    |

NOTES: ● indicates a strength; ○ a weakness; \* an index; † a survey question.

Ⓜ indicates that the country's data are older than the base year; see Appendix II for details, including the year of the data, at <http://globalinnovationindex.org>.

Square brackets indicate that the data minimum coverage (DMC) requirements were not met at the sub-pillar or pillar level; see page 181 of this appendix for details.

# United Arab Emirates

## Key indicators

|                            |                                  |
|----------------------------|----------------------------------|
| Population (millions)..... | 9.3                              |
| GDP (US\$ billions).....   | 375.0                            |
| GDP per capita, PPP\$..... | 67,616.9                         |
| Income group.....          | High income                      |
| Region.....                | Northern Africa and Western Asia |

|  | Score 0–100<br>or value (hard data) | Rank      |
|--|-------------------------------------|-----------|
| <b>Global Innovation Index (out of 127).....</b> | <b>43.2</b>                         | <b>35</b> |
| Innovation Output Sub-Index.....                 | 28.5                                | 56        |
| Innovation Input Sub-Index.....                  | 58.0                                | 23        |
| Innovation Efficiency Ratio.....                 | 0.5                                 | 104 ○     |
| Global Innovation Index 2016 (out of 128).....   | 39.4                                | 41        |

## 1 Institutions..... 80.6 25

|   |      |      |
|---|------|------|
| 1.1 Political environment.....                        | 81.9 | 19   |
| 1.1.1 Political stability & safety*.....              | 82.2 | 28   |
| 1.1.2 Government effectiveness*.....                  | 81.6 | 16   |
| 1.2 Regulatory environment.....                       | 82.8 | 22   |
| 1.2.1 Regulatory quality*.....                        | 71.1 | 28   |
| 1.2.2 Rule of law*.....                               | 60.1 | 37   |
| 1.2.3 Cost of redundancy dismissal, salary weeks..... | 8.0  | 1 ●  |
| 1.3 Business environment.....                         | 77.1 | 38   |
| 1.3.1 Ease of starting a business*.....               | 91.2 | 45   |
| 1.3.2 Ease of resolving insolvency*.....              | 40.6 | 92 ○ |
| 1.3.3 Ease of paying taxes*.....                      | 99.4 | 1 ●  |

## 2 Human capital & research..... 51.0 22

|  |         |      |
|--|---------|------|
| 2.1 Education.....   | 75.6    | [3]  |
| 2.1.1 Expenditure on education, % GDP.....                   | n/a     | n/a  |
| 2.1.2 Gov't expenditure/pupil, secondary, % GDP/cap.....     | n/a     | n/a  |
| 2.1.3 School life expectancy, years.....                     | n/a     | n/a  |
| 2.1.4 PISA scales in reading, maths, & science.....          | 474.3   | 37   |
| 2.1.5 Pupil-teacher ratio, secondary.....                    | 11.2    | 33   |
| 2.2 Tertiary education.....                                  | 59.1    | 8 ●  |
| 2.2.1 Tertiary enrolment, % gross.....                       | n/a     | n/a  |
| 2.2.2 Graduates in science & engineering, %.....             | 20.4    | 52   |
| 2.2.3 Tertiary inbound mobility, %.....                      | 46.9    | 1 ●  |
| 2.3 Research & development (R&D).....                        | 18.2    | 47   |
| 2.3.1 Researchers, FTE/mn pop.....                           | 2,003.4 | 38   |
| 2.3.2 Gross expenditure on R&D, % GDP.....                   | 0.9     | 41   |
| 2.3.3 Global R&D companies, avg. expend. top 3, mn \$US..... | 0.0     | 43 ○ |
| 2.3.4 QS university ranking, average score top 3*.....       | 28.9    | 40   |

## 3 Infrastructure..... 57.5 29

|  |          |      |
|--|----------|------|
| 3.1 Information & communication technologies (ICTs).....     | 78.3     | 23   |
| 3.1.1 ICT access*.....                                       | 81.4     | 23   |
| 3.1.2 ICT use*.....  | 68.2     | 25   |
| 3.1.3 Government's online service*.....                      | 89.1     | 13   |
| 3.1.4 E-participation*.....                                  | 74.6     | 32   |
| 3.2 General infrastructure.....                              | 51.0     | 21   |
| 3.2.1 Electricity output, kWh/cap.....                       | 12,098.9 | 10 ● |
| 3.2.2 Logistics performance*.....                            | 86.9     | 13 ● |
| 3.2.3 Gross capital formation, % GDP.....                    | 19.7     | 84 ○ |
| 3.3 Ecological sustainability.....                           | 43.3     | 71   |
| 3.3.1 GDP/unit of energy use.....                            | 8.1      | 68   |
| 3.3.2 Environmental performance*.....                        | 69.4     | 82   |
| 3.3.3 ISO 14001 environmental certificates/bn PPP\$ GDP..... | 2.9      | 36   |

## 4 Market sophistication..... 52.9 33

|   |      |      |
|---|------|------|
| 4.1 Credit.....                                     | 37.5 | 56   |
| 4.1.1 Ease of getting credit*.....                  | 45.0 | 84 ○ |
| 4.1.2 Domestic credit to private sector, % GDP..... | 76.5 | 39   |
| 4.1.3 Microfinance gross loans, % GDP.....          | n/a  | n/a  |

|   |       |     |
|---|-------|-----|
| 4.2 Investment.....                               | 47.3  | 33  |
| 4.2.1 Ease of protecting minority investors*..... | 75.0  | 9 ● |
| 4.2.2 Market capitalization, % GDP.....           | 52.9  | 30  |
| 4.2.3 Venture capital deals/bn PPP\$ GDP.....     | 0.1   | 28  |
| 4.3 Trade, competition, & market scale.....       | 73.9  | 25  |
| 4.3.1 Applied tariff rate, weighted mean, %.....  | 2.8   | 67  |
| 4.3.2 Intensity of local competition†.....        | 81.7  | 8 ● |
| 4.3.3 Domestic market scale, bn PPP\$.....        | 667.2 | 31  |

## 5 Business sophistication..... 47.8 25

|   |      |      |
|---|------|------|
| 5.1 Knowledge workers.....                                  | 58.1 | 26   |
| 5.1.1 Knowledge-intensive employment, % <sup>Ⓐ</sup> .....  | 36.1 | 33   |
| 5.1.2 Firms offering formal training, % firms.....          | n/a  | n/a  |
| 5.1.3 GERD performed by business, % of GDP.....             | 0.4  | 39   |
| 5.1.4 GERD financed by business, % <sup>Ⓐ</sup> .....       | 74.3 | 4 ●  |
| 5.1.5 Females employed w/advanced degrees, % total.....     | n/a  | n/a  |
| 5.2 Innovation linkages.....                                | 47.4 | 12 ● |
| 5.2.1 University/industry research collaboration†.....      | 58.5 | 24   |
| 5.2.2 State of cluster development†.....                    | 73.7 | 2 ●  |
| 5.2.3 GERD financed by abroad, %.....                       | n/a  | n/a  |
| 5.2.4 JV-strategic alliance deals/bn PPP\$ GDP.....         | 0.1  | 16   |
| 5.2.5 Patent families 2+ offices/bn PPP\$ GDP.....          | 0.1  | 68   |
| 5.3 Knowledge absorption.....                               | 37.8 | 42   |
| 5.3.1 Intellectual property payments, % total trade.....    | 0.6  | 51   |
| 5.3.2 High-tech imports less re-imports, % total trade..... | 8.0  | 66   |
| 5.3.3 ICT services imports, % total trade.....              | 0.6  | 92 ○ |
| 5.3.4 FDI net inflows, % GDP.....                           | 2.7  | 67   |
| 5.3.5 Research talent, % in business enterprise.....        | 60.9 | 10   |

## 6 Knowledge & technology outputs..... 20.9 71

|   |      |       |
|---|------|-------|
| 6.1 Knowledge creation.....                                 | 3.9  | 99 ○  |
| 6.1.1 Patents by origin/bn PPP\$ GDP.....                   | 0.1  | 114 ○ |
| 6.1.2 PCT patent applications/bn PPP\$ GDP.....             | 0.1  | 62    |
| 6.1.3 Utility models by origin/bn PPP\$ GDP.....            | n/a  | n/a   |
| 6.1.4 Scientific & technical articles/bn PPP\$ GDP.....     | 3.5  | 106 ○ |
| 6.1.5 Citable documents H index.....                        | 9.4  | 67    |
| 6.2 Knowledge impact.....                                   | 30.7 | 65    |
| 6.2.1 Growth rate of PPP\$ GDP/worker, %.....               | 1.3  | 47    |
| 6.2.2 New businesses/th pop. 15–64 <sup>Ⓐ</sup> .....       | 1.4  | 58    |
| 6.2.3 Computer software spending, % GDP.....                | 0.3  | 37    |
| 6.2.4 ISO 9001 quality certificates/bn PPP\$ GDP.....       | 7.7  | 45    |
| 6.2.5 High- & medium-high-tech manufactures, %.....         | n/a  | n/a   |
| 6.3 Knowledge diffusion.....                                | 28.1 | 45    |
| 6.3.1 Intellectual property receipts, % total trade.....    | 0.5  | 23    |
| 6.3.2 High-tech exports less re-exports, % total trade..... | 0.3  | 95 ○  |
| 6.3.3 ICT services exports, % total trade.....              | 1.7  | 61    |
| 6.3.4 FDI net outflows, % GDP.....                          | 2.3  | 26    |

## 7 Creative outputs..... 36.1 47

|  |      |       |
|--|------|-------|
| 7.1 Intangible assets.....   | 45.7 | 55    |
| 7.1.1 Trademarks by origin/bn PPP\$ GDP <sup>Ⓐ</sup> .....         | 11.4 | 101 ○ |
| 7.1.2 Industrial designs by origin/bn PPP\$ GDP <sup>Ⓐ</sup> ..... | 0.1  | 102 ○ |
| 7.1.3 ICTs & business model creation†.....                         | 79.9 | 10 ●  |
| 7.1.4 ICTs & organizational model creation†.....                   | 74.4 | 13 ●  |
| 7.2 Creative goods & services.....                                 | 28.0 | 34    |
| 7.2.1 Cultural & creative services exports, % of total trade.....  | n/a  | n/a   |
| 7.2.2 National feature films/mn pop. 15–69.....                    | 1.4  | 71    |
| 7.2.3 Global ent. & media market/th pop. 15–69.....                | 16.5 | 28    |
| 7.2.4 Printing & publishing manufactures, % <sup>Ⓐ</sup> .....     | 2.5  | 14    |
| 7.2.5 Creative goods exports, % total trade.....                   | 1.6  | 33    |
| 7.3 Online creativity.....   | 25.1 | 49    |
| 7.3.1 Generic top-level domains (TLDs)/th pop. 15–69.....          | 11.2 | 38    |
| 7.3.2 Country-code TLDs/th pop. 15–69.....                         | 5.6  | 47    |
| 7.3.3 Wikipedia edits/mn pop. 15–69 <sup>Ⓐ</sup> .....             | 4.6  | 68    |
| 7.3.4 Video uploads on YouTube/pop. 15–69.....                     | 39.1 | 32    |

NOTES: ● indicates a strength; ○ a weakness; \* an index; † a survey question.

Ⓐ indicates that the country's data are older than the base year; see Appendix II for details, including the year of the data, at <http://globalinnovationindex.org>.

Square brackets indicate that the data minimum coverage (DMC) requirements were not met at the sub-pillar or pillar level; see page 181 of this appendix for details.

## Key indicators

|                             |             |
|-----------------------------|-------------|
| Population (millions) ..... | 65.1        |
| GDP (US\$ billions) .....   | 2,649.9     |
| GDP per capita, PPP\$ ..... | 41,158.9    |
| Income group .....          | High income |
| Region .....                | Europe      |

|   | Score 0–100<br>or value (hard data) | Rank     |
|---|-------------------------------------|----------|
| <b>Global Innovation Index (out of 127)</b> ..... | <b>60.9</b>                         | <b>5</b> |
| Innovation Output Sub-Index .....                 | 53.5                                | 6        |
| Innovation Input Sub-Index .....                  | 68.3                                | 7        |
| Innovation Efficiency Ratio .....                 | 0.8                                 | 20       |
| Global Innovation Index 2016 (out of 128) .....   | 61.9                                | 3        |

|          |  |             |          |
|----------|--|-------------|----------|
| <b>1</b> | <b>Institutions</b> .....                        | <b>88.4</b> | <b>9</b> |
| 1.1      | Political environment .....                      | 82.1        | 18       |
| 1.1.1    | Political stability & safety* .....              | 77.3        | 40       |
| 1.1.2    | Government effectiveness* .....                  | 86.8        | 13       |
| 1.2      | Regulatory environment .....                     | 94.1        | 7        |
| 1.2.1    | Regulatory quality* .....                        | 89.6        | 4 ●      |
| 1.2.2    | Rule of law* .....                               | 92.2        | 14       |
| 1.2.3    | Cost of redundancy dismissal, salary weeks ..... | 9.3         | 27       |
| 1.3      | Business environment .....                       | 89.1        | 8        |
| 1.3.1    | Ease of starting a business* .....               | 94.6        | 15       |
| 1.3.2    | Ease of resolving insolvency* .....              | 82.0        | 12       |
| 1.3.3    | Ease of paying taxes* .....                      | 90.7        | 10       |

|          |   |             |          |
|----------|---|-------------|----------|
| <b>2</b> | <b>Human capital &amp; research</b> .....               | <b>63.3</b> | <b>6</b> |
| 2.1      | Education .....   | 59.9        | 22       |
| 2.1.1    | Expenditure on education, % GDP .....                   | 5.8         | 25       |
| 2.1.2    | Gov't expenditure/pupil, secondary, % GDP/cap .....     | 23.1        | 39 ○     |
| 2.1.3    | School life expectancy, years .....                     | 17.9        | 10       |
| 2.1.4    | PISA scales in reading, maths, & science .....          | 499.9       | 21       |
| 2.1.5    | Pupil-teacher ratio, secondary <sup>Ⓜ</sup> .....       | 15.8        | 69 ○     |
| 2.2      | Tertiary education .....                                | 60.5        | 5        |
| 2.2.1    | Tertiary enrolment, % gross <sup>Ⓜ</sup> .....          | 56.5        | 46 ○     |
| 2.2.2    | Graduates in science & engineering, % .....             | 25.2        | 30       |
| 2.2.3    | Tertiary inbound mobility, % <sup>Ⓜ</sup> .....         | 18.2        | 7        |
| 2.3      | Research & development (R&D) .....                      | 69.5        | 10       |
| 2.3.1    | Researchers, FTE/mn pop. .....                          | 4,470.8     | 18       |
| 2.3.2    | Gross expenditure on R&D, % GDP .....                   | 1.7         | 21       |
| 2.3.3    | Global R&D companies, avg. expend. top 3, mn \$US ..... | 88.0        | 7        |
| 2.3.4    | QS university ranking, average score top 3* .....       | 96.5        | 2 ●      |

|          |   |             |          |
|----------|---|-------------|----------|
| <b>3</b> | <b>Infrastructure</b> .....                             | <b>67.1</b> | <b>5</b> |
| 3.1      | Information & communication technologies (ICTs) .....   | 93.3        | 1 ●      |
| 3.1.1    | ICT access* .....                                       | 92.4        | 3 ●      |
| 3.1.2    | ICT use* .....  | 80.9        | 9        |
| 3.1.3    | Government's online service* .....                      | 100.0       | 1 ●      |
| 3.1.4    | E-participation* .....                                  | 100.0       | 1 ●      |
| 3.2      | General infrastructure .....                            | 43.6        | 43       |
| 3.2.1    | Electricity output, kWh/cap .....                       | 5,155.5     | 38       |
| 3.2.2    | Logistics performance* .....                            | 92.8        | 8        |
| 3.2.3    | Gross capital formation, % GDP .....                    | 17.3        | 102 ○    |
| 3.3      | Ecological sustainability .....                         | 64.5        | 7        |
| 3.3.1    | GDP/unit of energy use .....                            | 13.9        | 14       |
| 3.3.2    | Environmental performance* .....                        | 87.4        | 12       |
| 3.3.3    | ISO 14001 environmental certificates/bn PPP\$ GDP ..... | 6.6         | 16       |

|          |  |             |          |
|----------|--|-------------|----------|
| <b>4</b> | <b>Market sophistication</b> .....             | <b>70.2</b> | <b>5</b> |
| 4.1      | Credit .....                                   | 64.3        | 10       |
| 4.1.1    | Ease of getting credit* .....                  | 75.0        | 19       |
| 4.1.2    | Domestic credit to private sector, % GDP ..... | 134.1       | 14       |
| 4.1.3    | Microfinance gross loans, % GDP .....          | n/a         | n/a      |

|       |   |         |      |
|-------|---|---------|------|
| 4.2   | Investment .....                                  | 63.0    | 16   |
| 4.2.1 | Ease of protecting minority investors* .....      | 78.3    | 6    |
| 4.2.2 | Market capitalization, % GDP <sup>Ⓜ</sup> .....   | 65.0    | 26   |
| 4.2.3 | Venture capital deals/bn PPP\$ GDP .....          | 0.2     | 7    |
| 4.3   | Trade, competition, & market scale .....          | 83.3    | 5    |
| 4.3.1 | Applied tariff rate, weighted mean, % .....       | 1.6     | 23 ○ |
| 4.3.2 | Intensity of local competition <sup>†</sup> ..... | 83.2    | 3 ●  |
| 4.3.3 | Domestic market scale, bn PPP\$ .....             | 2,787.7 | 9    |

|          |   |             |           |
|----------|---|-------------|-----------|
| <b>5</b> | <b>Business sophistication</b> .....                          | <b>52.2</b> | <b>13</b> |
| 5.1      | Knowledge workers .....                                       | 65.0        | 14        |
| 5.1.1    | Knowledge-intensive employment, % .....                       | 47.6        | 8         |
| 5.1.2    | Firms offering formal training, % firms .....                 | n/a         | n/a       |
| 5.1.3    | GERD performed by business, % of GDP .....                    | 1.1         | 18        |
| 5.1.4    | GERD financed by business, % .....                            | 48.4        | 22        |
| 5.1.5    | Females employed w/advanced degrees, % total .....            | 22.2        | 17        |
| 5.2      | Innovation linkages .....                                     | 48.6        | 10        |
| 5.2.1    | University/industry research collaboration <sup>†</sup> ..... | 74.5        | 6         |
| 5.2.2    | State of cluster development <sup>†</sup> .....               | 72.3        | 5         |
| 5.2.3    | GERD financed by abroad, % .....                              | 17.6        | 24        |
| 5.2.4    | JV-strategic alliance deals/bn PPP\$ GDP .....                | 0.1         | 13        |
| 5.2.5    | Patent families 2+ offices/bn PPP\$ GDP .....                 | 2.5         | 21        |
| 5.3      | Knowledge absorption .....                                    | 42.9        | 28        |
| 5.3.1    | Intellectual property payments, % total trade .....           | 1.3         | 21        |
| 5.3.2    | High-tech imports less re-imports, % total trade .....        | 12.7        | 21        |
| 5.3.3    | ICT services imports, % total trade .....                     | 1.8         | 27        |
| 5.3.4    | FDI net inflows, % GDP .....                                  | 2.0         | 83 ○      |
| 5.3.5    | Research talent, % in business enterprise .....               | 38.2        | 36 ○      |

|          |  |             |           |
|----------|--|-------------|-----------|
| <b>6</b> | <b>Knowledge &amp; technology outputs</b> .....        | <b>46.5</b> | <b>13</b> |
| 6.1      | Knowledge creation .....                               | 56.0        | 10        |
| 6.1.1    | Patents by origin/bn PPP\$ GDP .....                   | 7.4         | 16        |
| 6.1.2    | PCT patent applications/bn PPP\$ GDP .....             | 2.0         | 18        |
| 6.1.3    | Utility models by origin/bn PPP\$ GDP .....            | n/a         | n/a       |
| 6.1.4    | Scientific & technical articles/bn PPP\$ GDP .....     | 41.6        | 14        |
| 6.1.5    | Citable documents H index .....                        | 100.0       | 1 ●       |
| 6.2      | Knowledge impact .....                                 | 53.2        | 6         |
| 6.2.1    | Growth rate of PPP\$ GDP/worker, % .....               | 0.8         | 65 ○      |
| 6.2.2    | New businesses/th pop. 15–64 <sup>Ⓜ</sup> .....        | 12.9        | 9         |
| 6.2.3    | Computer software spending, % GDP .....                | 0.8         | 4 ●       |
| 6.2.4    | ISO 9001 quality certificates/bn PPP\$ GDP .....       | 14.9        | 24        |
| 6.2.5    | High- & medium-high-tech manufactures, % .....         | 0.4         | 25        |
| 6.3      | Knowledge diffusion .....                              | 30.3        | 38        |
| 6.3.1    | Intellectual property receipts, % total trade .....    | 2.0         | 10        |
| 6.3.2    | High-tech exports less re-exports, % total trade ..... | 9.2         | 21        |
| 6.3.3    | ICT services exports, % total trade .....              | 3.3         | 24        |
| 6.3.4    | FDI net outflows, % GDP .....                          | (1.5)       | 122 ○     |

|          |  |             |            |
|----------|--|-------------|------------|
| <b>7</b> | <b>Creative outputs</b> .....                                | <b>60.5</b> | <b>4 ●</b> |
| 7.1      | Intangible assets .....                                      | 63.9        | 8          |
| 7.1.1    | Trademarks by origin/bn PPP\$ GDP .....                      | 52.7        | 43 ○       |
| 7.1.2    | Industrial designs by origin/bn PPP\$ GDP .....              | n/a         | n/a        |
| 7.1.3    | ICTs & business model creation <sup>†</sup> .....            | 83.8        | 1 ●        |
| 7.1.4    | ICTs & organizational model creation <sup>†</sup> .....      | 81.3        | 2 ●        |
| 7.2      | Creative goods & services .....                              | 45.6        | 6          |
| 7.2.1    | Cultural & creative services exports, % of total trade ..... | 1.0         | 15         |
| 7.2.2    | National feature films/mn pop. 15–69 .....                   | 6.6         | 27         |
| 7.2.3    | Global ent. & media market/th pop. 15–69 .....               | 71.6        | 5          |
| 7.2.4    | Printing & publishing manufactures, % .....                  | 1.9         | 23         |
| 7.2.5    | Creative goods exports, % total trade .....                  | 3.6         | 15         |
| 7.3      | Online creativity .....                                      | 68.7        | 4 ●        |
| 7.3.1    | Generic top-level domains (TLDs)/th pop. 15–69 .....         | 61.9        | 10         |
| 7.3.2    | Country-code TLDs/th pop. 15–69 .....                        | 69.5        | 7          |
| 7.3.3    | Wikipedia edits/mn pop. 15–69 .....                          | 6.9         | 12         |
| 7.3.4    | Video uploads on YouTube/pop. 15–69 .....                    | 76.4        | 3 ●        |

**NOTES:** ● indicates a strength; ○ a weakness; \* an index; † a survey question.

Ⓜ indicates that the country's data are older than the base year; see Appendix II for details, including the year of the data, at <http://globalinnovationindex.org>.

Square brackets indicate that the data minimum coverage (DMC) requirements were not met at the sub-pillar or pillar level; see page 181 of this appendix for details.

# United States of America

## Key indicators

|                            |                  |
|----------------------------|------------------|
| Population (millions)..... | 324.1            |
| GDP (US\$ billions).....   | 18,561.9         |
| GDP per capita, PPP\$..... | 55,805.2         |
| Income group.....          | High income      |
| Region.....                | Northern America |

|  | Score 0–100<br>or value (hard data) | Rank     |
|--|-------------------------------------|----------|
| <b>Global Innovation Index (out of 127).....</b> | <b>61.4</b>                         | <b>4</b> |
| Innovation Output Sub-Index.....                 | 53.9                                | 5        |
| Innovation Input Sub-Index.....                  | 68.9                                | 5        |
| Innovation Efficiency Ratio.....                 | 0.8                                 | 21       |
| Global Innovation Index 2016 (out of 128).....   | 61.4                                | 4        |

## 1 Institutions.....86.2 17

|   |      |     |
|---|------|-----|
| 1.1 Political environment.....                        | 80.3 | 21  |
| 1.1.1 Political stability & safety*.....              | 80.8 | 31  |
| 1.1.2 Government effectiveness*.....                  | 79.7 | 20  |
| 1.2 Regulatory environment.....                       | 90.4 | 13  |
| 1.2.1 Regulatory quality*.....                        | 75.3 | 19  |
| 1.2.2 Rule of law*.....                               | 86.3 | 18  |
| 1.2.3 Cost of redundancy dismissal, salary weeks..... | 8.0  | 1 ● |
| 1.3 Business environment.....                         | 88.1 | 10  |
| 1.3.1 Ease of starting a business*.....               | 91.2 | 44  |
| 1.3.2 Ease of resolving insolvency*.....              | 89.2 | 5   |
| 1.3.3 Ease of paying taxes*.....                      | 83.9 | 32  |

## 2 Human capital & research.....57.2 13

|  |         |      |
|--|---------|------|
| 2.1 Education.....   | 54.7    | 41   |
| 2.1.1 Expenditure on education, % GDP.....                   | 4.9     | 54   |
| 2.1.2 Gov't expenditure/pupil, secondary, % GDP/cap.....     | 22.7    | 41   |
| 2.1.3 School life expectancy, years.....                     | 16.5    | 20   |
| 2.1.4 PISA scales in reading, maths, & science.....          | 487.6   | 29   |
| 2.1.5 Pupil-teacher ratio, secondary <sup>Ⓔ</sup> .....      | 14.8    | 63 ○ |
| 2.2 Tertiary education.....                                  | 38.1    | 54   |
| 2.2.1 Tertiary enrolment, % gross.....                       | 85.8    | 9    |
| 2.2.2 Graduates in science & engineering, %.....             | 14.9    | 85 ○ |
| 2.2.3 Tertiary inbound mobility, %.....                      | 4.6     | 40   |
| 2.3 Research & development (R&D).....                        | 78.8    | 4    |
| 2.3.1 Researchers, FTE/mn pop. <sup>Ⓔ</sup> .....            | 4,232.0 | 20   |
| 2.3.2 Gross expenditure on R&D, % GDP.....                   | 2.8     | 10   |
| 2.3.3 Global R&D companies, avg. expend. top 3, mn \$US..... | 100.0   | 1 ●  |
| 2.3.4 QS university ranking, average score top 3*.....       | 99.0    | 1 ●  |

## 3 Infrastructure.....61.0 21

|  |          |      |
|--|----------|------|
| 3.1 Information & communication technologies (ICTs).....     | 85.2     | 11   |
| 3.1.1 ICT access*.....                                       | 82.7     | 19   |
| 3.1.2 ICT use*.....  | 75.7     | 17   |
| 3.1.3 Government's online service*.....                      | 92.8     | 9    |
| 3.1.4 E-participation*.....                                  | 89.8     | 12   |
| 3.2 General infrastructure.....                              | 52.8     | 16   |
| 3.2.1 Electricity output, kWh/cap.....                       | 13,342.4 | 8    |
| 3.2.2 Logistics performance*.....                            | 89.2     | 10   |
| 3.2.3 Gross capital formation, % GDP.....                    | 19.8     | 82 ○ |
| 3.3 Ecological sustainability.....                           | 45.0     | 61   |
| 3.3.1 GDP/unit of energy use.....                            | 7.6      | 76 ○ |
| 3.3.2 Environmental performance*.....                        | 84.7     | 26   |
| 3.3.3 ISO 14001 environmental certificates/bn PPP\$ GDP..... | 0.3      | 91 ○ |

## 4 Market sophistication.....83.4 1 ●

|   |       |     |
|---|-------|-----|
| 4.1 Credit.....                                     | 85.5  | 1 ● |
| 4.1.1 Ease of getting credit*.....                  | 95.0  | 2 ● |
| 4.1.2 Domestic credit to private sector, % GDP..... | 188.8 | 3 ● |
| 4.1.3 Microfinance gross loans, % GDP.....          | n/a   | n/a |

|   |          |     |
|---|----------|-----|
| 4.2 Investment.....                                     | 72.2     | 3 ● |
| 4.2.1 Ease of protecting minority investors*.....       | 64.7     | 40  |
| 4.2.2 Market capitalization, % GDP.....                 | 139.0    | 5   |
| 4.2.3 Venture capital deals/bn PPP\$ GDP.....           | 0.4      | 1 ● |
| 4.3 Trade, competition, & market scale.....             | 92.7     | 1 ● |
| 4.3.1 Applied tariff rate, weighted mean, %.....        | 1.6      | 50  |
| 4.3.2 Intensity of local competition <sup>†</sup> ..... | 83.0     | 5   |
| 4.3.3 Domestic market scale, bn PPP\$.....              | 18,561.9 | 2 ● |

## 5 Business sophistication.....56.4 8

|   |      |      |
|---|------|------|
| 5.1 Knowledge workers.....  | 67.4 | 11   |
| 5.1.1 Knowledge-intensive employment, % <sup>Ⓔ</sup> .....          | 38.0 | 28   |
| 5.1.2 Firms offering formal training, % firms.....                  | n/a  | n/a  |
| 5.1.3 GERD performed by business, % of GDP.....                     | 2.0  | 7    |
| 5.1.4 GERD financed by business, %.....                             | 64.2 | 8    |
| 5.1.5 Females employed w/advanced degrees, % total.....             | n/a  | n/a  |
| 5.2 Innovation linkages.....  | 46.6 | 15   |
| 5.2.1 University/industry research collaboration <sup>†</sup> ..... | 76.2 | 4    |
| 5.2.2 State of cluster development <sup>†</sup> .....               | 76.0 | 1 ●  |
| 5.2.3 GERD financed by abroad, %.....                               | 4.7  | 66 ○ |
| 5.2.4 JV-strategic alliance deals/bn PPP\$ GDP.....                 | 0.1  | 17   |
| 5.2.5 Patent families 2+ offices/bn PPP\$ GDP.....                  | 5.0  | 13   |
| 5.3 Knowledge absorption.....                                       | 55.2 | 6    |
| 5.3.1 Intellectual property payments, % total trade.....            | 1.6  | 19   |
| 5.3.2 High-tech imports less re-imports, % total trade.....         | 17.7 | 11   |
| 5.3.3 ICT services imports, % total trade.....                      | 1.3  | 52   |
| 5.3.4 FDI net inflows, % GDP.....                                   | 1.7  | 90 ○ |
| 5.3.5 Research talent, % in business enterprise <sup>Ⓔ</sup> .....  | 71.0 | 4    |

## 6 Knowledge & technology outputs.....54.4 7

|   |       |      |
|---|-------|------|
| 6.1 Knowledge creation.....                                       | 63.4  | 7    |
| 6.1.1 Patents by origin/bn PPP\$ GDP.....                         | 16.0  | 6    |
| 6.1.2 PCT patent applications/bn PPP\$ GDP.....                   | 3.0   | 14   |
| 6.1.3 Utility models by origin/bn PPP\$ GDP.....                  | n/a   | n/a  |
| 6.1.4 Scientific & technical articles/bn PPP\$ GDP.....           | 19.8  | 38   |
| 6.1.5 Citable documents H index.....                              | 100.0 | 1 ●  |
| 6.2 Knowledge impact.....   | 52.5  | 7    |
| 6.2.1 Growth rate of PPP\$ GDP/worker, %.....                     | 0.7   | 67 ○ |
| 6.2.2 New businesses/th pop. 15–64.....                           | n/a   | n/a  |
| 6.2.3 Computer software spending, % GDP.....                      | 1.1   | 1 ●  |
| 6.2.4 ISO 9001 quality certificates/bn PPP\$ GDP.....             | 1.8   | 94 ○ |
| 6.2.5 High- & medium-high-tech manufactures, % <sup>Ⓔ</sup> ..... | 0.4   | 13   |
| 6.3 Knowledge diffusion.....                                      | 47.3  | 12   |
| 6.3.1 Intellectual property receipts, % total trade.....          | 5.1   | 1 ●  |
| 6.3.2 High-tech exports less re-exports, % total trade.....       | 7.1   | 26   |
| 6.3.3 ICT services exports, % total trade.....                    | 1.5   | 68   |
| 6.3.4 FDI net outflows, % GDP.....                                | 2.1   | 29   |

## 7 Creative outputs.....53.5 10

|   |       |      |
|---|-------|------|
| 7.1 Intangible assets.....  | 50.1  | 38   |
| 7.1.1 Trademarks by origin/bn PPP\$ GDP.....                                    | 21.5  | 81 ○ |
| 7.1.2 Industrial designs by origin/bn PPP\$ GDP.....                            | 1.3   | 54   |
| 7.1.3 ICTs & business model creation <sup>†</sup> .....                         | 79.2  | 12   |
| 7.1.4 ICTs & organizational model creation <sup>†</sup> .....                   | 82.3  | 1 ●  |
| 7.2 Creative goods & services.....  | 48.2  | 5    |
| 7.2.1 Cultural & creative services exports, % of total trade <sup>Ⓔ</sup> ..... | 2.0   | 1 ●  |
| 7.2.2 National feature films/mn pop. 15–69.....                                 | 3.5   | 53   |
| 7.2.3 Global ent. & media market/th pop. 15–69.....                             | 97.1  | 3 ●  |
| 7.2.4 Printing & publishing manufactures, % <sup>Ⓔ</sup> .....                  | 1.9   | 24   |
| 7.2.5 Creative goods exports, % total trade.....                                | 1.7   | 31   |
| 7.3 Online creativity.....  | 65.4  | 7    |
| 7.3.1 Generic top-level domains (TLDs)/th pop. 15–69.....                       | 100.0 | 1 ●  |
| 7.3.2 Country-code TLDs/th pop. 15–69.....                                      | 2.9   | 58   |
| 7.3.3 Wikipedia edits/mn pop. 15–69.....  | 6.1   | 41   |
| 7.3.4 Video uploads on YouTube/pop. 15–69.....                                  | 100.0 | 1 ●  |

NOTES: ● indicates a strength; ○ a weakness; \* an index; † a survey question.

Ⓔ indicates that the country's data are older than the base year; see Appendix II for details, including the year of the data, at <http://globalinnovationindex.org>.

Square brackets indicate that the data minimum coverage (DMC) requirements were not met at the sub-pillar or pillar level; see page 181 of this appendix for details.

## Key indicators

|                            |                                 |
|----------------------------|---------------------------------|
| Population (millions)..... | 3.4                             |
| GDP (US\$ billions).....   | 54.4                            |
| GDP per capita, PPP\$..... | 21,506.5                        |
| Income group.....          | High income                     |
| Region.....                | Latin America and the Caribbean |

|  | Score 0–100<br>or value (hard data) | Rank      |
|--|-------------------------------------|-----------|
| <b>Global Innovation Index (out of 127).....</b> | <b>34.5</b>                         | <b>67</b> |
| Innovation Output Sub-Index.....                 | 25.6                                | 64        |
| Innovation Input Sub-Index.....                  | 43.5                                | 61        |
| Innovation Efficiency Ratio.....                 | 0.6                                 | 82        |
| Global Innovation Index 2016 (out of 128).....   | 34.3                                | 62        |

**1 Institutions.....69.0 44**

|   |      |    |   |
|---|------|----|---|
| 1.1 Political environment.....                        | 71.9 | 37 | ● |
| 1.1.1 Political stability & safety*.....              | 87.9 | 14 | ● |
| 1.1.2 Government effectiveness*.....                  | 56.0 | 42 |   |
| 1.2 Regulatory environment.....                       | 65.5 | 62 |   |
| 1.2.1 Regulatory quality*.....                        | 53.7 | 51 |   |
| 1.2.2 Rule of law*.....                               | 59.1 | 38 | ● |
| 1.2.3 Cost of redundancy dismissal, salary weeks..... | 20.8 | 86 |   |
| 1.3 Business environment.....                         | 69.4 | 70 |   |
| 1.3.1 Ease of starting a business*.....               | 89.8 | 51 |   |
| 1.3.2 Ease of resolving insolvency*.....              | 52.3 | 57 |   |
| 1.3.3 Ease of paying taxes*.....                      | 66.1 | 82 |   |

**2 Human capital & research.....33.5 57**

|  |       |     |   |
|--|-------|-----|---|
| 2.1 Education.....   | 56.9  | 37  | ● |
| 2.1.1 Expenditure on education, % GDP <sup>Ⓐ</sup> .....       | 4.4   | 69  |   |
| 2.1.2 Gov't expenditure/pupil, secondary, % GDP/cap.....       | n/a   | n/a |   |
| 2.1.3 School life expectancy, years <sup>Ⓐ</sup> .....         | 15.5  | 36  |   |
| 2.1.4 PISA scales in reading, maths, & science.....            | 430.0 | 48  |   |
| 2.1.5 Pupil-teacher ratio, secondary <sup>Ⓐ</sup> .....        | 11.3  | 35  |   |
| 2.2 Tertiary education.....                                    | 37.1  | 59  |   |
| 2.2.1 Tertiary enrolment, % gross <sup>Ⓐ</sup> .....           | 63.1  | 38  |   |
| 2.2.2 Graduates in science & engineering, % <sup>Ⓐ</sup> ..... | 15.6  | 83  | ○ |
| 2.2.3 Tertiary inbound mobility, %.....                        | n/a   | n/a |   |
| 2.3 Research & development (R&D).....                          | 6.6   | 69  |   |
| 2.3.1 Researchers, FTE/mn pop.....                             | 524.3 | 63  |   |
| 2.3.2 Gross expenditure on R&D, % GDP <sup>Ⓐ</sup> .....       | 0.3   | 77  |   |
| 2.3.3 Global R&D companies, avg. expend. top 3, mn \$US.....   | 0.0   | 43  | ○ |
| 2.3.4 QS university ranking, average score top 3*.....         | 12.6  | 60  |   |

**3 Infrastructure.....52.7 43**

|  |         |    |   |
|--|---------|----|---|
| 3.1 Information & communication technologies (ICTs).....     | 70.8    | 34 | ● |
| 3.1.1 ICT access*.....                                       | 72.5    | 43 |   |
| 3.1.2 ICT use*.....  | 62.0    | 35 | ● |
| 3.1.3 Government's online service*.....                      | 77.5    | 28 | ● |
| 3.1.4 E-participation*.....                                  | 71.2    | 39 |   |
| 3.2 General infrastructure.....                              | 32.8    | 85 |   |
| 3.2.1 Electricity output, kWh/cap.....                       | 3,804.4 | 55 |   |
| 3.2.2 Logistics performance*.....                            | 42.2    | 64 |   |
| 3.2.3 Gross capital formation, % GDP.....                    | 20.0    | 81 |   |
| 3.3 Ecological sustainability.....                           | 54.7    | 31 | ● |
| 3.3.1 GDP/unit of energy use.....                            | 14.1    | 13 | ● |
| 3.3.2 Environmental performance*.....                        | 74.0    | 61 |   |
| 3.3.3 ISO 14001 environmental certificates/bn PPP\$ GDP..... | 3.1     | 32 | ● |

**4 Market sophistication.....36.5 109 ○**

|   |      |     |   |
|---|------|-----|---|
| 4.1 Credit.....                                     | 23.8 | 104 | ○ |
| 4.1.1 Ease of getting credit*.....                  | 60.0 | 55  |   |
| 4.1.2 Domestic credit to private sector, % GDP..... | 30.0 | 98  |   |
| 4.1.3 Microfinance gross loans, % GDP.....          | 0.0  | 71  | ○ |

|   |      |     |   |
|---|------|-----|---|
| 4.2 Investment.....                                     | 31.4 | 104 | ○ |
| 4.2.1 Ease of protecting minority investors*.....       | 45.0 | 98  | ○ |
| 4.2.2 Market capitalization, % GDP.....                 | n/a  | n/a |   |
| 4.2.3 Venture capital deals/bn PPP\$ GDP.....           | 0.0  | 59  |   |
| 4.3 Trade, competition, & market scale.....             | 54.3 | 96  |   |
| 4.3.1 Applied tariff rate, weighted mean, %.....        | 4.8  | 89  |   |
| 4.3.2 Intensity of local competition <sup>†</sup> ..... | 60.6 | 96  |   |
| 4.3.3 Domestic market scale, bn PPP\$.....              | 73.9 | 83  |   |

**5 Business sophistication.....25.6 100 ○**

|   |      |     |   |
|---|------|-----|---|
| 5.1 Knowledge workers.....  | 34.0 | 78  |   |
| 5.1.1 Knowledge-intensive employment, % <sup>Ⓐ</sup> .....            | 21.0 | 69  |   |
| 5.1.2 Firms offering formal training, % firms <sup>Ⓐ</sup> .....      | 48.6 | 24  | ● |
| 5.1.3 GERD performed by business, % of GDP <sup>Ⓐ</sup> .....         | 0.0  | 80  | ○ |
| 5.1.4 GERD financed by business, % <sup>Ⓐ</sup> .....                 | 4.6  | 78  | ○ |
| 5.1.5 Females employed w/advanced degrees, % total <sup>Ⓐ</sup> ..... | 13.7 | 44  |   |
| 5.2 Innovation linkages.....  | 21.3 | 94  |   |
| 5.2.1 University/industry research collaboration <sup>†</sup> .....   | 40.7 | 66  |   |
| 5.2.2 State of cluster development <sup>†</sup> .....                 | 37.9 | 91  |   |
| 5.2.3 GERD financed by abroad, % <sup>Ⓐ</sup> .....                   | 7.4  | 53  |   |
| 5.2.4 JV-strategic alliance deals/bn PPP\$ GDP.....                   | 0.0  | 66  |   |
| 5.2.5 Patent families 2+ offices/bn PPP\$ GDP.....                    | 0.1  | 60  |   |
| 5.3 Knowledge absorption.....   | 21.6 | 117 | ○ |
| 5.3.1 Intellectual property payments, % total trade.....              | 0.4  | 68  |   |
| 5.3.2 High-tech imports less re-imports, % total trade.....           | 8.4  | 60  |   |
| 5.3.3 ICT services imports, % total trade.....                        | 0.4  | 105 | ○ |
| 5.3.4 FDI net inflows, % GDP.....                                     | 4.0  | 37  | ● |
| 5.3.5 Research talent, % in business enterprise.....                  | 0.9  | 78  | ○ |

**6 Knowledge & technology outputs.....20.3 76**

|   |      |     |   |
|---|------|-----|---|
| 6.1 Knowledge creation.....                                       | 10.8 | 63  |   |
| 6.1.1 Patents by origin/bn PPP\$ GDP.....                         | 0.4  | 83  |   |
| 6.1.2 PCT patent applications/bn PPP\$ GDP.....                   | n/a  | n/a |   |
| 6.1.3 Utility models by origin/bn PPP\$ GDP.....                  | 0.6  | 34  |   |
| 6.1.4 Scientific & technical articles/bn PPP\$ GDP.....           | 13.2 | 56  |   |
| 6.1.5 Citable documents H index.....                              | 9.6  | 65  |   |
| 6.2 Knowledge impact.....   | 31.3 | 61  |   |
| 6.2.1 Growth rate of PPP\$ GDP/worker, %.....                     | 1.2  | 50  |   |
| 6.2.2 New businesses/th pop. 15–64 <sup>Ⓐ</sup> .....             | 2.5  | 41  |   |
| 6.2.3 Computer software spending, % GDP.....                      | 0.2  | 65  |   |
| 6.2.4 ISO 9001 quality certificates/bn PPP\$ GDP.....             | 18.0 | 22  | ● |
| 6.2.5 High- & medium-high-tech manufactures, % <sup>Ⓐ</sup> ..... | 0.1  | 68  |   |
| 6.3 Knowledge diffusion.....                                      | 18.9 | 90  |   |
| 6.3.1 Intellectual property receipts, % total trade.....          | 0.0  | 97  | ○ |
| 6.3.2 High-tech exports less re-exports, % total trade.....       | 2.3  | 50  |   |
| 6.3.3 ICT services exports, % total trade.....                    | 2.6  | 42  |   |
| 6.3.4 FDI net outflows, % GDP.....                                | 0.2  | 87  |   |

**7 Creative outputs.....30.9 63**

|   |      |     |   |
|---|------|-----|---|
| 7.1 Intangible assets.....  | 42.9 | 61  |   |
| 7.1.1 Trademarks by origin/bn PPP\$ GDP.....                      | 50.1 | 49  |   |
| 7.1.2 Industrial designs by origin/bn PPP\$ GDP.....              | 0.1  | 105 | ○ |
| 7.1.3 ICTs & business model creation <sup>†</sup> .....           | 67.6 | 38  |   |
| 7.1.4 ICTs & organizational model creation <sup>†</sup> .....     | 57.0 | 48  |   |
| 7.2 Creative goods & services.....                                | 11.2 | 84  |   |
| 7.2.1 Cultural & creative services exports, % of total trade..... | n/a  | n/a |   |
| 7.2.2 National feature films/mn pop. 15–69.....                   | 4.7  | 41  |   |
| 7.2.3 Global ent. & media market/th pop. 15–69.....               | n/a  | n/a |   |
| 7.2.4 Printing & publishing manufactures, % <sup>Ⓐ</sup> .....    | 1.2  | 44  |   |
| 7.2.5 Creative goods exports, % total trade.....                  | 0.1  | 97  |   |
| 7.3 Online creativity.....  | 26.5 | 44  |   |
| 7.3.1 Generic top-level domains (TLDs)/th pop. 15–69.....         | 6.4  | 51  |   |
| 7.3.2 Country-code TLDs/th pop. 15–69.....                        | 10.0 | 39  |   |
| 7.3.3 Wikipedia edits/mn pop. 15–69.....                          | 6.5  | 28  | ● |
| 7.3.4 Video uploads on YouTube/pop. 15–69.....                    | n/a  | n/a |   |

NOTES: ● indicates a strength; ○ a weakness; \* an index; † a survey question.

Ⓐ indicates that the country's data are older than the base year; see Appendix II for details, including the year of the data, at <http://globalinnovationindex.org>.

Square brackets indicate that the data minimum coverage (DMC) requirements were not met at the sub-pillar or pillar level; see page 181 of this appendix for details.



## Key indicators

|                       |   |
|-----------------------|---|
| Population (millions) | 94.4                                    |
| GDP (US\$ billions)   | 200.5                                   |
| GDP per capita, PPP\$ | 6,024.4                                 |
| Income group          | Lower-middle income                     |
| Region                | South East Asia, East Asia, and Oceania |

|   | Score 0–100<br>or value (hard data) | Rank      |
|---|-------------------------------------|-----------|
| <b>Global Innovation Index (out of 127)</b> | <b>38.3</b>                         | <b>47</b> |
| Innovation Output Sub-Index                 | 34.9                                | 38        |
| Innovation Input Sub-Index                  | 41.7                                | 71        |
| Innovation Efficiency Ratio                 | 0.8                                 | 10 ●      |
| Global Innovation Index 2016 (out of 128)   | 35.4                                | 59        |

**1 Institutions** ..... 52.8 87

|       |  |      |       |
|-------|--|------|-------|
| 1.1   | Political environment                      | 54.1 | 59    |
| 1.1.1 | Political stability & safety*              | 64.1 | 59    |
| 1.1.2 | Government effectiveness*                  | 44.1 | 68    |
| 1.2   | Regulatory environment                     | 48.9 | 103   |
| 1.2.1 | Regulatory quality*                        | 29.4 | 100   |
| 1.2.2 | Rule of law*                               | 31.6 | 74    |
| 1.2.3 | Cost of redundancy dismissal, salary weeks | 24.6 | 101   |
| 1.3   | Business environment                       | 55.4 | 113 ○ |
| 1.3.1 | Ease of starting a business*               | 81.8 | 92    |
| 1.3.2 | Ease of resolving insolvency*              | 35.1 | 105   |
| 1.3.3 | Ease of paying taxes*                      | 49.4 | 115 ○ |

**2 Human capital & research** ..... 31.0 70

|       |   |       |       |
|-------|---|-------|-------|
| 2.1   | Education   | 61.2  | [17]  |
| 2.1.1 | Expenditure on education, % GDP                   | 5.7   | 26 ●  |
| 2.1.2 | Gov't expenditure/pupil, secondary, % GDP/cap     | n/a   | n/a   |
| 2.1.3 | School life expectancy, years                     | n/a   | n/a   |
| 2.1.4 | PISA scales in reading, maths, & science          | 502.0 | 20    |
| 2.1.5 | Pupil-teacher ratio, secondary                    | n/a   | n/a   |
| 2.2   | Tertiary education                                | 27.8  | 86    |
| 2.2.1 | Tertiary enrolment, % gross                       | 28.8  | 82    |
| 2.2.2 | Graduates in science & engineering, %             | 22.4  | 40    |
| 2.2.3 | Tertiary inbound mobility, %                      | 0.1   | 103 ○ |
| 2.3   | Research & development (R&D)                      | 4.1   | 80    |
| 2.3.1 | Researchers, FTE/mn pop. <sup>Ⓐ</sup>             | 674.8 | 58    |
| 2.3.2 | Gross expenditure on R&D, % GDP <sup>Ⓐ</sup>      | 0.4   | 73    |
| 2.3.3 | Global R&D companies, avg. expend. top 3, mn \$US | 0.0   | 43 ○  |
| 2.3.4 | QS university ranking, average score top 3*       | 0.0   | 75 ○  |

**3 Infrastructure** ..... 42.7 77

|       |   |         |      |
|-------|---|---------|------|
| 3.1   | Information & communication technologies (ICTs)   | 52.0    | 75   |
| 3.1.1 | ICT access*                                       | 46.0    | 90   |
| 3.1.2 | ICT use*  | 35.1    | 77   |
| 3.1.3 | Government's online service*                      | 57.2    | 72   |
| 3.1.4 | E-participation*                                  | 69.5    | 43   |
| 3.2   | General infrastructure                            | 39.8    | 52   |
| 3.2.1 | Electricity output, kWh/cap                       | 1,553.1 | 84   |
| 3.2.2 | Logistics performance*                            | 42.2    | 63   |
| 3.2.3 | Gross capital formation, % GDP                    | 28.0    | 29 ● |
| 3.3   | Ecological sustainability                         | 36.4    | 97   |
| 3.3.1 | GDP/unit of energy use                            | 7.1     | 84   |
| 3.3.2 | Environmental performance*                        | 58.5    | 102  |
| 3.3.3 | ISO 14001 environmental certificates/bn PPP\$ GDP | 2.2     | 47   |

**4 Market sophistication** ..... 52.8 34

|       |  |       |      |
|-------|--|-------|------|
| 4.1   | Credit                                   | 59.0  | 17 ● |
| 4.1.1 | Ease of getting credit*                  | 70.0  | 29   |
| 4.1.2 | Domestic credit to private sector, % GDP | 111.9 | 22 ● |
| 4.1.3 | Microfinance gross loans, % GDP          | 3.5   | 12 ● |

|       |   |       |     |
|-------|---|-------|-----|
| 4.2   | Investment                                  | 30.5  | 109 |
| 4.2.1 | Ease of protecting minority investors*      | 53.3  | 80  |
| 4.2.2 | Market capitalization, % GDP                | 26.8  | 54  |
| 4.2.3 | Venture capital deals/bn PPP\$ GDP          | 0.0   | 60  |
| 4.3   | Trade, competition, & market scale          | 68.9  | 41  |
| 4.3.1 | Applied tariff rate, weighted mean, %       | 3.1   | 69  |
| 4.3.2 | Intensity of local competition <sup>†</sup> | 65.9  | 77  |
| 4.3.3 | Domestic market scale, bn PPP\$             | 594.9 | 34  |

**5 Business sophistication** ..... 29.4 73

|       |   |      |       |
|-------|---|------|-------|
| 5.1   | Knowledge workers                                       | 23.3 | 102   |
| 5.1.1 | Knowledge-intensive employment, %                       | 10.8 | 94 ○  |
| 5.1.2 | Firms offering formal training, % firms                 | 22.2 | 69    |
| 5.1.3 | GERD performed by business, % of GDP <sup>Ⓐ</sup>       | 0.2  | 52    |
| 5.1.4 | GERD financed by business, % <sup>Ⓐ</sup>               | 40.0 | 36    |
| 5.1.5 | Females employed w/advanced degrees, % total            | 7.4  | 72    |
| 5.2   | Innovation linkages                                     | 20.8 | 100   |
| 5.2.1 | University/industry research collaboration <sup>†</sup> | 38.9 | 76    |
| 5.2.2 | State of cluster development <sup>†</sup>               | 47.5 | 50    |
| 5.2.3 | GERD financed by abroad, % <sup>Ⓐ</sup>                 | 1.5  | 82    |
| 5.2.4 | JV-strategic alliance deals/bn PPP\$ GDP                | 0.0  | 65    |
| 5.2.5 | Patent families 2+ offices/bn PPP\$ GDP                 | 0.0  | 96    |
| 5.3   | Knowledge absorption                                    | 44.1 | 23 ●  |
| 5.3.1 | Intellectual property payments, % total trade           | n/a  | n/a   |
| 5.3.2 | High-tech imports less re-imports, % total trade        | 22.6 | 3 ●   |
| 5.3.3 | ICT services imports, % total trade <sup>Ⓐ</sup>        | 0.1  | 123 ○ |
| 5.3.4 | FDI net inflows, % GDP                                  | 5.4  | 26 ●  |
| 5.3.5 | Research talent, % in business enterprise <sup>Ⓐ</sup>  | 21.1 | 54    |

**6 Knowledge & technology outputs** ..... 35.0 28 ●

|       |   |      |       |
|-------|---|------|-------|
| 6.1   | Knowledge creation                                    | 8.0  | 73    |
| 6.1.1 | Patents by origin/bn PPP\$ GDP                        | 1.1  | 61    |
| 6.1.2 | PCT patent applications/bn PPP\$ GDP                  | 0.0  | 100 ○ |
| 6.1.3 | Utility models by origin/bn PPP\$ GDP                 | 0.6  | 35    |
| 6.1.4 | Scientific & technical articles/bn PPP\$ GDP          | 5.6  | 94    |
| 6.1.5 | Citable documents H index                             | 10.6 | 58    |
| 6.2   | Knowledge impact                                      | 55.8 | 5 ●   |
| 6.2.1 | Growth rate of PPP\$ GDP/worker, %                    | 6.9  | 1 ●   |
| 6.2.2 | New businesses/th pop. 15–64                          | n/a  | n/a   |
| 6.2.3 | Computer software spending, % GDP                     | 0.3  | 39    |
| 6.2.4 | ISO 9001 quality certificates/bn PPP\$ GDP            | 7.5  | 48    |
| 6.2.5 | High- & medium-high-tech manufactures, % <sup>Ⓐ</sup> | 0.3  | 46    |
| 6.3   | Knowledge diffusion                                   | 41.4 | 19 ●  |
| 6.3.1 | Intellectual property receipts, % total trade         | n/a  | n/a   |
| 6.3.2 | High-tech exports less re-exports, % total trade      | 26.8 | 4 ●   |
| 6.3.3 | ICT services exports, % total trade <sup>Ⓐ</sup>      | 0.1  | 122 ○ |
| 6.3.4 | FDI net outflows, % GDP                               | 0.8  | 59    |

**7 Creative outputs** ..... 34.8 52

|       |  |      |      |
|-------|--|------|------|
| 7.1   | Intangible assets                                      | 46.2 | 52   |
| 7.1.1 | Trademarks by origin/bn PPP\$ GDP                      | 81.7 | 20 ● |
| 7.1.2 | Industrial designs by origin/bn PPP\$ GDP              | 3.3  | 33   |
| 7.1.3 | ICTs & business model creation <sup>†</sup>            | 57.1 | 78   |
| 7.1.4 | ICTs & organizational model creation <sup>†</sup>      | 54.2 | 61   |
| 7.2   | Creative goods & services                              | 27.4 | 36   |
| 7.2.1 | Cultural & creative services exports, % of total trade | n/a  | n/a  |
| 7.2.2 | National feature films/mn pop. 15–69 <sup>Ⓐ</sup>      | 0.2  | 98 ○ |
| 7.2.3 | Global ent. & media market/th pop. 15–69               | 0.9  | 57 ○ |
| 7.2.4 | Printing & publishing manufactures, % <sup>Ⓐ</sup>     | 0.7  | 81   |
| 7.2.5 | Creative goods exports, % total trade                  | 6.0  | 7 ●  |
| 7.3   | Online creativity                                      | 19.3 | 64   |
| 7.3.1 | Generic top-level domains (TLDs)/th pop. 15–69         | 2.6  | 70   |
| 7.3.2 | Country-code TLDs/th pop. 15–69                        | 2.6  | 60   |
| 7.3.3 | Wikipedia edits/mn pop. 15–69                          | 4.9  | 64   |
| 7.3.4 | Video uploads on YouTube/pop. 15–69                    | 24.3 | 52   |

NOTES: ● indicates a strength; ○ a weakness; \* an index; † a survey question.

Ⓐ indicates that the country's data are older than the base year; see Appendix II for details, including the year of the data, at <http://globalinnovationindex.org>.

Square brackets indicate that the data minimum coverage (DMC) requirements were not met at the sub-pillar or pillar level; see page 181 of this appendix for details.



**Key indicators**

|                             |                                  |
|-----------------------------|----------------------------------|
| Population (millions) ..... | 27.5                             |
| GDP (US\$ billions) .....   | 31.3                             |
| GDP per capita, PPP\$ ..... | 2,670.6                          |
| Income group.....           | Lower-middle income              |
| Region.....                 | Northern Africa and Western Asia |

|  | Score 0–100<br>or value (hard data) | Rank       |
|--|-------------------------------------|------------|
| <b>Global Innovation Index (out of 127).....</b> | <b>15.6</b>                         | <b>127</b> |
| Innovation Output Sub-Index .....                | 8.9                                 | 125        |
| Innovation Input Sub-Index.....                  | 22.4                                | 127        |
| Innovation Efficiency Ratio.....                 | 0.4                                 | 119        |
| Global Innovation Index 2016 (out of 128) .....  | 14.6                                | 128        |

**1 Institutions..... 30.6 126**

|   |      |     |
|---|------|-----|
| 1.1 Political environment .....                       | 0.0  | 127 |
| 1.1.1 Political stability & safety*.....              | 0.0  | 127 |
| 1.1.2 Government effectiveness*.....                  | 0.0  | 127 |
| 1.2 Regulatory environment.....                       | 35.1 | 119 |
| 1.2.1 Regulatory quality*.....                        | 14.0 | 123 |
| 1.2.2 Rule of law*.....                               | 3.2  | 126 |
| 1.2.3 Cost of redundancy dismissal, salary weeks..... | 27.4 | 110 |
| 1.3 Business environment.....                         | 56.6 | 110 |
| 1.3.1 Ease of starting a business*.....               | 71.6 | 116 |
| 1.3.2 Ease of resolving insolvency*.....              | 26.7 | 122 |
| 1.3.3 Ease of paying taxes*.....                      | 71.6 | 70  |

**2 Human capital & research..... 13.5 120**

|  |      |     |
|--|------|-----|
| 2.1 Education.....   | 25.4 | 117 |
| 2.1.1 Expenditure on education, % GDP <sup>Ⓐ</sup> .....               | 4.6  | 66  |
| 2.1.2 Gov't expenditure/pupil, secondary, % GDP/cap <sup>Ⓐ</sup> ..... | 12.6 | 89  |
| 2.1.3 School life expectancy, years <sup>Ⓐ</sup> .....                 | 9.0  | 106 |
| 2.1.4 PISA scales in reading, maths, & science.....                    | n/a  | n/a |
| 2.1.5 Pupil-teacher ratio, secondary.....                              | n/a  | n/a |
| 2.2 Tertiary education.....  | 15.1 | 109 |
| 2.2.1 Tertiary enrolment, % gross <sup>Ⓐ</sup> .....                   | 10.0 | 105 |
| 2.2.2 Graduates in science & engineering, %.....                       | n/a  | n/a |
| 2.2.3 Tertiary inbound mobility, % <sup>Ⓐ</sup> .....                  | 4.3  | 43  |
| 2.3 Research & development (R&D).....                                  | 0.0  | 115 |
| 2.3.1 Researchers, FTE/mn pop.....                                     | n/a  | n/a |
| 2.3.2 Gross expenditure on R&D, % GDP.....                             | n/a  | n/a |
| 2.3.3 Global R&D companies, avg. expend. top 3, mn \$US.....           | 0.0  | 43  |
| 2.3.4 QS university ranking, average score top 3*.....                 | 0.0  | 75  |

**3 Infrastructure..... 16.3 126**

|  |       |     |
|--|-------|-----|
| 3.1 Information & communication technologies (ICTs).....     | 16.5  | 121 |
| 3.1.1 ICT access*.....                                       | 26.6  | 116 |
| 3.1.2 ICT use*.....  | 11.2  | 111 |
| 3.1.3 Government's online service*.....                      | 14.5  | 119 |
| 3.1.4 E-participation*.....                                  | 13.6  | 121 |
| 3.2 General infrastructure.....                              | 1.6   | 127 |
| 3.2.1 Electricity output, kWh/cap.....                       | 292.1 | 109 |
| 3.2.2 Logistics performance* <sup>Ⓐ</sup> .....              | 5.6   | 122 |
| 3.2.3 Gross capital formation, % GDP.....                    | 3.2   | 124 |
| 3.3 Ecological sustainability.....                           | 30.7  | 115 |
| 3.3.1 GDP/unit of energy use.....                            | 12.5  | 23  |
| 3.3.2 Environmental performance*.....                        | n/a   | n/a |
| 3.3.3 ISO 14001 environmental certificates/bn PPP\$ GDP..... | 0.0   | 125 |

**4 Market sophistication..... 32.1 117**

|   |     |     |
|---|-----|-----|
| 4.1 Credit.....   | 0.6 | 127 |
| 4.1.1 Ease of getting credit*.....                                | 0.0 | 126 |
| 4.1.2 Domestic credit to private sector, % GDP <sup>Ⓐ</sup> ..... | 5.6 | 125 |
| 4.1.3 Microfinance gross loans, % GDP.....                        | 0.0 | 64  |

|   |      |      |
|---|------|------|
| 4.2 Investment.....                                     | 43.3 | [47] |
| 4.2.1 Ease of protecting minority investors*.....       | 43.3 | 101  |
| 4.2.2 Market capitalization, % GDP.....                 | n/a  | n/a  |
| 4.2.3 Venture capital deals/bn PPP\$ GDP.....           | n/a  | n/a  |
| 4.3 Trade, competition, & market scale.....             | 52.2 | 100  |
| 4.3.1 Applied tariff rate, weighted mean, %.....        | 5.1  | 91   |
| 4.3.2 Intensity of local competition <sup>†</sup> ..... | 54.6 | 115  |
| 4.3.3 Domestic market scale, bn PPP\$.....              | 73.4 | 84   |

**5 Business sophistication..... 19.5 123**

|   |       |     |
|---|-------|-----|
| 5.1 Knowledge workers.....  | 16.9  | 114 |
| 5.1.1 Knowledge-intensive employment, % <sup>Ⓐ</sup> .....                | 15.0  | 87  |
| 5.1.2 Firms offering formal training, % firms.....                        | 14.3  | 86  |
| 5.1.3 GERD performed by business, % of GDP.....                           | n/a   | n/a |
| 5.1.4 GERD financed by business, %.....                                   | n/a   | n/a |
| 5.1.5 Females employed w/advanced degrees, % total <sup>Ⓐ</sup> .....     | 1.6   | 84  |
| 5.2 Innovation linkages.....  | 19.9  | 108 |
| 5.2.1 University/industry research collaboration <sup>†</sup> .....       | 14.8  | 123 |
| 5.2.2 State of cluster development <sup>†</sup> .....                     | 32.4  | 115 |
| 5.2.3 GERD financed by abroad, %.....                                     | n/a   | n/a |
| 5.2.4 JV-strategic alliance deals/bn PPP\$ GDP.....                       | n/a   | n/a |
| 5.2.5 Patent families 2+ offices/bn PPP\$ GDP <sup>Ⓐ</sup> .....          | 0.0   | 110 |
| 5.3 Knowledge absorption.....   | 21.8  | 114 |
| 5.3.1 Intellectual property payments, % total trade <sup>Ⓐ</sup> .....    | 0.0   | 109 |
| 5.3.2 High-tech imports less re-imports, % total trade <sup>Ⓐ</sup> ..... | 4.5   | 112 |
| 5.3.3 ICT services imports, % total trade <sup>Ⓐ</sup> .....              | 1.4   | 48  |
| 5.3.4 FDI net inflows, % GDP.....   | (0.3) | 126 |
| 5.3.5 Research talent, % in business enterprise.....                      | n/a   | n/a |

**6 Knowledge & technology outputs..... 6.8 126**

|   |        |     |
|---|--------|-----|
| 6.1 Knowledge creation.....   | 1.1    | 124 |
| 6.1.1 Patents by origin/bn PPP\$ GDP.....                                 | 0.1    | 112 |
| 6.1.2 PCT patent applications/bn PPP\$ GDP.....                           | n/a    | n/a |
| 6.1.3 Utility models by origin/bn PPP\$ GDP <sup>Ⓐ</sup> .....            | 0.0    | 63  |
| 6.1.4 Scientific & technical articles/bn PPP\$ GDP.....                   | 2.8    | 112 |
| 6.1.5 Citable documents H index.....                                      | 2.0    | 119 |
| 6.2 Knowledge impact.....   | 0.4    | 127 |
| 6.2.1 Growth rate of PPP\$ GDP/worker, %.....                             | (31.1) | 110 |
| 6.2.2 New businesses/th pop. 15–64.....                                   | n/a    | n/a |
| 6.2.3 Computer software spending, % GDP.....                              | 0.0    | 118 |
| 6.2.4 ISO 9001 quality certificates/bn PPP\$ GDP.....                     | 0.3    | 121 |
| 6.2.5 High- & medium-high-tech manufactures, % <sup>Ⓐ</sup> .....         | 0.0    | 102 |
| 6.3 Knowledge diffusion.....  | 18.9   | 91  |
| 6.3.1 Intellectual property receipts, % total trade <sup>Ⓐ</sup> .....    | 0.4    | 27  |
| 6.3.2 High-tech exports less re-exports, % total trade <sup>Ⓐ</sup> ..... | 0.0    | 123 |
| 6.3.3 ICT services exports, % total trade <sup>Ⓐ</sup> .....              | 2.0    | 53  |
| 6.3.4 FDI net outflows, % GDP.....  | 0.0    | 102 |

**7 Creative outputs..... 11.0 124**

|   |      |     |
|---|------|-----|
| 7.1 Intangible assets.....  | 18.3 | 123 |
| 7.1.1 Trademarks by origin/bn PPP\$ GDP.....                      | 17.5 | 86  |
| 7.1.2 Industrial designs by origin/bn PPP\$ GDP.....              | 0.1  | 109 |
| 7.1.3 ICTs & business model creation <sup>†</sup> .....           | 29.9 | 123 |
| 7.1.4 ICTs & organizational model creation <sup>†</sup> .....     | 25.7 | 123 |
| 7.2 Creative goods & services.....                                | 1.0  | 126 |
| 7.2.1 Cultural & creative services exports, % of total trade..... | n/a  | n/a |
| 7.2.2 National feature films/mn pop. 15–69.....                   | n/a  | n/a |
| 7.2.3 Global ent. & media market/th pop. 15–69.....               | 0.0  | 63  |
| 7.2.4 Printing & publishing manufactures, % <sup>Ⓐ</sup> .....    | 0.4  | 95  |
| 7.2.5 Creative goods exports, % total trade <sup>Ⓐ</sup> .....    | 0.0  | 124 |
| 7.3 Online creativity.....  | 6.3  | 107 |
| 7.3.1 Generic top-level domains (TLDs)/th pop. 15–69.....         | 0.4  | 110 |
| 7.3.2 Country-code TLDs/th pop. 15–69.....                        | 0.0  | 122 |
| 7.3.3 Wikipedia edits/mn pop. 15–69 <sup>Ⓐ</sup> .....            | 2.5  | 104 |
| 7.3.4 Video uploads on YouTube/pop. 15–69.....                    | 0.8  | 71  |

**NOTES:** ● indicates a strength; ○ a weakness; \* an index; † a survey question.

Ⓐ indicates that the country's data are older than the base year; see Appendix II for details, including the year of the data, at <http://globalinnovationindex.org>.

Square brackets indicate that the data minimum coverage (DMC) requirements were not met at the sub-pillar or pillar level; see page 181 of this appendix for details.

## Key indicators

|                       |                     |
|-----------------------|---------------------|
| Population (millions) | 16.7                |
| GDP (US\$ billions)   | 20.6                |
| GDP per capita, PPP\$ | 3,868.1             |
| Income group          | Lower-middle income |
| Region                | Sub-Saharan Africa  |

|   | Score 0–100<br>or value (hard data) | Rank         |
|---|-------------------------------------|--------------|
| <b>Global Innovation Index (out of 127)</b> | <b>20.8</b>                         | <b>124</b> ○ |
| Innovation Output Sub-Index                 | 15.5                                | 118          |
| Innovation Input Sub-Index                  | 26.1                                | 125 ○        |
| Innovation Efficiency Ratio                 | 0.6                                 | 79           |
| Global Innovation Index 2016 (out of 128)   | 19.9                                | 125          |

**1 Institutions**.....46.9 104

|  |      |       |
|--|------|-------|
| 1.1 Political environment                        | 46.9 | 76    |
| 1.1.1 Political stability & safety*              | 65.9 | 57 ●  |
| 1.1.2 Government effectiveness*                  | 27.9 | 98    |
| 1.2 Regulatory environment                       | 23.7 | 124 ○ |
| 1.2.1 Regulatory quality*                        | 31.3 | 96    |
| 1.2.2 Rule of law*                               | 32.0 | 73    |
| 1.2.3 Cost of redundancy dismissal, salary weeks | 50.6 | 124 ○ |
| 1.3 Business environment                         | 70.2 | 65 ●  |
| 1.3.1 Ease of starting a business*               | 85.0 | 80    |
| 1.3.2 Ease of resolving insolvency*              | 45.4 | 75    |
| 1.3.3 Ease of paying taxes*                      | 80.2 | 49 ●  |

**2 Human capital & research**.....0.8 [127]

|   |      |       |
|---|------|-------|
| 2.1 Education   | 0.0  | [127] |
| 2.1.1 Expenditure on education, % GDP <sup>Ⓔ</sup>      | 1.1  | 117 ○ |
| 2.1.2 Gov't expenditure/pupil, secondary, % GDP/cap     | n/a  | n/a   |
| 2.1.3 School life expectancy, years                     | n/a  | n/a   |
| 2.1.4 PISA scales in reading, maths, & science          | n/a  | n/a   |
| 2.1.5 Pupil-teacher ratio, secondary                    | n/a  | n/a   |
| 2.2 Tertiary education                                  | n/a  | n/a   |
| 2.2.1 Tertiary enrolment, % gross                       | n/a  | n/a   |
| 2.2.2 Graduates in science & engineering, %             | n/a  | n/a   |
| 2.2.3 Tertiary inbound mobility, %                      | n/a  | n/a   |
| 2.3 Research & development (R&D)                        | 1.6  | 96    |
| 2.3.1 Researchers, FTE/mn pop. <sup>Ⓔ</sup>             | 40.9 | 93    |
| 2.3.2 Gross expenditure on R&D, % GDP <sup>Ⓔ</sup>      | 0.3  | 81    |
| 2.3.3 Global R&D companies, avg. expend. top 3, mn \$US | 0.0  | 43 ○  |
| 2.3.4 QS university ranking, average score top 3*       | 0.0  | 75 ○  |

**3 Infrastructure**.....26.3 116

|   |       |       |
|---|-------|-------|
| 3.1 Information & communication technologies (ICTs)     | 28.2  | 110   |
| 3.1.1 ICT access*                                       | 28.4  | 114   |
| 3.1.2 ICT use*  | 11.7  | 110   |
| 3.1.3 Government's online service*                      | 37.0  | 101   |
| 3.1.4 E-participation*                                  | 35.6  | 105   |
| 3.2 General infrastructure                              | 36.8  | 66 ●  |
| 3.2.1 Electricity output, kWh/cap                       | 919.3 | 95    |
| 3.2.2 Logistics performance*                            | 17.0  | 108   |
| 3.2.3 Gross capital formation, % GDP                    | 31.5  | 14 ●  |
| 3.3 Ecological sustainability                           | 13.9  | 126 ○ |
| 3.3.1 GDP/unit of energy use                            | 5.7   | 96    |
| 3.3.2 Environmental performance*                        | n/a   | n/a   |
| 3.3.3 ISO 14001 environmental certificates/bn PPP\$ GDP | 0.4   | 88    |

**4 Market sophistication**.....38.4 100

|  |      |      |
|--|------|------|
| 4.1 Credit                                     | 27.9 | 87   |
| 4.1.1 Ease of getting credit*                  | 75.0 | 19 ● |
| 4.1.2 Domestic credit to private sector, % GDP | 19.8 | 112  |
| 4.1.3 Microfinance gross loans, % GDP          | 0.1  | 58   |

|  |      |      |
|--|------|------|
| 4.2 Investment   | 29.3 | 115  |
| 4.2.1 Ease of protecting minority investors*             | 53.3 | 80   |
| 4.2.2 Market capitalization, % GDP <sup>Ⓔ</sup>          | 13.6 | 72   |
| 4.2.3 Venture capital deals/bn PPP\$ GDP                 | 0.0  | 56   |
| 4.3 Trade, competition, & market scale                   | 58.0 | 79   |
| 4.3.1 Applied tariff rate, weighted mean, % <sup>Ⓔ</sup> | 3.4  | 72   |
| 4.3.2 Intensity of local competition <sup>†</sup>        | 69.9 | 62 ● |
| 4.3.3 Domestic market scale, bn PPP\$                    | 65.2 | 88   |

**5 Business sophistication**.....18.3 125 ○

|  |      |       |
|--|------|-------|
| 5.1 Knowledge workers  | 15.5 | 116   |
| 5.1.1 Knowledge-intensive employment, % <sup>Ⓔ</sup>             | 7.3  | 98    |
| 5.1.2 Firms offering formal training, % firms                    | 28.2 | 56    |
| 5.1.3 GERD performed by business, % of GDP <sup>Ⓔ</sup>          | 0.0  | 84    |
| 5.1.4 GERD financed by business, % <sup>Ⓔ</sup>                  | 3.2  | 82    |
| 5.1.5 Females employed w/advanced degrees, % total               | n/a  | n/a   |
| 5.2 Innovation linkages  | 19.8 | 109   |
| 5.2.1 University/industry research collaboration <sup>†</sup>    | 41.4 | 58 ●  |
| 5.2.2 State of cluster development <sup>†</sup>                  | 45.3 | 64 ●  |
| 5.2.3 GERD financed by abroad, % <sup>Ⓔ</sup>                    | 1.6  | 79    |
| 5.2.4 JV-strategic alliance deals/bn PPP\$ GDP <sup>Ⓔ</sup>      | 0.0  | 105 ○ |
| 5.2.5 Patent families 2+ offices/bn PPP\$ GDP <sup>Ⓔ</sup>       | 0.0  | 98    |
| 5.3 Knowledge absorption   | 19.6 | 123 ○ |
| 5.3.1 Intellectual property payments, % total trade <sup>Ⓔ</sup> | 0.0  | 112 ○ |
| 5.3.2 High-tech imports less re-imports, % total trade           | 5.2  | 106   |
| 5.3.3 ICT services imports, % total trade <sup>Ⓔ</sup>           | 0.4  | 108   |
| 5.3.4 FDI net inflows, % GDP                                     | 6.8  | 18 ●  |
| 5.3.5 Research talent, % in business enterprise <sup>Ⓔ</sup>     | 4.9  | 74    |

**6 Knowledge & technology outputs**.....16.1 95

|  |       |       |
|--|-------|-------|
| 6.1 Knowledge creation                                 | 4.7   | 90    |
| 6.1.1 Patents by origin/bn PPP\$ GDP <sup>Ⓔ</sup>      | 0.2   | 92    |
| 6.1.2 PCT patent applications/bn PPP\$ GDP             | n/a   | n/a   |
| 6.1.3 Utility models by origin/bn PPP\$ GDP            | n/a   | n/a   |
| 6.1.4 Scientific & technical articles/bn PPP\$ GDP     | 5.4   | 96    |
| 6.1.5 Citable documents H index                        | 5.9   | 88    |
| 6.2 Knowledge impact                                   | 33.4  | 54 ●  |
| 6.2.1 Growth rate of PPP\$ GDP/worker, %               | 4.3   | 12 ●  |
| 6.2.2 New businesses/th pop. 15–64                     | 1.3   | 59 ●  |
| 6.2.3 Computer software spending, % GDP                | 0.0   | 114   |
| 6.2.4 ISO 9001 quality certificates/bn PPP\$ GDP       | 0.8   | 112   |
| 6.2.5 High- & medium-high-tech manufactures, %         | n/a   | n/a   |
| 6.3 Knowledge diffusion                                | 10.4  | 125 ○ |
| 6.3.1 Intellectual property receipts, % total trade    | n/a   | n/a   |
| 6.3.2 High-tech exports less re-exports, % total trade | 0.6   | 75    |
| 6.3.3 ICT services exports, % total trade <sup>Ⓔ</sup> | 0.3   | 110   |
| 6.3.4 FDI net outflows, % GDP                          | (1.2) | 121 ○ |

**7 Creative outputs**.....14.9 120 ○

|  |      |       |
|--|------|-------|
| 7.1 Intangible assets  | 28.0 | 113   |
| 7.1.1 Trademarks by origin/bn PPP\$ GDP <sup>Ⓔ</sup>         | 8.8  | 106   |
| 7.1.2 Industrial designs by origin/bn PPP\$ GDP <sup>Ⓔ</sup> | 0.5  | 80    |
| 7.1.3 ICTs & business model creation <sup>†</sup>            | 48.6 | 108   |
| 7.1.4 ICTs & organizational model creation <sup>†</sup>      | 44.0 | 97    |
| 7.2 Creative goods & services                                | 1.5  | [122] |
| 7.2.1 Cultural & creative services exports, % of total trade | n/a  | n/a   |
| 7.2.2 National feature films/mn pop. 15–69                   | n/a  | n/a   |
| 7.2.3 Global ent. & media market/th pop. 15–69               | n/a  | n/a   |
| 7.2.4 Printing & publishing manufactures, %                  | n/a  | n/a   |
| 7.2.5 Creative goods exports, % total trade                  | 0.0  | 106   |
| 7.3 Online creativity  | 2.2  | 121 ○ |
| 7.3.1 Generic top-level domains (TLDs)/th pop. 15–69         | 0.1  | 121 ○ |
| 7.3.2 Country-code TLDs/th pop. 15–69                        | 0.0  | 126 ○ |
| 7.3.3 Wikipedia edits/mn pop. 15–69 <sup>Ⓔ</sup>             | 0.7  | 120 ○ |
| 7.3.4 Video uploads on YouTube/pop. 15–69                    | n/a  | n/a   |

NOTES: ● indicates a strength; ○ a weakness; \* an index; † a survey question.

Ⓔ indicates that the country's data are older than the base year; see Appendix II for details, including the year of the data, at <http://globalinnovationindex.org>.

Square brackets indicate that the data minimum coverage (DMC) requirements were not met at the sub-pillar or pillar level; see page 181 of this appendix for details.

**Key indicators**

|                             |                    |
|-----------------------------|--------------------|
| Population (millions) ..... | 16.0               |
| GDP (US\$ billions) .....   | 14.2               |
| GDP per capita, PPP\$ ..... | 2,096.2            |
| Income group .....          | Low income         |
| Region .....                | Sub-Saharan Africa |

|   | Score 0–100<br>or value (hard data) | Rank       |
|---|-------------------------------------|------------|
| <b>Global Innovation Index (out of 127)</b> ..... | <b>21.8</b>                         | <b>121</b> |
| Innovation Output Sub-Index .....                 | 15.6                                | 116        |
| Innovation Input Sub-Index .....                  | 28.0                                | 124 ○      |
| Innovation Efficiency Ratio .....                 | 0.6                                 | 89         |
| Global Innovation Index 2016 (out of 128) .....   | n/a                                 | n/a        |

|   |             |            |   |
|---|-------------|------------|---|
| <b>1 Institutions</b> .....                                   | <b>35.7</b> | <b>125</b> | ○ |
| 1.1 Political environment .....                               | 31.3        | 114        |   |
| 1.1.1 Political stability & safety* .....                     | 49.8        | 93         |   |
| 1.1.2 Government effectiveness* .....                         | 12.7        | 124        | ○ |
| 1.2 Regulatory environment .....                              | 32.9        | 121        |   |
| 1.2.1 Regulatory quality* .....                               | 0.0         | 127        | ○ |
| 1.2.2 Rule of law* .....                                      | 0.0         | 127        | ○ |
| 1.2.3 Cost of redundancy dismissal, salary weeks .....        | 25.3        | 102        |   |
| 1.3 Business environment .....                                | 42.9        | 126        | ○ |
| 1.3.1 Ease of starting a business* .....                      | 49.1        | 127        | ○ |
| 1.3.2 Ease of resolving insolvency* .....                     | 28.5        | 118        |   |
| 1.3.3 Ease of paying taxes* .....                             | 51.2        | 112        |   |
| <b>2 Human capital &amp; research</b> .....                   | <b>28.7</b> | <b>79</b>  |   |
| 2.1 Education .....   | 54.5        | 42         | ● |
| 2.1.1 Expenditure on education, % GDP .....                   | 8.4         | 3          | ● |
| 2.1.2 Gov't expenditure/pupil, secondary, % GDP/cap .....     | 35.1        | 10         | ● |
| 2.1.3 School life expectancy, years <sup>Ⓐ</sup> .....        | 10.3        | 101        |   |
| 2.1.4 PISA scales in reading, maths, & science .....          | n/a         | n/a        |   |
| 2.1.5 Pupil-teacher ratio, secondary <sup>Ⓐ</sup> .....       | 22.5        | 89         |   |
| 2.2 Tertiary education .....                                  | 31.3        | 77         |   |
| 2.2.1 Tertiary enrolment, % gross .....                       | 8.4         | 109        |   |
| 2.2.2 Graduates in science & engineering, % .....             | 29.4        | 9          | ● |
| 2.2.3 Tertiary inbound mobility, % .....                      | 0.5         | 91         |   |
| 2.3 Research & development (R&D) .....                        | 0.3         | 111        |   |
| 2.3.1 Researchers, FTE/mn pop. <sup>Ⓐ</sup> .....             | 89.6        | 86         |   |
| 2.3.2 Gross expenditure on R&D, % GDP .....                   | n/a         | n/a        |   |
| 2.3.3 Global R&D companies, avg. expend. top 3, mn \$US ..... | 0.0         | 43         | ○ |
| 2.3.4 QS university ranking, average score top 3* .....       | 0.0         | 75         | ○ |
| <b>3 Infrastructure</b> .....                                 | <b>15.5</b> | <b>127</b> | ○ |
| 3.1 Information & communication technologies (ICTs) .....     | 26.9        | 111        |   |
| 3.1.1 ICT access* .....                                       | 33.5        | 105        |   |
| 3.1.2 ICT use* .....  | 19.1        | 100        |   |
| 3.1.3 Government's online service* .....                      | 26.1        | 111        |   |
| 3.1.4 E-participation* .....                                  | 28.8        | 107        |   |
| 3.2 General infrastructure .....                              | 13.1        | 125        | ○ |
| 3.2.1 Electricity output, kWh/cap .....                       | 657.2       | 101        |   |
| 3.2.2 Logistics performance* .....                            | 0.9         | 126        | ○ |
| 3.2.3 Gross capital formation, % GDP .....                    | 14.2        | 115        |   |
| 3.3 Ecological sustainability .....                           | 6.4         | 127        | ○ |
| 3.3.1 GDP/unit of energy use .....                            | 2.3         | 117        | ○ |
| 3.3.2 Environmental performance* .....                        | n/a         | n/a        |   |
| 3.3.3 ISO 14001 environmental certificates/bn PPP\$ GDP ..... | 1.0         | 63         |   |
| <b>4 Market sophistication</b> .....                          | <b>37.2</b> | <b>105</b> |   |
| 4.1 Credit .....  | 25.1        | 98         |   |
| 4.1.1 Ease of getting credit* .....                           | 50.0        | 72         |   |
| 4.1.2 Domestic credit to private sector, % GDP .....          | n/a         | n/a        |   |
| 4.1.3 Microfinance gross loans, % GDP .....                   | 0.0         | 69         |   |

|   |      |     |   |
|---|------|-----|---|
| 4.2 Investment .....                                    | 38.1 | 75  |   |
| 4.2.1 Ease of protecting minority investors* .....      | 51.7 | 86  |   |
| 4.2.2 Market capitalization, % GDP .....                | n/a  | n/a |   |
| 4.2.3 Venture capital deals/bn PPP\$ GDP .....          | 0.0  | 36  | ● |
| 4.3 Trade, competition, & market scale .....            | 48.4 | 108 |   |
| 4.3.1 Applied tariff rate, weighted mean, % .....       | 5.4  | 95  |   |
| 4.3.2 Intensity of local competition <sup>†</sup> ..... | 63.6 | 85  |   |
| 4.3.3 Domestic market scale, bn PPP\$ .....             | 28.3 | 110 |   |

**5 Business sophistication**.....**22.8** **114**

|   |      |       |   |
|---|------|-------|---|
| 5.1 Knowledge workers .....   | 23.1 | [104] |   |
| 5.1.1 Knowledge-intensive employment, % <sup>Ⓐ</sup> .....                | 6.1  | 100   |   |
| 5.1.2 Firms offering formal training, % firms <sup>Ⓐ</sup> .....          | 31.2 | 49    |   |
| 5.1.3 GERD performed by business, % of GDP .....                          | n/a  | n/a   |   |
| 5.1.4 GERD financed by business, % .....                                  | n/a  | n/a   |   |
| 5.1.5 Females employed w/advanced degrees, % total .....                  | n/a  | n/a   |   |
| 5.2 Innovation linkages .....   | 20.2 | 106   |   |
| 5.2.1 University/industry research collaboration <sup>†</sup> .....       | 25.0 | 118   |   |
| 5.2.2 State of cluster development <sup>†</sup> .....                     | 28.4 | 122   | ○ |
| 5.2.3 GERD financed by abroad, % .....                                    | n/a  | n/a   |   |
| 5.2.4 JV-strategic alliance deals/bn PPP\$ GDP .....                      | 0.1  | 28    | ● |
| 5.2.5 Patent families 2+ offices/bn PPP\$ GDP <sup>Ⓐ</sup> .....          | 0.1  | 71    |   |
| 5.3 Knowledge absorption .....  | 25.2 | 97    |   |
| 5.3.1 Intellectual property payments, % total trade <sup>Ⓐ</sup> .....    | 0.3  | 71    |   |
| 5.3.2 High-tech imports less re-imports, % total trade <sup>Ⓐ</sup> ..... | 8.4  | 61    | ● |
| 5.3.3 ICT services imports, % total trade <sup>Ⓐ</sup> .....              | 0.2  | 118   |   |
| 5.3.4 FDI net inflows, % GDP .....  | 3.0  | 58    | ● |
| 5.3.5 Research talent, % in business enterprise .....                     | n/a  | n/a   |   |

**6 Knowledge & technology outputs**.....**14.0** **110**

|   |       |     |   |
|---|-------|-----|---|
| 6.1 Knowledge creation .....  | 7.6   | 76  |   |
| 6.1.1 Patents by origin/bn PPP\$ GDP .....                                | 0.3   | 84  |   |
| 6.1.2 PCT patent applications/bn PPP\$ GDP .....                          | 0.1   | 69  |   |
| 6.1.3 Utility models by origin/bn PPP\$ GDP .....                         | n/a   | n/a |   |
| 6.1.4 Scientific & technical articles/bn PPP\$ GDP .....                  | 15.6  | 49  | ● |
| 6.1.5 Citable documents H index .....                                     | 6.5   | 84  |   |
| 6.2 Knowledge impact .....  | 21.1  | 104 |   |
| 6.2.1 Growth rate of PPP\$ GDP/worker, % .....                            | (2.4) | 103 |   |
| 6.2.2 New businesses/th pop. 15–64 .....                                  | n/a   | n/a |   |
| 6.2.3 Computer software spending, % GDP .....                             | 0.4   | 24  | ● |
| 6.2.4 ISO 9001 quality certificates/bn PPP\$ GDP .....                    | 4.6   | 63  | ● |
| 6.2.5 High- & medium-high-tech manufactures, % .....                      | n/a   | n/a |   |
| 6.3 Knowledge diffusion .....   | 13.3  | 120 |   |
| 6.3.1 Intellectual property receipts, % total trade <sup>Ⓐ</sup> .....    | 0.0   | 78  |   |
| 6.3.2 High-tech exports less re-exports, % total trade <sup>Ⓐ</sup> ..... | 0.2   | 98  |   |
| 6.3.3 ICT services exports, % total trade <sup>Ⓐ</sup> .....              | 0.0   | 125 | ○ |
| 6.3.4 FDI net outflows, % GDP .....                                       | 0.3   | 77  |   |

**7 Creative outputs**.....**17.2** **113**

|  |      |      |
|--|------|------|
| 7.1 Intangible assets .....  | 28.2 | 112  |
| 7.1.1 Trademarks by origin/bn PPP\$ GDP .....                      | 10.2 | 103  |
| 7.1.2 Industrial designs by origin/bn PPP\$ GDP .....              | n/a  | n/a  |
| 7.1.3 ICTs & business model creation <sup>†</sup> .....            | 46.6 | 113  |
| 7.1.4 ICTs & organizational model creation <sup>†</sup> .....      | 33.2 | 117  |
| 7.2 Creative goods & services .....                                | 8.4  | [95] |
| 7.2.1 Cultural & creative services exports, % of total trade ..... | n/a  | n/a  |
| 7.2.2 National feature films/mn pop. 15–69 .....                   | n/a  | n/a  |
| 7.2.3 Global ent. & media market/th pop. 15–69 .....               | n/a  | n/a  |
| 7.2.4 Printing & publishing manufactures, % .....                  | n/a  | n/a  |
| 7.2.5 Creative goods exports, % total trade <sup>Ⓐ</sup> .....     | 0.3  | 70   |
| 7.3 Online creativity .....  | 4.1  | 113  |
| 7.3.1 Generic top-level domains (TLDs)/th pop. 15–69 .....         | 0.4  | 109  |
| 7.3.2 Country-code TLDs/th pop. 15–69 .....                        | 0.1  | 114  |
| 7.3.3 Wikipedia edits/mn pop. 15–69 <sup>Ⓐ</sup> .....             | 1.2  | 113  |
| 7.3.4 Video uploads on YouTube/pop. 15–69 .....                    | n/a  | n/a  |

**NOTES:** ● indicates a strength; ○ a weakness; \* an index; † a survey question.

Ⓐ indicates that the country's data are older than the base year; see Appendix II for details, including the year of the data, at <http://globalinnovationindex.org>.

Square brackets indicate that the data minimum coverage (DMC) requirements were not met at the sub-pillar or pillar level; see page 181 of this appendix for details.



# Appendix II

Data Tables





# Data Tables

This appendix provides tables for each of the 81 indicators that make up the Global Innovation Index 2017.

## Structure

Each table is identified by indicator number, with the first digit representing the pillar, the second representing the sub-pillar, and the final digit representing the indicator within that particular sub-pillar. For example, Table 5.1.4 shows results for indicator 5.1.4, GERD financed by business enterprise, which is the fourth indicator of sub-pillar 5.1, knowledge workers, within pillar 5, Business sophistication.

The sub-heading text provides a detailed description of each indicator and includes information on the units of each variable, the scaling factor (if any), the question asked (for survey questions), and the most frequent year for which data were available.

For each indicator for each economy, the most recent value within the period 2007–16 was used (with the exceptions of four indicators, which are further explained in Appendix III). In instances where this base year does not correspond to the most frequent year reported in the sub-heading, the year of the value appears in parentheses after the economy name. These instances are noted in the Country/Economy

Profiles after the indicator name with a clock symbol.

A total of 57 variables are hard data. A total of 19 variables are composite indicators and 5 are survey questions from the World Economic Forum’s Executive Opinion Survey.

value of the specific indicator for that country (in the units specified in the sub-heading), the normalized score in the 0–100 range, and the percentage of economies with scores that fall below the normalized score (i.e., percent ranks). To the far right of each column, a solid circle indicates that an indicator is a strength for the country/economy in question, and a hollow circle indicates that it is a weakness (refer to Appendix I, Country/Economy Profiles, for details).

- Strengths (●) are all ranks of 1, 2, and 3, as well as all scores with percent ranks greater than the 10th highest percent rank among the 81 indicators in a specific economy.
- Weaknesses (○) are all scores with percent ranks lower than the 10th smallest percent rank among the 81 indicators in a specific economy.

For four hard data series (7.3.1, 7.3.2, 7.3.3, and 7.3.4), the raw data were provided under the condition that only the normalized scores be published and therefore the original value equals the normalized score. For indicators 1.3.1, 1.3.2, 1.3.3, 2.3.4, 3.3.2, 4.1.1, and 4.2.1, the range for both measures is the same—(0–100)—and therefore both measures are also identical.

Details on the computation methodology can be found in Appendix IV, Technical Notes.

| 1.1.1 Political stability and absence of violence/terrorism |                     |       |             | Political stability and absence of violence/terrorism index   2015 |      |                              |       |             |            |
|---|---------------------|-------|-------------|--|------|------------------------------|-------|-------------|------------|
| Rank  | Country/Economy     | Score | Scale 0–100 | Percentile   | Rank | Country/Economy              | Score | Scale 0–100 | Percentile |
| 1   | New Zealand         | 1.46  | 100.00      | 1.00   | 81   | Algeria                      | 0.07  | 62.26       | 6.46       |
| 2   | Switzerland         | 1.44  | 99.99       | 1.00   | 80   | Argentina                    | 0.07  | 62.21       | 6.46       |
| 3   | Netherlands         | 1.41  | 99.44       | 1.00   | 81   | Aruba                        | 0.08  | 62.79       | 6.46       |
| 4   | Denmark             | 1.37  | 98.52       | 1.00   | 80   | Canada                       | 0.10  | 64.41       | 5.67       |
| 5   | Canada              | 1.34  | 97.67       | 1.00   | 80   | Andorra                      | 0.10  | 64.26       | 6.46       |
| 6   | Finland             | 1.34  | 97.62       | 1.00   | 80   | Anguilla                     | 0.10  | 64.26       | 6.46       |
| 7   | World (excludes EU) | 1.31  | 96.14       | 1.00   | 71   | Barbados                     | 0.11  | 65.20       | 6.44       |
| 8   | Malta               | 1.29  | 95.61       | 1.00   | 72   | Yemen                        | 0.02  | 58.79       | 6.44       |
| 9   | Ireland             | 1.16  | 91.68       | 1.00   | 73   | Togo                         | 0.11  | 66.61       | 6.43       |
| 10  | Malta               | 1.14  | 89.65       | 1.00   | 74   | South Africa                 | 0.10  | 66.36       | 6.43       |
| 11  | Ireland             | 1.14  | 89.63       | 1.00   | 74   | Yemen                        | 0.02  | 58.79       | 6.44       |
| 12  | Belgium             | 1.10  | 88.00       | 1.00   | 76   | Guatemala                    | 0.10  | 66.36       | 6.43       |
| 13  | Hong Kong (China)   | 0.96  | 87.93       | 1.00   | 77   | Bolivia (Plurinational S.)   | 0.10  | 67.00       | 6.40       |
| 14  | Japan               | 0.96  | 87.54       | 1.00   | 78   | Algeria                      | 0.10  | 66.36       | 6.43       |
| 15  | Japan               | 0.96  | 87.51       | 1.00   | 78   | Morocco                      | 0.14  | 72.69       | 5.39       |
| 16  | China               | 0.96  | 87.51       | 1.00   | 78   | Algeria                      | 0.10  | 66.36       | 6.43       |
| 17  | Canada              | 0.93  | 87.11       | 1.00   | 80   | Madagascar                   | 0.10  | 67.14       | 6.37       |
| 18  | Costa Rica          | 0.90  | 86.12       | 1.00   | 82   | Guatemala                    | 0.10  | 66.36       | 6.43       |
| 19  | United Kingdom      | 0.86  | 84.86       | 1.00   | 84   | Guatemala                    | 0.10  | 66.36       | 6.43       |
| 20  | United Kingdom      | 0.86  | 84.86       | 1.00   | 84   | Guatemala                    | 0.10  | 66.36       | 6.43       |
| 21  | United Kingdom      | 0.86  | 84.86       | 1.00   | 84   | Guatemala                    | 0.10  | 66.36       | 6.43       |
| 22  | Malta               | 0.85  | 84.31       | 1.00   | 86   | Armenia and Nagorno Karabakh | 0.10  | 67.00       | 6.33       |
| 23  | Malta               | 0.85  | 84.31       | 1.00   | 86   | Armenia and Nagorno Karabakh | 0.10  | 67.00       | 6.33       |
| 24  | Armenia             | 0.80  | 82.12       | 1.00   | 88   | Armenia                      | 0.11  | 67.48       | 6.31       |
| 25  | Armenia             | 0.80  | 82.12       | 1.00   | 88   | Armenia                      | 0.11  | 67.48       | 6.31       |
| 26  | Armenia             | 0.80  | 82.12       | 1.00   | 88   | Armenia                      | 0.11  | 67.48       | 6.31       |
| 27  | Armenia             | 0.80  | 82.12       | 1.00   | 88   | Armenia                      | 0.11  | 67.48       | 6.31       |
| 28  | Armenia             | 0.80  | 82.12       | 1.00   | 88   | Armenia                      | 0.11  | 67.48       | 6.31       |
| 29  | Armenia             | 0.80  | 82.12       | 1.00   | 88   | Armenia                      | 0.11  | 67.48       | 6.31       |
| 30  | Armenia             | 0.80  | 82.12       | 1.00   | 88   | Armenia                      | 0.11  | 67.48       | 6.31       |
| 31  | Armenia             | 0.80  | 82.12       | 1.00   | 88   | Armenia                      | 0.11  | 67.48       | 6.31       |
| 32  | Armenia             | 0.80  | 82.12       | 1.00   | 88   | Armenia                      | 0.11  | 67.48       | 6.31       |
| 33  | Armenia             | 0.80  | 82.12       | 1.00   | 88   | Armenia                      | 0.11  | 67.48       | 6.31       |
| 34  | Armenia             | 0.80  | 82.12       | 1.00   | 88   | Armenia                      | 0.11  | 67.48       | 6.31       |
| 35  | Armenia             | 0.80  | 82.12       | 1.00   | 88   | Armenia                      | 0.11  | 67.48       | 6.31       |
| 36  | Armenia             | 0.80  | 82.12       | 1.00   | 88   | Armenia                      | 0.11  | 67.48       | 6.31       |
| 37  | Armenia             | 0.80  | 82.12       | 1.00   | 88   | Armenia                      | 0.11  | 67.48       | 6.31       |
| 38  | Armenia             | 0.80  | 82.12       | 1.00   | 88   | Armenia                      | 0.11  | 67.48       | 6.31       |
| 39  | Armenia             | 0.80  | 82.12       | 1.00   | 88   | Armenia                      | 0.11  | 67.48       | 6.31       |
| 40  | Armenia             | 0.80  | 82.12       | 1.00   | 88   | Armenia                      | 0.11  | 67.48       | 6.31       |
| 41  | Armenia             | 0.80  | 82.12       | 1.00   | 88   | Armenia                      | 0.11  | 67.48       | 6.31       |
| 42  | Armenia             | 0.80  | 82.12       | 1.00   | 88   | Armenia                      | 0.11  | 67.48       | 6.31       |
| 43  | Armenia             | 0.80  | 82.12       | 1.00   | 88   | Armenia                      | 0.11  | 67.48       | 6.31       |
| 44  | Armenia             | 0.80  | 82.12       | 1.00   | 88   | Armenia                      | 0.11  | 67.48       | 6.31       |
| 45  | Armenia             | 0.80  | 82.12       | 1.00   | 88   | Armenia                      | 0.11  | 67.48       | 6.31       |
| 46  | Armenia             | 0.80  | 82.12       | 1.00   | 88   | Armenia                      | 0.11  | 67.48       | 6.31       |
| 47  | Armenia             | 0.80  | 82.12       | 1.00   | 88   | Armenia                      | 0.11  | 67.48       | 6.31       |
| 48  | Armenia             | 0.80  | 82.12       | 1.00   | 88   | Armenia                      | 0.11  | 67.48       | 6.31       |
| 49  | Armenia             | 0.80  | 82.12       | 1.00   | 88   | Armenia                      | 0.11  | 67.48       | 6.31       |
| 50  | Armenia             | 0.80  | 82.12       | 1.00   | 88   | Armenia                      | 0.11  | 67.48       | 6.31       |
| 51  | Armenia             | 0.80  | 82.12       | 1.00   | 88   | Armenia                      | 0.11  | 67.48       | 6.31       |
| 52  | Armenia             | 0.80  | 82.12       | 1.00   | 88   | Armenia                      | 0.11  | 67.48       | 6.31       |
| 53  | Armenia             | 0.80  | 82.12       | 1.00   | 88   | Armenia                      | 0.11  | 67.48       | 6.31       |
| 54  | Armenia             | 0.80  | 82.12       | 1.00   | 88   | Armenia                      | 0.11  | 67.48       | 6.31       |
| 55  | Armenia             | 0.80  | 82.12       | 1.00   | 88   | Armenia                      | 0.11  | 67.48       | 6.31       |
| 56  | Armenia             | 0.80  | 82.12       | 1.00   | 88   | Armenia                      | 0.11  | 67.48       | 6.31       |
| 57  | Armenia             | 0.80  | 82.12       | 1.00   | 88   | Armenia                      | 0.11  | 67.48       | 6.31       |
| 58  | Armenia             | 0.80  | 82.12       | 1.00   | 88   | Armenia                      | 0.11  | 67.48       | 6.31       |
| 59  | Armenia             | 0.80  | 82.12       | 1.00   | 88   | Armenia                      | 0.11  | 67.48       | 6.31       |
| 60  | Armenia             | 0.80  | 82.12       | 1.00   | 88   | Armenia                      | 0.11  | 67.48       | 6.31       |
| 61  | Armenia             | 0.80  | 82.12       | 1.00   | 88   | Armenia                      | 0.11  | 67.48       | 6.31       |
| 62  | Armenia             | 0.80  | 82.12       | 1.00   | 88   | Armenia                      | 0.11  | 67.48       | 6.31       |
| 63  | Armenia             | 0.80  | 82.12       | 1.00   | 88   | Armenia                      | 0.11  | 67.48       | 6.31       |
| 64  | Armenia             | 0.80  | 82.12       | 1.00   | 88   | Armenia                      | 0.11  | 67.48       | 6.31       |
| 65  | Armenia             | 0.80  | 82.12       | 1.00   | 88   | Armenia                      | 0.11  | 67.48       | 6.31       |
| 66  | Armenia             | 0.80  | 82.12       | 1.00   | 88   | Armenia                      | 0.11  | 67.48       | 6.31       |
| 67  | Armenia             | 0.80  | 82.12       | 1.00   | 88   | Armenia                      | 0.11  | 67.48       | 6.31       |
| 68  | Armenia             | 0.80  | 82.12       | 1.00   | 88   | Armenia                      | 0.11  | 67.48       | 6.31       |
| 69  | Armenia             | 0.80  | 82.12       | 1.00   | 88   | Armenia                      | 0.11  | 67.48       | 6.31       |
| 70  | Armenia             | 0.80  | 82.12       | 1.00   | 88   | Armenia                      | 0.11  | 67.48       | 6.31       |
| 71  | Armenia             | 0.80  | 82.12       | 1.00   | 88   | Armenia                      | 0.11  | 67.48       | 6.31       |
| 72  | Armenia             | 0.80  | 82.12       | 1.00   | 88   | Armenia                      | 0.11  | 67.48       | 6.31       |
| 73  | Armenia             | 0.80  | 82.12       | 1.00   | 88   | Armenia                      | 0.11  | 67.48       | 6.31       |
| 74  | Armenia             | 0.80  | 82.12       | 1.00   | 88   | Armenia                      | 0.11  | 67.48       | 6.31       |
| 75  | Armenia             | 0.80  | 82.12       | 1.00   | 88   | Armenia                      | 0.11  | 67.48       | 6.31       |
| 76  | Armenia             | 0.80  | 82.12       | 1.00   | 88   | Armenia                      | 0.11  | 67.48       | 6.31       |
| 77  | Armenia             | 0.80  | 82.12       | 1.00   | 88   | Armenia                      | 0.11  | 67.48       | 6.31       |
| 78  | Armenia             | 0.80  | 82.12       | 1.00   | 88   | Armenia                      | 0.11  | 67.48       | 6.31       |
| 79  | Armenia             | 0.80  | 82.12       | 1.00   | 88   | Armenia                      | 0.11  | 67.48       | 6.31       |
| 80  | Armenia             | 0.80  | 82.12       | 1.00   | 88   | Armenia                      | 0.11  | 67.48       | 6.31       |
| 81  | Armenia             | 0.80  | 82.12       | 1.00   | 88   | Armenia                      | 0.11  | 67.48       | 6.31       |

## Explanation of scores

The tables list the economies by their rank order, with the best performers at the top. After the rank comes the country/economy name, the original



# Index of Data Tables

## 1 Institutions

|  |     |
|--|-----|
| 1.1 Political environment  |     |
| 1.1.1 Political stability and absence of violence/terrorism..... | 319 |
| 1.1.2 Government effectiveness .....                             | 320 |
| 1.2 Regulatory environment                                       |     |
| 1.2.1 Regulatory quality.....                                    | 321 |
| 1.2.2 Rule of law .....  | 322 |
| 1.2.3 Cost of redundancy dismissal .....                         | 323 |
| 1.3 Business environment   |     |
| 1.3.1 Ease of starting a business.....                           | 324 |
| 1.3.2 Ease of resolving insolvency .....                         | 325 |
| 1.3.3 Ease of paying taxes.....                                  | 326 |

## 2 Human capital & research

|   |     |
|---|-----|
| 2.1 Education   |     |
| 2.1.1 Expenditure on education.....                                 | 327 |
| 2.1.2 Government expenditure on education per pupil, secondary..... | 328 |
| 2.1.3 School life expectancy.....                                   | 329 |
| 2.1.4 Assessment in reading, mathematics, and science.....          | 330 |
| 2.1.5 Pupil-teacher ratio, secondary.....                           | 331 |
| 2.2 Tertiary education  |     |
| 2.2.1 Tertiary enrolment.....                                       | 332 |
| 2.2.2 Graduates in science and engineering.....                     | 333 |
| 2.2.3 Tertiary-level inbound mobility.....                          | 334 |
| 2.3 Research & development (R&D)                                    |     |
| 2.3.1 Researchers .....   | 335 |
| 2.3.2 Gross expenditure on R&D (GERD).....                          | 336 |
| 2.3.3 Global R&D companies, average expenditure top 3 .....         | 337 |
| 2.3.4 QS university ranking average score top 3 universities.....   | 338 |

## 3 Infrastructure

|   |     |
|---|-----|
| 3.1 Information & communication technologies (ICTs) |     |
| 3.1.1 ICT access.....                               | 339 |
| 3.1.2 ICT use.....                                  | 340 |
| 3.1.3 Government's online service.....              | 341 |
| 3.1.4 Online e-participation .....                  | 342 |
| 3.2 General infrastructure                          |     |
| 3.2.1 Electricity output.....                       | 343 |
| 3.2.2 Logistics performance.....                    | 344 |
| 3.2.3 Gross capital formation .....                 | 345 |
| 3.3 Ecological sustainability                       |     |
| 3.3.1 GDP per unit of energy use.....               | 346 |
| 3.3.2 Environmental performance.....                | 347 |
| 3.3.3 ISO 14001 environmental certificates.....     | 348 |

## 4 Market sophistication

|   |     |
|---|-----|
| 4.1 Credit  |     |
| 4.1.1 Ease of getting credit.....                           | 349 |
| 4.1.2 Domestic credit to private sector .....               | 350 |
| 4.1.3 Microfinance institutions' gross loan portfolio ..... | 351 |
| 4.2 Investment  |     |
| 4.2.1 Ease of protecting minority investors.....            | 352 |
| 4.2.2 Market capitalization.....                            | 353 |
| 4.2.3 Venture capital deals.....                            | 354 |
| 4.3 Trade, competition, & market scale                      |     |
| 4.3.1 Applied tariff rate, weighted mean.....               | 355 |
| 4.3.2 Intensity of local competition .....                  | 356 |
| 4.3.3 Domestic market scale .....                           | 357 |

## 5 Business sophistication

|   |     |
|---|-----|
| 5.1 Knowledge workers                                 |     |
| 5.1.1 Employment in knowledge-intensive services..... | 358 |
| 5.1.2 Firms offering formal training.....             | 359 |
| 5.1.3 GERD performed by business enterprise.....      | 360 |
| 5.1.4 GERD financed by business enterprise.....       | 361 |
| 5.1.5 Females employed with advanced degrees.....     | 362 |
| 5.2 Innovation linkages                               |     |
| 5.2.1 University/industry research collaboration..... | 363 |
| 5.2.2 State of cluster development.....               | 364 |
| 5.2.3 GERD financed by abroad.....                    | 365 |
| 5.2.4 Joint venture/strategic alliance deals.....     | 366 |
| 5.2.5 Patent families filed in two offices.....       | 367 |
| 5.3 Knowledge absorption                              |     |
| 5.3.1 Intellectual property payments.....             | 368 |
| 5.3.2 High-tech imports.....                          | 369 |
| 5.3.3 ICT services imports.....                       | 370 |
| 5.3.4 Foreign direct investment net inflows.....      | 371 |
| 5.3.5 Research talent in business enterprise.....     | 372 |

## 6 Knowledge & technology outputs

|   |     |
|---|-----|
| 6.1 Knowledge creation                              |     |
| 6.1.1 Patent applications by origin.....            | 373 |
| 6.1.2 PCT international applications by origin..... | 374 |
| 6.1.3 Utility model applications by origin.....     | 375 |
| 6.1.4 Scientific and technical publications.....    | 376 |
| 6.1.5 Citable documents H index.....                | 377 |
| 6.2 Knowledge impact                                |     |
| 6.2.1 Growth rate of GDP per person engaged.....    | 378 |
| 6.2.2 New business density.....                     | 379 |
| 6.2.3 Total computer software spending.....         | 380 |
| 6.2.4 ISO 9001 quality certificates.....            | 381 |
| 6.2.5 High-tech and medium-high-tech output.....    | 382 |
| 6.3 Knowledge diffusion                             |     |
| 6.3.1 Intellectual property receipts.....           | 383 |
| 6.3.2 High-tech exports.....                        | 384 |
| 6.3.3 ICT services exports.....                     | 385 |
| 6.3.4 Foreign direct investment net outflows.....   | 386 |

## 7 Creative outputs

|  |     |
|--|-----|
| 7.1 Intangible assets                                  |     |
| 7.1.1 Trademark application class count by origin..... | 387 |
| 7.1.2 Industrial designs by origin.....                | 388 |
| 7.1.3 ICTs and business model creation.....            | 389 |
| 7.1.4 ICTs and organizational model creation.....      | 390 |
| 7.2 Creative goods & services                          |     |
| 7.2.1 Cultural and creative services exports.....      | 391 |
| 7.2.2 National feature films produced.....             | 392 |
| 7.2.3 Global entertainment and media market.....       | 393 |
| 7.2.4 Printing and publishing output.....              | 394 |
| 7.2.5 Creative goods exports.....                      | 395 |
| 7.3 Online creativity                                  |     |
| 7.3.1 Generic top-level domains (gTLDs).....           | 396 |
| 7.3.2 Country-code top-level domains (ccTLDs).....     | 397 |
| 7.3.3 Wikipedia yearly edits.....                      | 398 |
| 7.3.4 Video uploads on YouTube.....                    | 399 |

| Rank | Country/Economy          | Value | Score (0–100) | Percent rank |   | Rank | Country/Economy            | Value | Score (0–100) | Percent rank |   |
|------|--------------------------|-------|---------------|--------------|---|------|----------------------------|-------|---------------|--------------|---|
| 1    | New Zealand              | 1.49  | 100.00        | 1.00         | ● | 65   | Malawi                     | -0.07 | 62.26         | 0.49         | ● |
| 2    | Luxembourg               | 1.41  | 97.99         | 0.99         | ● | 66   | Argentina                  | -0.07 | 62.25         | 0.48         |   |
| 3    | Switzerland              | 1.31  | 95.64         | 0.98         | ● | 67   | Rwanda                     | -0.08 | 61.79         | 0.48         |   |
| 4    | Iceland                  | 1.27  | 94.58         | 0.98         | ● | 68   | Cambodia                   | -0.10 | 61.46         | 0.47         |   |
| 5    | Canada                   | 1.24  | 93.97         | 0.97         | ● | 69   | Kazakhstan                 | -0.10 | 61.46         | 0.46         |   |
| 6    | Singapore                | 1.24  | 93.85         | 0.96         |   | 70   | Ecuador                    | -0.10 | 61.39         | 0.45         |   |
| 7    | Brunei Darussalam        | 1.21  | 93.14         | 0.95         | ● | 71   | Kuwait                     | -0.11 | 61.20         | 0.44         |   |
| 8    | Austria                  | 1.19  | 92.61         | 0.94         | ● | 72   | Senegal                    | -0.17 | 59.74         | 0.44         |   |
| 9    | Norway                   | 1.15  | 91.68         | 0.94         |   | 73   | Togo                       | -0.17 | 59.61         | 0.43         | ● |
| 10   | Malta                    | 1.04  | 89.06         | 0.93         |   | 74   | South Africa               | -0.18 | 59.58         | 0.42         |   |
| 11   | Finland                  | 1.04  | 89.03         | 0.92         |   | 75   | TFYR of Macedonia          | -0.20 | 59.05         | 0.41         |   |
| 12   | Botswana                 | 1.03  | 88.80         | 0.91         | ● | 76   | Greece                     | -0.23 | 58.34         | 0.40         |   |
| 13   | Hong Kong (China)        | 0.99  | 87.93         | 0.90         |   | 77   | Bolivia, Plurinational St. | -0.28 | 57.00         | 0.40         |   |
| 14   | Uruguay                  | 0.99  | 87.85         | 0.90         | ● | 78   | Armenia                    | -0.29 | 56.76         | 0.39         |   |
| 15   | Japan                    | 0.98  | 87.55         | 0.89         |   | 79   | Morocco                    | -0.34 | 55.69         | 0.38         |   |
| 16   | Qatar                    | 0.98  | 87.54         | 0.88         | ● | 80   | Brazil                     | -0.38 | 54.64         | 0.37         |   |
| 17   | Sweden                   | 0.97  | 87.25         | 0.87         |   | 81   | Moldova, Rep.              | -0.39 | 54.34         | 0.37         |   |
| 18   | Czech Republic           | 0.96  | 87.12         | 0.87         |   | 82   | Georgia                    | -0.40 | 54.21         | 0.36         |   |
| 19   | Slovakia                 | 0.96  | 87.05         | 0.86         | ● | 83   | Madagascar                 | -0.40 | 54.08         | 0.35         |   |
| 20   | Mauritius                | 0.95  | 86.86         | 0.85         | ● | 84   | Guinea                     | -0.45 | 53.03         | 0.34         | ● |
| 21   | Netherlands              | 0.93  | 86.40         | 0.84         |   | 85   | Tanzania, United Rep.      | -0.45 | 52.95         | 0.33         |   |
| 22   | Ireland                  | 0.93  | 86.33         | 0.83         |   | 86   | Bosnia and Herzegovina     | -0.45 | 52.89         | 0.33         |   |
| 23   | Slovenia                 | 0.92  | 86.14         | 0.83         |   | 87   | Peru                       | -0.51 | 51.59         | 0.32         |   |
| 24   | Australia                | 0.90  | 85.72         | 0.82         |   | 88   | Honduras                   | -0.51 | 51.48         | 0.31         |   |
| 25   | Denmark                  | 0.89  | 85.48         | 0.81         |   | 89   | Saudi Arabia               | -0.54 | 50.64         | 0.30         |   |
| 26   | Poland                   | 0.87  | 85.04         | 0.80         |   | 90   | China                      | -0.56 | 50.25         | 0.29         |   |
| 27   | Portugal                 | 0.87  | 85.04         | 0.79         |   | 91   | Jordan                     | -0.58 | 49.87         | 0.29         |   |
| 28   | United Arab Emirates     | 0.76  | 82.16         | 0.79         |   | 92   | Mozambique                 | -0.58 | 49.85         | 0.28         |   |
| 29   | Hungary                  | 0.73  | 81.59         | 0.78         |   | 93   | Zimbabwe                   | -0.58 | 49.84         | 0.27         |   |
| 30   | Germany                  | 0.72  | 81.19         | 0.77         |   | 94   | Indonesia                  | -0.60 | 49.39         | 0.26         |   |
| 31   | United States of America | 0.70  | 80.80         | 0.76         |   | 95   | Guatemala                  | -0.65 | 48.14         | 0.25         |   |
| 32   | Lithuania                | 0.70  | 80.79         | 0.75         |   | 96   | Burkina Faso               | -0.65 | 48.07         | 0.25         |   |
| 33   | Oman                     | 0.69  | 80.69         | 0.75         | ● | 97   | Azerbaijan                 | -0.69 | 47.14         | 0.24         |   |
| 34   | Mongolia                 | 0.65  | 79.59         | 0.74         |   | 98   | Philippines                | -0.84 | 43.51         | 0.23         |   |
| 35   | Namibia                  | 0.65  | 79.56         | 0.73         | ● | 99   | Côte d'Ivoire              | -0.86 | 42.95         | 0.22         |   |
| 36   | Estonia                  | 0.62  | 78.91         | 0.72         |   | 100  | Uganda                     | -0.86 | 42.94         | 0.21         |   |
| 37   | Belgium                  | 0.60  | 78.47         | 0.71         |   | 101  | Tajikistan                 | -0.87 | 42.82         | 0.21         |   |
| 38   | Costa Rica               | 0.58  | 77.88         | 0.71         |   | 102  | Tunisia                    | -0.87 | 42.81         | 0.20         |   |
| 39   | Croatia                  | 0.58  | 77.82         | 0.70         |   | 103  | Kyrgyzstan                 | -0.87 | 42.68         | 0.19         |   |
| 40   | United Kingdom           | 0.56  | 77.35         | 0.69         |   | 104  | Mexico                     | -0.87 | 42.65         | 0.18         | ○ |
| 41   | Cyprus                   | 0.54  | 77.00         | 0.68         |   | 105  | Iran, Islamic Rep.         | -0.91 | 41.89         | 0.17         |   |
| 42   | Latvia                   | 0.45  | 74.80         | 0.67         |   | 106  | India                      | -0.92 | 41.51         | 0.17         |   |
| 43   | Panama                   | 0.41  | 73.85         | 0.67         |   | 107  | Nepal                      | -0.93 | 41.40         | 0.16         |   |
| 44   | Chile                    | 0.40  | 73.57         | 0.66         |   | 108  | Thailand                   | -0.96 | 40.67         | 0.15         | ○ |
| 45   | Albania                  | 0.36  | 72.51         | 0.65         |   | 109  | Niger                      | -0.98 | 40.13         | 0.14         |   |
| 46   | Italy                    | 0.34  | 72.18         | 0.64         |   | 110  | Cameroon                   | -0.99 | 39.81         | 0.13         |   |
| 47   | Spain                    | 0.29  | 70.82         | 0.63         |   | 111  | Algeria                    | -1.05 | 38.46         | 0.13         |   |
| 48   | France                   | 0.27  | 70.47         | 0.63         |   | 112  | Russian Federation         | -1.05 | 38.40         | 0.12         | ○ |
| 49   | Trinidad and Tobago      | 0.27  | 70.42         | 0.62         | ● | 113  | Colombia                   | -1.06 | 38.12         | 0.11         | ○ |
| 50   | Serbia                   | 0.23  | 69.34         | 0.61         |   | 114  | Bahrain                    | -1.08 | 37.70         | 0.10         |   |
| 51   | Romania                  | 0.20  | 68.59         | 0.60         |   | 115  | Israel                     | -1.12 | 36.72         | 0.10         | ○ |
| 52   | Malaysia                 | 0.19  | 68.48         | 0.60         |   | 116  | Bangladesh                 | -1.15 | 35.84         | 0.09         |   |
| 53   | Dominican Republic       | 0.17  | 67.97         | 0.59         | ● | 117  | Turkey                     | -1.28 | 32.90         | 0.08         | ○ |
| 54   | Montenegro               | 0.13  | 66.95         | 0.58         |   | 118  | Kenya                      | -1.29 | 32.53         | 0.07         | ○ |
| 55   | Korea, Rep.              | 0.10  | 66.24         | 0.57         |   | 119  | Egypt                      | -1.34 | 31.27         | 0.06         |   |
| 56   | Jamaica                  | 0.09  | 66.14         | 0.56         |   | 120  | Ethiopia                   | -1.48 | 27.95         | 0.06         |   |
| 57   | Zambia                   | 0.09  | 65.92         | 0.56         | ● | 121  | Mali                       | -1.66 | 23.65         | 0.05         |   |
| 58   | Bulgaria                 | 0.02  | 64.25         | 0.55         |   | 122  | Lebanon                    | -1.72 | 22.14         | 0.04         | ○ |
| 59   | Viet Nam                 | 0.01  | 64.10         | 0.54         |   | 123  | Burundi                    | -1.73 | 21.86         | 0.03         |   |
| 60   | Benin                    | 0.00  | 63.89         | 0.53         |   | 124  | Ukraine                    | -1.93 | 16.96         | 0.02         | ○ |
| 61   | Belarus                  | 0.00  | 63.79         | 0.52         |   | 125  | Nigeria                    | -2.07 | 13.62         | 0.02         | ○ |
| 62   | Paraguay                 | -0.02 | 63.28         | 0.52         |   | 126  | Pakistan                   | -2.54 | 2.14          | 0.01         | ○ |
| 63   | Sri Lanka                | -0.03 | 63.11         | 0.51         |   | 127  | Yemen                      | -2.63 | 0.00          | 0.00         | ○ |
| 64   | El Salvador              | -0.05 | 62.63         | 0.50         |   |      |                            |       |               |              |   |

SOURCE: World Bank, *Worldwide Governance Indicators, 2016 update*

NOTE: ● indicates a strength; ○ a weakness

# 1.1.2 Government effectiveness

## Government effectiveness index | 2015

| Rank | Country/Economy          | Value | Score (0–100) | Percent rank |   | Rank | Country/Economy            | Value | Score (0–100) | Percent rank |   |
|------|--------------------------|-------|---------------|--------------|---|------|----------------------------|-------|---------------|--------------|---|
| 1    | Singapore                | 2.25  | 100.00        | 1.00         | ● | 65   | Philippines                | 0.11  | 44.90         | 0.49         |   |
| 2    | Switzerland              | 2.01  | 93.78         | 0.99         | ● | 66   | India                      | 0.10  | 44.73         | 0.48         |   |
| 3    | Hong Kong (China)        | 1.93  | 91.68         | 0.98         | ● | 67   | Oman                       | 0.09  | 44.55         | 0.48         |   |
| 4    | New Zealand              | 1.89  | 90.70         | 0.98         | ● | 68   | Viet Nam                   | 0.08  | 44.13         | 0.47         |   |
| 5    | Norway                   | 1.86  | 89.98         | 0.97         | ● | 69   | Albania                    | 0.03  | 42.86         | 0.46         |   |
| 6    | Denmark                  | 1.85  | 89.65         | 0.96         | ● | 70   | Sri Lanka                  | 0.01  | 42.37         | 0.45         |   |
| 7    | Netherlands              | 1.84  | 89.46         | 0.95         |   | 71   | Kuwait                     | -0.02 | 41.52         | 0.44         |   |
| 8    | Finland                  | 1.82  | 88.96         | 0.94         |   | 72   | Colombia                   | -0.03 | 41.25         | 0.44         |   |
| 9    | Sweden                   | 1.81  | 88.68         | 0.94         |   | 73   | Romania                    | -0.04 | 41.17         | 0.43         |   |
| 10   | Japan                    | 1.79  | 88.16         | 0.93         |   | 74   | Rwanda                     | -0.04 | 41.14         | 0.42         |   |
| 11   | Canada                   | 1.77  | 87.49         | 0.92         |   | 75   | Kazakhstan                 | -0.05 | 40.79         | 0.41         |   |
| 12   | Germany                  | 1.74  | 86.84         | 0.91         |   | 76   | Morocco                    | -0.06 | 40.60         | 0.40         |   |
| 13   | United Kingdom           | 1.74  | 86.81         | 0.90         |   | 77   | Argentina                  | -0.09 | 39.91         | 0.40         |   |
| 14   | Luxembourg               | 1.72  | 86.45         | 0.90         |   | 78   | Tunisia                    | -0.10 | 39.48         | 0.39         |   |
| 15   | Australia                | 1.56  | 82.18         | 0.89         |   | 79   | Armenia                    | -0.14 | 38.67         | 0.38         |   |
| 16   | United Arab Emirates     | 1.54  | 81.63         | 0.88         |   | 80   | Russian Federation         | -0.18 | 37.46         | 0.37         |   |
| 17   | Ireland                  | 1.54  | 81.62         | 0.87         |   | 81   | Brazil                     | -0.19 | 37.29         | 0.37         |   |
| 18   | Iceland                  | 1.50  | 80.70         | 0.87         |   | 82   | Iran, Islamic Rep.         | -0.20 | 36.97         | 0.36         |   |
| 19   | Austria                  | 1.47  | 80.00         | 0.86         |   | 83   | Indonesia                  | -0.22 | 36.38         | 0.35         |   |
| 20   | United States of America | 1.46  | 79.70         | 0.85         |   | 84   | Azerbaijan                 | -0.23 | 36.16         | 0.34         |   |
| 21   | France                   | 1.44  | 79.22         | 0.84         |   | 85   | El Salvador                | -0.24 | 35.92         | 0.33         |   |
| 22   | Belgium                  | 1.44  | 79.17         | 0.83         |   | 86   | Peru                       | -0.28 | 35.02         | 0.33         |   |
| 23   | Israel                   | 1.38  | 77.47         | 0.83         |   | 87   | Kenya                      | -0.29 | 34.83         | 0.32         |   |
| 24   | Portugal                 | 1.23  | 73.81         | 0.82         |   | 88   | Dominican Republic         | -0.34 | 33.31         | 0.31         |   |
| 25   | Lithuania                | 1.20  | 73.00         | 0.81         |   | 89   | Mongolia                   | -0.40 | 31.78         | 0.30         |   |
| 26   | Spain                    | 1.18  | 72.39         | 0.80         |   | 90   | Senegal                    | -0.44 | 30.97         | 0.29         |   |
| 27   | Latvia                   | 1.10  | 70.35         | 0.79         |   | 91   | Ecuador                    | -0.44 | 30.95         | 0.29         |   |
| 28   | Estonia                  | 1.09  | 70.18         | 0.79         |   | 92   | Lebanon                    | -0.47 | 30.06         | 0.28         |   |
| 29   | Chile                    | 1.08  | 69.94         | 0.78         |   | 93   | Belarus                    | -0.48 | 29.92         | 0.27         |   |
| 30   | Brunei Darussalam        | 1.05  | 69.19         | 0.77         | ● | 94   | Uganda                     | -0.48 | 29.74         | 0.26         |   |
| 31   | Czech Republic           | 1.05  | 69.16         | 0.76         |   | 95   | Algeria                    | -0.51 | 29.15         | 0.25         |   |
| 32   | Cyprus                   | 1.04  | 68.77         | 0.75         |   | 96   | Ukraine                    | -0.51 | 28.95         | 0.25         |   |
| 33   | Mauritius                | 1.04  | 68.76         | 0.75         | ● | 97   | Bosnia and Herzegovina     | -0.54 | 28.17         | 0.24         |   |
| 34   | Korea, Rep.              | 1.03  | 68.51         | 0.74         |   | 98   | Zambia                     | -0.55 | 27.91         | 0.23         |   |
| 35   | Qatar                    | 1.00  | 67.72         | 0.73         |   | 99   | Burkina Faso               | -0.59 | 27.09         | 0.22         |   |
| 36   | Slovenia                 | 0.97  | 67.17         | 0.72         |   | 100  | Tanzania, United Rep.      | -0.60 | 26.77         | 0.21         |   |
| 37   | Malaysia                 | 0.96  | 66.92         | 0.71         |   | 101  | Niger                      | -0.61 | 26.55         | 0.21         |   |
| 38   | Malta                    | 0.85  | 64.01         | 0.71         |   | 102  | Benin                      | -0.62 | 26.28         | 0.20         |   |
| 39   | Slovakia                 | 0.84  | 63.73         | 0.70         |   | 103  | Moldova, Rep.              | -0.63 | 25.94         | 0.19         |   |
| 40   | Poland                   | 0.80  | 62.69         | 0.69         |   | 104  | Ethiopia                   | -0.64 | 25.69         | 0.18         |   |
| 41   | Bahrain                  | 0.57  | 56.89         | 0.68         |   | 105  | Côte d'Ivoire              | -0.65 | 25.43         | 0.17         |   |
| 42   | Uruguay                  | 0.54  | 56.02         | 0.67         |   | 106  | Bolivia, Plurinational St. | -0.66 | 25.26         | 0.17         |   |
| 43   | Botswana                 | 0.51  | 55.33         | 0.67         |   | 107  | Pakistan                   | -0.66 | 25.16         | 0.16         |   |
| 44   | Croatia                  | 0.51  | 55.23         | 0.66         |   | 108  | Malawi                     | -0.67 | 24.81         | 0.15         |   |
| 45   | Hungary                  | 0.49  | 54.78         | 0.65         |   | 109  | Cambodia                   | -0.69 | 24.43         | 0.14         |   |
| 46   | Italy                    | 0.45  | 53.81         | 0.64         |   | 110  | Guatemala                  | -0.71 | 23.82         | 0.13         |   |
| 47   | China                    | 0.42  | 53.05         | 0.63         |   | 111  | Bangladesh                 | -0.73 | 23.45         | 0.13         |   |
| 48   | Georgia                  | 0.40  | 52.46         | 0.63         |   | 112  | Mozambique                 | -0.74 | 23.10         | 0.12         |   |
| 49   | Costa Rica               | 0.38  | 51.88         | 0.62         |   | 113  | Egypt                      | -0.76 | 22.58         | 0.11         |   |
| 50   | Thailand                 | 0.36  | 51.31         | 0.61         |   | 114  | Cameroon                   | -0.76 | 22.54         | 0.10         |   |
| 51   | Panama                   | 0.30  | 49.79         | 0.60         |   | 115  | Honduras                   | -0.82 | 21.12         | 0.10         | ○ |
| 52   | South Africa             | 0.27  | 48.96         | 0.60         |   | 116  | Tajikistan                 | -0.82 | 21.10         | 0.09         |   |
| 53   | Namibia                  | 0.26  | 48.77         | 0.59         |   | 117  | Kyrgyzstan                 | -0.90 | 18.99         | 0.08         |   |
| 54   | Greece                   | 0.25  | 48.55         | 0.58         |   | 118  | Mali                       | -0.91 | 18.74         | 0.07         |   |
| 55   | Jamaica                  | 0.25  | 48.47         | 0.57         |   | 119  | Paraguay                   | -0.95 | 17.87         | 0.06         | ○ |
| 56   | Trinidad and Tobago      | 0.24  | 48.24         | 0.56         | ● | 120  | Nigeria                    | -0.95 | 17.70         | 0.06         |   |
| 57   | Turkey                   | 0.23  | 48.13         | 0.56         |   | 121  | Nepal                      | -1.04 | 15.35         | 0.05         | ○ |
| 58   | Bulgaria                 | 0.22  | 47.70         | 0.55         |   | 122  | Guinea                     | -1.14 | 12.98         | 0.04         |   |
| 59   | Mexico                   | 0.21  | 47.57         | 0.54         |   | 123  | Burundi                    | -1.15 | 12.74         | 0.03         |   |
| 60   | Saudi Arabia             | 0.21  | 47.55         | 0.53         |   | 124  | Zimbabwe                   | -1.15 | 12.66         | 0.02         | ○ |
| 61   | Montenegro               | 0.16  | 46.29         | 0.52         |   | 125  | Togo                       | -1.18 | 11.86         | 0.02         | ○ |
| 62   | Jordan                   | 0.14  | 45.64         | 0.52         |   | 126  | Madagascar                 | -1.29 | 8.96          | 0.01         | ○ |
| 63   | TFYR of Macedonia        | 0.13  | 45.39         | 0.51         |   | 127  | Yemen                      | -1.64 | 0.00          | 0.00         | ○ |
| 64   | Serbia                   | 0.11  | 45.08         | 0.50         |   |      |                            |       |               |              |   |

SOURCE: World Bank, *Worldwide Governance Indicators, 2016 update*

NOTE: ● Indicates a strength; ○ a weakness



# 1.2.1 Regulatory quality

## Regulatory quality index | 2015

| Rank | Country/Economy          | Value | Score (0–100) | Percent rank |   | Rank | Country/Economy            | Value | Score (0–100) | Percent rank |   |
|------|--------------------------|-------|---------------|--------------|---|------|----------------------------|-------|---------------|--------------|---|
| 1    | Singapore                | 2.26  | 100.00        | 1.00         | ● | 65   | Albania                    | 0.20  | 47.20         | 0.49         |   |
| 2    | Hong Kong (China)        | 2.18  | 97.79         | 0.99         | ● | 66   | Trinidad and Tobago        | 0.15  | 45.84         | 0.48         |   |
| 3    | New Zealand              | 1.95  | 91.94         | 0.98         | ● | 67   | Serbia                     | 0.14  | 45.60         | 0.48         |   |
| 4    | United Kingdom           | 1.86  | 89.58         | 0.98         | ● | 68   | Jamaica                    | 0.11  | 44.93         | 0.47         |   |
| 5    | Finland                  | 1.83  | 88.89         | 0.97         | ● | 69   | Jordan                     | 0.05  | 43.34         | 0.46         |   |
| 6    | Ireland                  | 1.81  | 88.51         | 0.96         | ● | 70   | Saudi Arabia               | 0.03  | 42.90         | 0.45         |   |
| 7    | Sweden                   | 1.81  | 88.37         | 0.95         |   | 71   | Kazakhstan                 | -0.03 | 41.48         | 0.44         |   |
| 8    | Australia                | 1.80  | 88.05         | 0.94         |   | 72   | Philippines                | -0.04 | 41.18         | 0.44         |   |
| 9    | Netherlands              | 1.77  | 87.36         | 0.94         |   | 73   | Dominican Republic         | -0.04 | 41.17         | 0.43         |   |
| 10   | Switzerland              | 1.76  | 87.03         | 0.93         |   | 74   | Sri Lanka                  | -0.05 | 40.79         | 0.42         |   |
| 11   | Denmark                  | 1.73  | 86.47         | 0.92         |   | 75   | Moldova, Rep.              | -0.05 | 40.76         | 0.41         |   |
| 12   | Canada                   | 1.71  | 85.75         | 0.91         |   | 76   | Namibia                    | -0.08 | 40.02         | 0.40         |   |
| 13   | Luxembourg               | 1.67  | 84.93         | 0.90         |   | 77   | Kuwait                     | -0.16 | 38.13         | 0.40         |   |
| 14   | Germany                  | 1.67  | 84.71         | 0.90         |   | 78   | Morocco                    | -0.17 | 37.71         | 0.39         |   |
| 15   | Estonia                  | 1.66  | 84.48         | 0.89         |   | 79   | Senegal                    | -0.18 | 37.55         | 0.38         |   |
| 16   | Norway                   | 1.63  | 83.90         | 0.88         |   | 80   | Bosnia and Herzegovina     | -0.18 | 37.50         | 0.37         |   |
| 17   | Austria                  | 1.43  | 78.70         | 0.87         |   | 81   | Guatemala                  | -0.20 | 36.90         | 0.37         |   |
| 18   | Chile                    | 1.35  | 76.72         | 0.87         | ● | 82   | Indonesia                  | -0.21 | 36.74         | 0.36         |   |
| 19   | United States of America | 1.30  | 75.31         | 0.86         |   | 83   | Brazil                     | -0.21 | 36.69         | 0.35         |   |
| 20   | Lithuania                | 1.28  | 74.87         | 0.85         | ● | 84   | Uganda                     | -0.24 | 35.93         | 0.34         |   |
| 21   | Belgium                  | 1.28  | 74.79         | 0.84         |   | 85   | Azerbaijan                 | -0.25 | 35.61         | 0.33         |   |
| 22   | Israel                   | 1.27  | 74.61         | 0.83         |   | 86   | Paraguay                   | -0.27 | 35.29         | 0.33         |   |
| 23   | Iceland                  | 1.27  | 74.57         | 0.83         |   | 87   | China                      | -0.27 | 35.25         | 0.32         |   |
| 24   | Japan                    | 1.18  | 72.23         | 0.82         |   | 88   | Lebanon                    | -0.28 | 35.03         | 0.31         |   |
| 25   | Malta                    | 1.17  | 72.17         | 0.81         |   | 89   | Kenya                      | -0.29 | 34.60         | 0.30         |   |
| 26   | Korea, Rep.              | 1.16  | 71.69         | 0.80         |   | 90   | Mongolia                   | -0.33 | 33.61         | 0.29         |   |
| 27   | France                   | 1.15  | 71.65         | 0.79         |   | 91   | Burkina Faso               | -0.36 | 32.90         | 0.29         |   |
| 28   | United Arab Emirates     | 1.13  | 71.11         | 0.79         |   | 92   | Tanzania, United Rep.      | -0.36 | 32.85         | 0.28         |   |
| 29   | Mauritius                | 1.09  | 69.97         | 0.78         | ● | 93   | India                      | -0.39 | 32.11         | 0.27         |   |
| 30   | Latvia                   | 1.09  | 69.89         | 0.77         |   | 94   | Tunisia                    | -0.39 | 32.03         | 0.26         |   |
| 31   | Czech Republic           | 1.08  | 69.87         | 0.76         |   | 95   | Honduras                   | -0.40 | 31.96         | 0.25         |   |
| 32   | Cyprus                   | 1.06  | 69.25         | 0.75         |   | 96   | Zambia                     | -0.42 | 31.32         | 0.25         |   |
| 33   | Poland                   | 1.00  | 67.63         | 0.75         |   | 97   | Kyrgyzstan                 | -0.47 | 30.20         | 0.24         |   |
| 34   | Portugal                 | 0.94  | 66.17         | 0.74         |   | 98   | Cambodia                   | -0.48 | 29.84         | 0.23         |   |
| 35   | Georgia                  | 0.92  | 65.76         | 0.73         |   | 99   | Mozambique                 | -0.49 | 29.47         | 0.22         |   |
| 36   | Brunei Darussalam        | 0.84  | 63.67         | 0.72         |   | 100  | Viet Nam                   | -0.50 | 29.43         | 0.21         |   |
| 37   | Bahrain                  | 0.83  | 63.30         | 0.71         |   | 101  | Côte d'Ivoire              | -0.52 | 28.94         | 0.21         |   |
| 38   | Slovakia                 | 0.79  | 62.27         | 0.71         |   | 102  | Russian Federation         | -0.52 | 28.76         | 0.20         | ○ |
| 39   | Spain                    | 0.79  | 62.21         | 0.70         |   | 103  | Benin                      | -0.56 | 27.92         | 0.19         |   |
| 40   | Malaysia                 | 0.77  | 61.87         | 0.69         |   | 104  | Mali                       | -0.57 | 27.56         | 0.18         |   |
| 41   | Hungary                  | 0.77  | 61.78         | 0.68         |   | 105  | Ukraine                    | -0.58 | 27.29         | 0.17         |   |
| 42   | Italy                    | 0.73  | 60.79         | 0.67         |   | 106  | Pakistan                   | -0.62 | 26.17         | 0.17         |   |
| 43   | Qatar                    | 0.69  | 59.82         | 0.67         |   | 107  | Burundi                    | -0.71 | 23.98         | 0.16         |   |
| 44   | Slovenia                 | 0.62  | 58.00         | 0.66         |   | 108  | Niger                      | -0.73 | 23.56         | 0.15         |   |
| 45   | Romania                  | 0.59  | 57.23         | 0.65         |   | 109  | Madagascar                 | -0.76 | 22.75         | 0.14         |   |
| 46   | Oman                     | 0.58  | 57.01         | 0.64         |   | 110  | Nepal                      | -0.79 | 22.04         | 0.13         |   |
| 47   | Bulgaria                 | 0.55  | 56.26         | 0.63         |   | 111  | Egypt                      | -0.80 | 21.75         | 0.13         |   |
| 48   | Peru                     | 0.49  | 54.75         | 0.63         |   | 112  | Malawi                     | -0.82 | 21.18         | 0.12         |   |
| 49   | Costa Rica               | 0.49  | 54.73         | 0.62         |   | 113  | Togo                       | -0.82 | 21.14         | 0.11         |   |
| 50   | Botswana                 | 0.49  | 54.53         | 0.61         |   | 114  | Nigeria                    | -0.84 | 20.62         | 0.10         |   |
| 51   | Uruguay                  | 0.45  | 53.69         | 0.60         |   | 115  | Guinea                     | -0.86 | 20.03         | 0.10         |   |
| 52   | Colombia                 | 0.45  | 53.67         | 0.60         |   | 116  | Cameroon                   | -0.91 | 18.96         | 0.09         |   |
| 53   | TFYR of Macedonia        | 0.45  | 53.55         | 0.59         |   | 117  | Bolivia, Plurinational St. | -0.91 | 18.94         | 0.08         |   |
| 54   | Mexico                   | 0.40  | 52.35         | 0.58         |   | 118  | Bangladesh                 | -0.93 | 18.37         | 0.07         |   |
| 55   | Greece                   | 0.40  | 52.28         | 0.57         |   | 119  | Argentina                  | -0.96 | 17.66         | 0.06         | ○ |
| 56   | Panama                   | 0.37  | 51.71         | 0.56         |   | 120  | Belarus                    | -1.00 | 16.49         | 0.06         | ○ |
| 57   | Croatia                  | 0.36  | 51.43         | 0.56         |   | 121  | Ethiopia                   | -1.00 | 16.42         | 0.05         |   |
| 58   | Turkey                   | 0.33  | 50.57         | 0.55         |   | 122  | Tajikistan                 | -1.01 | 16.39         | 0.04         |   |
| 59   | South Africa             | 0.30  | 49.89         | 0.54         |   | 123  | Yemen                      | -1.10 | 13.96         | 0.03         |   |
| 60   | Thailand                 | 0.30  | 49.77         | 0.53         |   | 124  | Ecuador                    | -1.14 | 12.92         | 0.02         | ○ |
| 61   | Armenia                  | 0.25  | 48.49         | 0.52         |   | 125  | Algeria                    | -1.17 | 12.20         | 0.02         | ○ |
| 62   | Rwanda                   | 0.25  | 48.48         | 0.52         |   | 126  | Iran, Islamic Rep.         | -1.28 | 9.37          | 0.01         | ○ |
| 63   | Montenegro               | 0.23  | 47.88         | 0.51         |   | 127  | Zimbabwe                   | -1.65 | 0.00          | 0.00         | ○ |
| 64   | El Salvador              | 0.20  | 47.23         | 0.50         |   |      |                            |       |               |              |   |

SOURCE: World Bank, *Worldwide Governance Indicators, 2016 update*

NOTE: ● indicates a strength; ○ a weakness

# 1.2.2 Rule of law

## Rule of law index | 2015

| Rank | Country/Economy          | Value | Score (0–100) | Percent rank |   | Rank | Country/Economy            | Value | Score (0–100) | Percent rank |   |
|------|--------------------------|-------|---------------|--------------|---|------|----------------------------|-------|---------------|--------------|---|
| 1    | Finland                  | 2.07  | 100.00        | 1.00         | ● | 65   | Thailand                   | -0.11 | 36.32         | 0.49         |   |
| 2    | Sweden                   | 2.04  | 99.15         | 0.99         | ● | 66   | Panama                     | -0.12 | 35.95         | 0.48         |   |
| 3    | Denmark                  | 2.04  | 99.05         | 0.98         | ● | 67   | Bulgaria                   | -0.12 | 35.80         | 0.48         |   |
| 4    | Norway                   | 2.02  | 98.51         | 0.98         | ● | 68   | Trinidad and Tobago        | -0.14 | 35.22         | 0.47         |   |
| 5    | New Zealand              | 2.02  | 98.46         | 0.97         | ● | 69   | Senegal                    | -0.15 | 34.97         | 0.46         |   |
| 6    | Switzerland              | 1.97  | 96.87         | 0.96         |   | 70   | TFYR of Macedonia          | -0.17 | 34.35         | 0.45         |   |
| 7    | Netherlands              | 1.93  | 95.94         | 0.95         |   | 71   | Brazil                     | -0.19 | 33.78         | 0.44         |   |
| 8    | Singapore                | 1.88  | 94.39         | 0.94         |   | 72   | Jamaica                    | -0.23 | 32.55         | 0.44         |   |
| 9    | Luxembourg               | 1.86  | 93.89         | 0.94         |   | 73   | Zambia                     | -0.25 | 32.03         | 0.43         |   |
| 10   | Austria                  | 1.85  | 93.47         | 0.93         | ● | 74   | Viet Nam                   | -0.27 | 31.57         | 0.42         |   |
| 11   | Canada                   | 1.84  | 93.05         | 0.92         |   | 75   | Bosnia and Herzegovina     | -0.29 | 30.91         | 0.41         |   |
| 12   | Hong Kong (China)        | 1.83  | 92.95         | 0.91         |   | 76   | Colombia                   | -0.31 | 30.44         | 0.40         |   |
| 13   | Australia                | 1.82  | 92.71         | 0.90         |   | 77   | Malawi                     | -0.33 | 29.70         | 0.40         |   |
| 14   | United Kingdom           | 1.81  | 92.16         | 0.90         |   | 78   | China                      | -0.34 | 29.57         | 0.39         |   |
| 15   | Ireland                  | 1.79  | 91.65         | 0.89         |   | 79   | Uganda                     | -0.34 | 29.46         | 0.38         |   |
| 16   | Germany                  | 1.78  | 91.49         | 0.88         |   | 80   | Armenia                    | -0.34 | 29.39         | 0.37         |   |
| 17   | Iceland                  | 1.67  | 88.35         | 0.87         |   | 81   | Philippines                | -0.35 | 29.33         | 0.37         |   |
| 18   | United States of America | 1.60  | 86.27         | 0.87         |   | 82   | Albania                    | -0.36 | 28.92         | 0.36         |   |
| 19   | Japan                    | 1.51  | 83.58         | 0.86         |   | 83   | Kazakhstan                 | -0.37 | 28.67         | 0.35         |   |
| 20   | Belgium                  | 1.42  | 80.94         | 0.85         |   | 84   | Mongolia                   | -0.39 | 28.01         | 0.34         |   |
| 21   | France                   | 1.41  | 80.51         | 0.84         |   | 85   | Moldova, Rep.              | -0.40 | 27.67         | 0.33         |   |
| 22   | Chile                    | 1.33  | 78.36         | 0.83         | ● | 86   | Indonesia                  | -0.41 | 27.36         | 0.33         |   |
| 23   | Estonia                  | 1.33  | 78.23         | 0.83         |   | 87   | Tanzania, United Rep.      | -0.43 | 26.99         | 0.32         |   |
| 24   | Israel                   | 1.17  | 73.55         | 0.82         |   | 88   | Ethiopia                   | -0.44 | 26.70         | 0.31         |   |
| 25   | Malta                    | 1.15  | 73.12         | 0.81         |   | 89   | Dominican Republic         | -0.46 | 26.08         | 0.30         |   |
| 26   | Portugal                 | 1.14  | 72.84         | 0.80         |   | 90   | Mexico                     | -0.47 | 25.69         | 0.29         |   |
| 27   | Czech Republic           | 1.12  | 72.24         | 0.79         |   | 91   | Kenya                      | -0.49 | 25.09         | 0.29         |   |
| 28   | Cyprus                   | 1.01  | 68.98         | 0.79         |   | 92   | Egypt                      | -0.50 | 24.72         | 0.28         |   |
| 29   | Lithuania                | 0.98  | 68.18         | 0.78         |   | 93   | Peru                       | -0.53 | 23.90         | 0.27         |   |
| 30   | Korea, Rep.              | 0.95  | 67.31         | 0.77         |   | 94   | Burkina Faso               | -0.53 | 23.86         | 0.26         |   |
| 31   | Slovenia                 | 0.95  | 67.28         | 0.76         |   | 95   | Benin                      | -0.58 | 22.43         | 0.25         |   |
| 32   | Spain                    | 0.90  | 65.62         | 0.75         |   | 96   | El Salvador                | -0.59 | 22.12         | 0.25         |   |
| 33   | Qatar                    | 0.88  | 65.26         | 0.75         |   | 97   | Azerbaijan                 | -0.60 | 21.80         | 0.24         |   |
| 34   | Mauritius                | 0.85  | 64.37         | 0.74         |   | 98   | Niger                      | -0.61 | 21.70         | 0.23         |   |
| 35   | Poland                   | 0.80  | 62.69         | 0.73         |   | 99   | Côte d'Ivoire              | -0.62 | 21.34         | 0.22         |   |
| 36   | Latvia                   | 0.79  | 62.38         | 0.72         |   | 100  | Madagascar                 | -0.69 | 19.13         | 0.21         |   |
| 37   | United Arab Emirates     | 0.71  | 60.10         | 0.71         |   | 101  | Paraguay                   | -0.69 | 19.11         | 0.21         |   |
| 38   | Uruguay                  | 0.68  | 59.15         | 0.71         | ● | 102  | Bangladesh                 | -0.70 | 18.96         | 0.20         |   |
| 39   | Botswana                 | 0.63  | 57.90         | 0.70         |   | 103  | Nepal                      | -0.70 | 18.93         | 0.19         |   |
| 40   | Malaysia                 | 0.57  | 56.20         | 0.69         |   | 104  | Russian Federation         | -0.72 | 18.39         | 0.18         |   |
| 41   | Slovakia                 | 0.48  | 53.55         | 0.68         |   | 105  | Mali                       | -0.76 | 17.33         | 0.17         |   |
| 42   | Costa Rica               | 0.48  | 53.41         | 0.67         |   | 106  | Lebanon                    | -0.79 | 16.45         | 0.17         |   |
| 43   | Oman                     | 0.46  | 52.93         | 0.67         |   | 107  | Belarus                    | -0.79 | 16.43         | 0.16         | ○ |
| 44   | Jordan                   | 0.46  | 52.92         | 0.66         |   | 108  | Pakistan                   | -0.79 | 16.38         | 0.15         |   |
| 45   | Bahrain                  | 0.46  | 52.87         | 0.65         |   | 109  | Togo                       | -0.80 | 16.05         | 0.14         |   |
| 46   | Brunei Darussalam        | 0.44  | 52.38         | 0.64         |   | 110  | Ukraine                    | -0.80 | 16.01         | 0.13         |   |
| 47   | Hungary                  | 0.40  | 51.22         | 0.63         |   | 111  | Argentina                  | -0.80 | 15.93         | 0.13         |   |
| 48   | Georgia                  | 0.30  | 48.08         | 0.63         |   | 112  | Algeria                    | -0.83 | 15.13         | 0.12         |   |
| 49   | Saudi Arabia             | 0.25  | 46.84         | 0.62         |   | 113  | Mozambique                 | -0.87 | 14.10         | 0.11         |   |
| 50   | Italy                    | 0.25  | 46.77         | 0.61         |   | 114  | Cambodia                   | -0.92 | 12.53         | 0.10         |   |
| 51   | Greece                   | 0.24  | 46.50         | 0.60         |   | 115  | Honduras                   | -0.95 | 11.63         | 0.10         | ○ |
| 52   | Croatia                  | 0.20  | 45.33         | 0.60         |   | 116  | Iran, Islamic Rep.         | -0.95 | 11.54         | 0.09         |   |
| 53   | Namibia                  | 0.19  | 44.95         | 0.59         |   | 117  | Cameroon                   | -0.96 | 11.34         | 0.08         |   |
| 54   | Romania                  | 0.15  | 43.90         | 0.58         |   | 118  | Guatemala                  | -0.99 | 10.59         | 0.07         |   |
| 55   | Rwanda                   | 0.07  | 41.51         | 0.57         |   | 119  | Kyrgyzstan                 | -1.00 | 10.26         | 0.06         | ○ |
| 56   | Sri Lanka                | 0.07  | 41.42         | 0.56         |   | 120  | Tajikistan                 | -1.01 | 9.92          | 0.06         |   |
| 57   | South Africa             | 0.06  | 41.05         | 0.56         |   | 121  | Ecuador                    | -1.03 | 9.36          | 0.05         | ○ |
| 58   | Kuwait                   | 0.03  | 40.44         | 0.55         |   | 122  | Nigeria                    | -1.04 | 8.89          | 0.04         | ○ |
| 59   | Montenegro               | 0.03  | 40.37         | 0.54         |   | 123  | Burundi                    | -1.12 | 6.65          | 0.03         |   |
| 60   | Tunisia                  | -0.05 | 37.88         | 0.53         |   | 124  | Bolivia, Plurinational St. | -1.15 | 5.76          | 0.02         | ○ |
| 61   | India                    | -0.06 | 37.76         | 0.52         |   | 125  | Guinea                     | -1.17 | 5.16          | 0.02         | ○ |
| 62   | Turkey                   | -0.06 | 37.66         | 0.52         |   | 126  | Yemen                      | -1.24 | 3.25          | 0.01         |   |
| 63   | Morocco                  | -0.08 | 37.17         | 0.51         |   | 127  | Zimbabwe                   | -1.35 | 0.00          | 0.00         | ○ |
| 64   | Serbia                   | -0.09 | 36.64         | 0.50         |   |      |                            |       |               |              |   |

SOURCE: World Bank, *Worldwide Governance Indicators, 2016 update*

NOTE: ● Indicates a strength; ○ a weakness

# 1.2.3

## Cost of redundancy dismissal

Sum of notice period and severance pay for redundancy dismissal (in salary weeks, averages for workers with 1, 5, and 10 years of tenure, with a minimum threshold of 8 weeks) | 2016

| Rank | Country/Economy          | Value | Score (0–100) | Percent rank |   | Rank | Country/Economy                   | Value | Score (0–100) | Percent rank |   |
|------|--------------------------|-------|---------------|--------------|---|------|-----------------------------------|-------|---------------|--------------|---|
| 1    | Austria                  | 8.00  | 100.00        | 0.86         | ● | 65   | Netherlands                       | 15.85 | 84.46         | 0.49         | ○ |
| 1    | Bahrain                  | 8.00  | 100.00        | 0.86         | ● | 66   | Greece                            | 15.89 | 84.38         | 0.48         |   |
| 1    | Brunei Darussalam        | 8.00  | 100.00        | 0.86         | ● | 67   | Burundi                           | 15.89 | 84.38         | 0.48         |   |
| 1    | Cyprus                   | 8.00  | 100.00        | 0.86         | ● | 68   | Colombia                          | 16.67 | 82.84         | 0.47         |   |
| 1    | Denmark                  | 8.00  | 100.00        | 0.86         | ● | 69   | Malawi                            | 16.67 | 82.84         | 0.46         |   |
| 1    | Hong Kong (China)        | 8.00  | 100.00        | 0.86         | ● | 70   | Portugal                          | 17.00 | 82.18         | 0.45         | ○ |
| 1    | Italy                    | 8.00  | 100.00        | 0.86         | ● | 71   | Algeria                           | 17.33 | 81.52         | 0.44         |   |
| 1    | Japan                    | 8.00  | 100.00        | 0.86         | ● | 71   | Kyrgyzstan                        | 17.33 | 81.52         | 0.44         |   |
| 1    | Jordan                   | 8.00  | 100.00        | 0.86         | ● | 73   | Russian Federation                | 17.33 | 81.52         | 0.43         |   |
| 1    | Kenya                    | 8.00  | 100.00        | 0.86         | ● | 74   | Spain                             | 17.38 | 81.42         | 0.42         | ○ |
| 1    | Malta                    | 8.00  | 100.00        | 0.86         | ● | 75   | Panama                            | 18.13 | 79.93         | 0.41         |   |
| 1    | New Zealand              | 8.00  | 100.00        | 0.86         | ● | 76   | Costa Rica                        | 18.70 | 78.81         | 0.40         |   |
| 1    | Nigeria                  | 8.00  | 100.00        | 0.86         | ● | 77   | Slovakia                          | 18.78 | 78.66         | 0.40         |   |
| 1    | Oman (2015)              | 8.00  | 100.00        | 0.86         | ● | 78   | Poland                            | 18.78 | 78.66         | 0.39         |   |
| 1    | Romania                  | 8.00  | 100.00        | 0.86         | ● | 79   | Ethiopia                          | 19.14 | 77.93         | 0.38         |   |
| 1    | Serbia                   | 8.00  | 100.00        | 0.86         | ● | 80   | Cambodia                          | 19.37 | 77.49         | 0.37         |   |
| 1    | Singapore                | 8.00  | 100.00        | 0.86         | ● | 81   | Belgium                           | 19.67 | 76.90         | 0.37         | ○ |
| 1    | United Arab Emirates     | 8.00  | 100.00        | 0.86         | ● | 82   | Cameroon                          | 19.86 | 76.51         | 0.36         |   |
| 1    | United States of America | 8.00  | 100.00        | 0.86         | ● | 83   | Czech Republic                    | 20.22 | 75.80         | 0.35         | ○ |
| 20   | Bulgaria                 | 8.62  | 98.77         | 0.84         | ● | 84   | Trinidad and Tobago               | 20.51 | 75.22         | 0.34         |   |
| 20   | Georgia                  | 8.62  | 98.77         | 0.84         | ● | 85   | Morocco                           | 20.69 | 74.87         | 0.33         |   |
| 22   | Kazakhstan               | 8.67  | 98.68         | 0.81         | ● | 86   | Uruguay                           | 20.80 | 74.65         | 0.33         |   |
| 22   | Mongolia                 | 8.67  | 98.68         | 0.81         | ● | 87   | Albania                           | 20.83 | 74.60         | 0.32         |   |
| 22   | Norway                   | 8.67  | 98.68         | 0.81         | ● | 88   | Germany                           | 21.56 | 73.16         | 0.31         | ○ |
| 22   | Uganda                   | 8.67  | 98.68         | 0.81         | ● | 89   | Tunisia                           | 21.57 | 73.13         | 0.30         |   |
| 26   | Bosnia and Herzegovina   | 9.22  | 97.58         | 0.80         | ● | 90   | Azerbaijan                        | 21.67 | 72.94         | 0.29         |   |
| 27   | South Africa             | 9.33  | 97.36         | 0.78         | ● | 90   | Belarus                           | 21.67 | 72.94         | 0.29         |   |
| 27   | Tanzania, United Rep.    | 9.33  | 97.36         | 0.78         | ● | 92   | Luxembourg                        | 21.67 | 72.94         | 0.28         | ○ |
| 27   | United Kingdom           | 9.33  | 97.36         | 0.78         | ● | 93   | Botswana                          | 21.69 | 72.89         | 0.27         |   |
| 30   | Namibia                  | 9.67  | 96.70         | 0.77         | ● | 94   | Mexico                            | 22.00 | 72.28         | 0.26         |   |
| 31   | Canada                   | 10.00 | 96.04         | 0.76         |   | 95   | Moldova, Rep.                     | 22.60 | 71.09         | 0.25         |   |
| 32   | Guinea                   | 10.06 | 95.91         | 0.75         | ● | 96   | El Salvador                       | 22.86 | 70.58         | 0.25         |   |
| 33   | Finland                  | 10.11 | 95.82         | 0.74         |   | 97   | Iran, Islamic Rep.                | 23.11 | 70.08         | 0.24         |   |
| 33   | Switzerland              | 10.11 | 95.82         | 0.74         |   | 98   | Qatar                             | 23.22 | 69.86         | 0.23         |   |
| 35   | Burkina Faso             | 10.47 | 95.10         | 0.73         | ● | 99   | Saudi Arabia                      | 23.74 | 68.84         | 0.22         |   |
| 36   | Mauritius                | 10.62 | 94.81         | 0.72         |   | 100  | Lithuania                         | 24.56 | 67.22         | 0.21         | ○ |
| 37   | Slovenia                 | 10.68 | 94.70         | 0.71         |   | 101  | Viet Nam                          | 24.56 | 67.22         | 0.21         |   |
| 38   | Armenia                  | 11.00 | 94.06         | 0.71         |   | 102  | Zimbabwe                          | 25.28 | 65.79         | 0.20         |   |
| 39   | Montenegro               | 11.22 | 93.63         | 0.70         |   | 103  | Dominican Republic                | 26.18 | 64.00         | 0.19         |   |
| 40   | Peru                     | 11.43 | 93.21         | 0.69         | ● | 104  | Guatemala                         | 26.96 | 62.45         | 0.18         |   |
| 41   | Benin                    | 11.63 | 92.82         | 0.68         | ● | 105  | Nepal                             | 27.19 | 62.00         | 0.17         |   |
| 42   | France                   | 11.84 | 92.39         | 0.67         |   | 105  | Pakistan                          | 27.19 | 62.00         | 0.17         |   |
| 43   | Australia                | 12.00 | 92.08         | 0.67         |   | 107  | Chile                             | 27.40 | 61.59         | 0.14         | ○ |
| 44   | Estonia                  | 12.90 | 90.29         | 0.66         |   | 107  | China                             | 27.40 | 61.59         | 0.14         | ○ |
| 45   | Rwanda                   | 12.95 | 90.19         | 0.65         |   | 107  | Korea, Rep.                       | 27.40 | 61.59         | 0.14         | ○ |
| 46   | Iceland                  | 13.00 | 90.10         | 0.64         |   | 110  | Yemen                             | 27.40 | 61.59         | 0.13         |   |
| 47   | Latvia                   | 13.00 | 90.10         | 0.62         |   | 111  | Israel                            | 27.44 | 61.50         | 0.12         | ○ |
| 47   | TFYR of Macedonia        | 13.00 | 90.10         | 0.62         |   | 111  | Philippines                       | 27.44 | 61.50         | 0.12         | ○ |
| 47   | Ukraine                  | 13.00 | 90.10         | 0.62         |   | 113  | Kuwait                            | 28.12 | 60.16         | 0.11         | ○ |
| 50   | Côte d'Ivoire            | 13.07 | 89.96         | 0.61         | ● | 114  | Paraguay                          | 29.40 | 57.61         | 0.10         |   |
| 51   | Togo                     | 13.14 | 89.81         | 0.60         | ● | 115  | Malaysia                          | 29.44 | 57.54         | 0.10         | ○ |
| 52   | Hungary                  | 13.41 | 89.28         | 0.60         |   | 116  | Turkey                            | 29.78 | 56.88         | 0.09         | ○ |
| 53   | Mali                     | 13.65 | 88.81         | 0.59         | ● | 117  | Argentina                         | 30.33 | 55.78         | 0.07         | ○ |
| 54   | Jamaica                  | 14.00 | 88.12         | 0.58         |   | 117  | Honduras                          | 30.33 | 55.78         | 0.07         | ○ |
| 55   | Niger                    | 14.01 | 88.10         | 0.57         |   | 119  | Bangladesh                        | 31.00 | 54.46         | 0.06         |   |
| 56   | Ireland                  | 14.33 | 87.46         | 0.56         | ○ | 120  | Ecuador                           | 31.78 | 52.92         | 0.06         |   |
| 57   | Sweden                   | 14.44 | 87.24         | 0.56         | ○ | 121  | Thailand                          | 36.00 | 44.55         | 0.05         | ○ |
| 58   | Madagascar               | 14.67 | 86.80         | 0.55         | ● | 122  | Egypt                             | 36.83 | 42.90         | 0.04         | ○ |
| 59   | Senegal                  | 14.81 | 86.52         | 0.54         |   | 123  | Mozambique                        | 37.51 | 41.57         | 0.03         | ○ |
| 60   | Croatia                  | 15.11 | 85.92         | 0.52         |   | 124  | Zambia                            | 50.56 | 15.73         | 0.02         | ○ |
| 60   | Lebanon                  | 15.11 | 85.92         | 0.52         |   | 125  | Indonesia                         | 57.78 | 1.43          | 0.02         | ○ |
| 62   | Brazil                   | 15.45 | 85.26         | 0.52         |   | 126  | Bolivia, Plurinational St. (2014) | 82.33 | 0.00          | 0.00         | ○ |
| 63   | Tajikistan               | 15.53 | 85.09         | 0.51         | ● | 126  | Sri Lanka                         | 58.50 | 0.00          | 0.00         | ○ |
| 64   | India                    | 15.76 | 84.63         | 0.50         |   |      |                                   |       |               |              |   |

SOURCE: World Bank, *Ease of Doing Business Index 2017: Equal Opportunity for All*  
 NOTE: ● indicates a strength; ○ a weakness

# 1.3.1 Ease of starting a business

## Ease of starting a business (distance to frontier) | 2016

| Rank | Country/Economy          | Value | Score (0–100) | Percent rank |   | Rank | Country/Economy            | Value | Score (0–100) | Percent rank |   |
|------|--------------------------|-------|---------------|--------------|---|------|----------------------------|-------|---------------|--------------|---|
| 1    | New Zealand              | 99.96 | 99.96         | 1.00         | ● | 65   | Turkey                     | 86.98 | 86.98         | 0.49         |   |
| 2    | Canada                   | 98.23 | 98.23         | 0.99         | ● | 66   | Czech Republic             | 86.86 | 86.86         | 0.48         |   |
| 3    | Hong Kong (China)        | 98.20 | 98.20         | 0.98         | ● | 67   | Bulgaria                   | 86.82 | 86.82         | 0.48         |   |
| 4    | TFYR of Macedonia        | 98.14 | 98.14         | 0.98         | ● | 68   | Brunei Darussalam          | 86.72 | 86.72         | 0.47         |   |
| 5    | Azerbaijan               | 97.74 | 97.74         | 0.97         | ● | 69   | Spain                      | 86.61 | 86.61         | 0.45         | ○ |
| 6    | Singapore                | 96.49 | 96.49         | 0.96         |   | 69   | Tajikistan                 | 86.61 | 86.61         | 0.45         |   |
| 7    | Australia                | 96.47 | 96.47         | 0.95         | ● | 71   | Niger                      | 86.16 | 86.16         | 0.44         |   |
| 8    | Georgia                  | 96.13 | 96.13         | 0.94         | ● | 72   | Japan                      | 86.09 | 86.09         | 0.44         |   |
| 9    | Armenia                  | 96.07 | 96.07         | 0.94         | ● | 73   | Senegal                    | 86.07 | 86.07         | 0.43         |   |
| 10   | Ireland                  | 95.91 | 95.91         | 0.93         |   | 74   | Qatar                      | 86.06 | 86.06         | 0.42         |   |
| 11   | Korea, Rep.              | 95.83 | 95.83         | 0.92         |   | 75   | Mexico                     | 85.74 | 85.74         | 0.41         |   |
| 12   | Jamaica                  | 95.61 | 95.61         | 0.91         | ● | 76   | Croatia                    | 85.56 | 85.56         | 0.40         |   |
| 13   | Estonia                  | 95.13 | 95.13         | 0.90         |   | 77   | Iran, Islamic Rep.         | 85.06 | 85.06         | 0.40         |   |
| 14   | Sweden                   | 94.64 | 94.64         | 0.90         |   | 78   | Peru                       | 85.01 | 85.01         | 0.38         |   |
| 15   | United Kingdom           | 94.58 | 94.58         | 0.89         |   | 78   | Tunisia                    | 85.01 | 85.01         | 0.38         |   |
| 16   | Belgium                  | 94.49 | 94.49         | 0.88         |   | 80   | Zambia                     | 84.95 | 84.95         | 0.37         |   |
| 17   | Burundi                  | 94.45 | 94.45         | 0.87         | ● | 81   | Jordan                     | 84.62 | 84.62         | 0.37         |   |
| 18   | Ukraine                  | 94.40 | 94.40         | 0.87         | ● | 82   | Poland                     | 84.22 | 84.22         | 0.36         | ○ |
| 19   | Norway                   | 94.30 | 94.30         | 0.86         |   | 83   | Mali                       | 84.12 | 84.12         | 0.35         |   |
| 20   | Latvia                   | 94.15 | 94.15         | 0.84         |   | 84   | Nepal                      | 83.77 | 83.77         | 0.34         |   |
| 20   | Netherlands              | 94.15 | 94.15         | 0.84         |   | 85   | Austria                    | 83.72 | 83.72         | 0.33         | ○ |
| 22   | Denmark                  | 94.07 | 94.07         | 0.83         |   | 86   | Malaysia                   | 83.67 | 83.67         | 0.33         |   |
| 23   | Russian Federation       | 93.57 | 93.57         | 0.83         |   | 87   | Madagascar                 | 83.48 | 83.48         | 0.32         |   |
| 24   | France                   | 93.27 | 93.27         | 0.82         |   | 88   | Germany                    | 83.42 | 83.42         | 0.31         | ○ |
| 25   | Finland                  | 93.13 | 93.13         | 0.81         |   | 89   | Dominican Republic         | 83.34 | 83.34         | 0.30         |   |
| 26   | Lithuania                | 92.99 | 92.99         | 0.80         |   | 90   | Kenya                      | 83.13 | 83.13         | 0.29         |   |
| 27   | Kyrgyzstan               | 92.95 | 92.95         | 0.79         | ● | 91   | Guatemala                  | 82.31 | 82.31         | 0.29         |   |
| 28   | Belarus                  | 92.91 | 92.91         | 0.79         | ● | 92   | Viet Nam                   | 81.76 | 81.76         | 0.28         |   |
| 29   | Oman                     | 92.85 | 92.85         | 0.77         | ● | 93   | Bangladesh                 | 81.74 | 81.74         | 0.27         |   |
| 29   | Portugal                 | 92.85 | 92.85         | 0.77         |   | 94   | Togo                       | 81.71 | 81.71         | 0.26         |   |
| 31   | Iceland                  | 92.64 | 92.64         | 0.76         |   | 95   | Costa Rica                 | 81.57 | 81.57         | 0.25         |   |
| 32   | Mongolia                 | 92.55 | 92.55         | 0.75         |   | 96   | China                      | 81.02 | 81.02         | 0.25         |   |
| 33   | Egypt                    | 92.43 | 92.43         | 0.75         | ● | 97   | El Salvador                | 80.70 | 80.70         | 0.24         |   |
| 34   | Morocco                  | 92.34 | 92.34         | 0.74         | ● | 98   | South Africa               | 80.47 | 80.47         | 0.23         | ○ |
| 35   | Israel                   | 92.28 | 92.28         | 0.73         |   | 99   | Malta                      | 80.21 | 80.21         | 0.22         | ○ |
| 36   | Panama                   | 92.01 | 92.01         | 0.72         |   | 100  | Guinea                     | 80.20 | 80.20         | 0.21         |   |
| 37   | Moldova, Rep.            | 91.96 | 91.96         | 0.71         |   | 101  | Mozambique                 | 79.86 | 79.86         | 0.21         |   |
| 38   | Kazakhstan               | 91.94 | 91.94         | 0.71         |   | 102  | Tanzania, United Rep.      | 79.14 | 79.14         | 0.20         |   |
| 39   | Albania                  | 91.73 | 91.73         | 0.70         | ● | 103  | Nigeria                    | 78.62 | 78.62         | 0.19         |   |
| 40   | Serbia                   | 91.67 | 91.67         | 0.69         |   | 104  | Lebanon                    | 78.45 | 78.45         | 0.18         |   |
| 41   | Mauritius                | 91.65 | 91.65         | 0.68         |   | 105  | Pakistan                   | 77.88 | 77.88         | 0.17         |   |
| 42   | Slovenia                 | 91.42 | 91.42         | 0.67         |   | 106  | Algeria                    | 77.54 | 77.54         | 0.17         |   |
| 43   | Côte d'Ivoire            | 91.38 | 91.38         | 0.67         | ● | 107  | Paraguay                   | 77.53 | 77.53         | 0.16         |   |
| 44   | United States of America | 91.23 | 91.23         | 0.66         |   | 108  | Saudi Arabia               | 77.09 | 77.09         | 0.15         | ○ |
| 45   | Cyprus                   | 91.21 | 91.21         | 0.64         |   | 109  | Honduras                   | 77.02 | 77.02         | 0.14         |   |
| 45   | United Arab Emirates     | 91.21 | 91.21         | 0.64         |   | 110  | Cameroon                   | 76.99 | 76.99         | 0.13         |   |
| 47   | Greece                   | 90.70 | 90.70         | 0.63         |   | 111  | Malawi                     | 76.73 | 76.73         | 0.13         |   |
| 48   | Benin                    | 90.56 | 90.56         | 0.63         | ● | 112  | Indonesia                  | 76.43 | 76.43         | 0.12         |   |
| 49   | Montenegro               | 90.07 | 90.07         | 0.62         |   | 113  | Botswana                   | 76.21 | 76.21         | 0.11         | ○ |
| 50   | Chile                    | 89.84 | 89.84         | 0.61         |   | 114  | India                      | 74.31 | 74.31         | 0.10         | ○ |
| 51   | Uruguay                  | 89.79 | 89.79         | 0.60         |   | 115  | Argentina                  | 73.56 | 73.56         | 0.10         | ○ |
| 52   | Colombia                 | 89.57 | 89.57         | 0.60         |   | 116  | Yemen                      | 71.59 | 71.59         | 0.09         |   |
| 53   | Romania                  | 89.48 | 89.48         | 0.59         |   | 117  | Uganda                     | 71.30 | 71.30         | 0.08         |   |
| 54   | Italy                    | 89.40 | 89.40         | 0.58         |   | 118  | Ecuador                    | 70.61 | 70.61         | 0.07         |   |
| 55   | Luxembourg               | 88.66 | 88.66         | 0.57         |   | 119  | Namibia                    | 68.87 | 68.87         | 0.06         | ○ |
| 56   | Slovakia                 | 88.62 | 88.62         | 0.56         |   | 120  | Philippines                | 68.86 | 68.86         | 0.06         | ○ |
| 57   | Trinidad and Tobago      | 88.59 | 88.59         | 0.56         | ● | 121  | Kuwait                     | 66.77 | 66.77         | 0.05         | ○ |
| 58   | Switzerland              | 88.39 | 88.39         | 0.55         | ○ | 122  | Bosnia and Herzegovina     | 65.09 | 65.09         | 0.04         | ○ |
| 59   | Burkina Faso             | 88.06 | 88.06         | 0.54         | ● | 123  | Brazil                     | 65.04 | 65.04         | 0.03         | ○ |
| 60   | Bahrain                  | 87.82 | 87.82         | 0.53         |   | 124  | Bolivia, Plurinational St. | 62.94 | 62.94         | 0.02         | ○ |
| 61   | Sri Lanka                | 87.52 | 87.52         | 0.52         |   | 125  | Ethiopia                   | 55.96 | 55.96         | 0.02         | ○ |
| 62   | Hungary                  | 87.28 | 87.28         | 0.52         |   | 126  | Cambodia                   | 54.93 | 54.93         | 0.01         | ○ |
| 63   | Rwanda                   | 87.17 | 87.17         | 0.51         |   | 127  | Zimbabwe                   | 49.13 | 49.13         | 0.00         | ○ |
| 64   | Thailand                 | 87.01 | 87.01         | 0.50         |   |      |                            |       |               |              |   |

SOURCE: World Bank, *Ease of Doing Business Index 2017: Equal Opportunity for All*

NOTE: ● indicates a strength; ○ a weakness

# 1.3.2 Ease of resolving insolvency

## Ease of resolving insolvency (distance to frontier) | 2016

| Rank | Country/Economy          | Value | Score (0–100) | Percent rank |   | Rank | Country/Economy            | Value | Score (0–100) | Percent rank |   |
|------|--------------------------|-------|---------------|--------------|---|------|----------------------------|-------|---------------|--------------|---|
| 1    | Finland                  | 93.89 | 93.89         | 1.00         | ● | 65   | Trinidad and Tobago        | 48.74 | 48.74         | 0.49         |   |
| 2    | Japan                    | 93.34 | 93.34         | 0.99         | ● | 66   | Cambodia                   | 48.10 | 48.10         | 0.48         |   |
| 3    | Germany                  | 92.28 | 92.28         | 0.98         | ● | 67   | Rwanda                     | 47.85 | 47.85         | 0.48         |   |
| 4    | Korea, Rep.              | 89.22 | 89.22         | 0.98         | ● | 68   | Algeria                    | 47.67 | 47.67         | 0.47         |   |
| 5    | United States of America | 89.19 | 89.19         | 0.97         |   | 69   | Sri Lanka                  | 46.73 | 46.73         | 0.46         |   |
| 6    | Norway                   | 89.06 | 89.06         | 0.96         | ● | 70   | Indonesia                  | 46.46 | 46.46         | 0.45         |   |
| 7    | Portugal                 | 85.24 | 85.24         | 0.95         | ● | 71   | Armenia                    | 46.06 | 46.06         | 0.44         |   |
| 8    | Denmark                  | 84.86 | 84.86         | 0.94         |   | 72   | Peru                       | 45.85 | 45.85         | 0.44         |   |
| 9    | Belgium                  | 84.32 | 84.32         | 0.94         | ● | 73   | El Salvador                | 45.83 | 45.83         | 0.43         |   |
| 10   | Netherlands              | 84.00 | 84.00         | 0.93         |   | 74   | Luxembourg                 | 45.40 | 45.40         | 0.42         |   |
| 11   | Slovenia                 | 83.97 | 83.97         | 0.92         | ● | 75   | Zambia                     | 45.36 | 45.36         | 0.41         |   |
| 12   | United Kingdom           | 82.04 | 82.04         | 0.91         |   | 76   | Malta                      | 45.35 | 45.35         | 0.40         |   |
| 13   | Iceland                  | 81.70 | 81.70         | 0.90         |   | 77   | Pakistan                   | 45.01 | 45.01         | 0.40         |   |
| 14   | Canada                   | 81.43 | 81.43         | 0.90         |   | 78   | Azerbaijan                 | 44.77 | 44.77         | 0.39         |   |
| 15   | Cyprus                   | 81.38 | 81.38         | 0.89         |   | 79   | Togo                       | 44.69 | 44.69         | 0.38         |   |
| 16   | Ireland                  | 80.01 | 80.01         | 0.88         |   | 80   | Bahrain                    | 44.66 | 44.66         | 0.37         |   |
| 17   | Spain                    | 79.62 | 79.62         | 0.87         |   | 81   | Nepal                      | 44.64 | 44.64         | 0.37         |   |
| 18   | Sweden                   | 79.44 | 79.44         | 0.87         |   | 82   | Mongolia                   | 43.59 | 43.59         | 0.36         |   |
| 19   | Austria                  | 78.93 | 78.93         | 0.86         |   | 83   | Kenya                      | 43.39 | 43.39         | 0.35         |   |
| 20   | Australia                | 78.73 | 78.73         | 0.85         |   | 84   | Oman                       | 42.65 | 42.65         | 0.34         |   |
| 21   | Thailand                 | 77.08 | 77.08         | 0.84         | ● | 85   | Bolivia, Plurinational St. | 42.28 | 42.28         | 0.33         |   |
| 22   | France                   | 76.62 | 76.62         | 0.83         |   | 86   | Namibia                    | 41.96 | 41.96         | 0.33         |   |
| 23   | Italy                    | 76.59 | 76.59         | 0.83         |   | 87   | Argentina                  | 41.87 | 41.87         | 0.32         |   |
| 24   | Czech Republic           | 76.42 | 76.42         | 0.82         |   | 88   | Mali                       | 41.46 | 41.46         | 0.31         |   |
| 25   | Poland                   | 76.37 | 76.37         | 0.81         | ● | 89   | Tanzania, United Rep.      | 41.04 | 41.04         | 0.30         |   |
| 26   | Hong Kong (China)        | 75.06 | 75.06         | 0.80         |   | 90   | Senegal                    | 40.74 | 40.74         | 0.29         |   |
| 27   | Singapore                | 74.31 | 74.31         | 0.79         |   | 91   | Paraguay                   | 40.70 | 40.70         | 0.29         |   |
| 28   | Mexico                   | 73.11 | 73.11         | 0.79         |   | 92   | United Arab Emirates       | 40.61 | 40.61         | 0.28         | ○ |
| 29   | Israel                   | 72.75 | 72.75         | 0.78         |   | 93   | Niger                      | 40.36 | 40.36         | 0.27         |   |
| 30   | TFYR of Macedonia        | 72.38 | 72.38         | 0.77         | ● | 94   | Georgia                    | 40.02 | 40.02         | 0.26         |   |
| 31   | Colombia                 | 71.74 | 71.74         | 0.76         |   | 95   | Costa Rica                 | 39.62 | 39.62         | 0.25         |   |
| 32   | New Zealand              | 71.43 | 71.43         | 0.75         |   | 96   | Kuwait                     | 39.58 | 39.58         | 0.25         |   |
| 33   | Slovakia                 | 70.53 | 70.53         | 0.75         |   | 97   | Egypt                      | 39.51 | 39.51         | 0.24         |   |
| 34   | Kazakhstan               | 69.17 | 69.17         | 0.74         | ● | 98   | Uganda                     | 39.40 | 39.40         | 0.23         |   |
| 35   | Jamaica                  | 69.15 | 69.15         | 0.73         | ● | 99   | Burkina Faso               | 39.25 | 39.25         | 0.22         |   |
| 36   | Mauritius                | 69.06 | 69.06         | 0.72         |   | 100  | Guinea                     | 38.84 | 38.84         | 0.21         |   |
| 37   | Montenegro               | 68.37 | 68.37         | 0.71         |   | 101  | Benin                      | 38.72 | 38.72         | 0.21         |   |
| 38   | Bosnia and Herzegovina   | 66.93 | 66.93         | 0.71         | ● | 102  | Qatar                      | 38.23 | 38.23         | 0.20         |   |
| 39   | Estonia                  | 65.46 | 65.46         | 0.70         |   | 103  | Ethiopia                   | 37.60 | 37.60         | 0.19         |   |
| 40   | Albania                  | 64.96 | 64.96         | 0.69         | ● | 104  | Cameroon                   | 36.63 | 36.63         | 0.18         |   |
| 41   | Latvia                   | 63.95 | 63.95         | 0.68         |   | 105  | Viet Nam                   | 35.08 | 35.08         | 0.17         |   |
| 42   | Switzerland              | 62.61 | 62.61         | 0.67         |   | 106  | Turkey                     | 34.98 | 34.98         | 0.17         | ○ |
| 43   | Malaysia                 | 62.49 | 62.49         | 0.67         |   | 107  | Madagascar                 | 34.24 | 34.24         | 0.16         |   |
| 44   | Serbia                   | 59.66 | 59.66         | 0.66         |   | 108  | Kyrgyzstan                 | 34.08 | 34.08         | 0.15         |   |
| 45   | Bulgaria                 | 59.38 | 59.38         | 0.65         |   | 109  | Morocco                    | 33.89 | 33.89         | 0.14         | ○ |
| 46   | Romania                  | 59.16 | 59.16         | 0.64         |   | 110  | Panama                     | 33.36 | 33.36         | 0.13         |   |
| 47   | South Africa             | 57.94 | 57.94         | 0.63         |   | 111  | India                      | 32.75 | 32.75         | 0.13         | ○ |
| 48   | Russian Federation       | 56.69 | 56.69         | 0.63         |   | 112  | Honduras                   | 31.66 | 31.66         | 0.12         |   |
| 49   | Greece                   | 56.66 | 56.66         | 0.62         |   | 113  | Nigeria                    | 30.60 | 30.60         | 0.11         |   |
| 50   | China                    | 55.82 | 55.82         | 0.61         |   | 114  | Burundi                    | 30.52 | 30.52         | 0.10         |   |
| 51   | Croatia                  | 55.62 | 55.62         | 0.60         |   | 115  | Jordan                     | 30.38 | 30.38         | 0.10         | ○ |
| 52   | Chile                    | 55.51 | 55.51         | 0.60         |   | 116  | Lebanon                    | 30.03 | 30.03         | 0.09         | ○ |
| 53   | Philippines              | 55.24 | 55.24         | 0.59         |   | 117  | Tajikistan                 | 28.70 | 28.70         | 0.08         |   |
| 54   | Brunei Darussalam        | 55.11 | 55.11         | 0.58         |   | 118  | Zimbabwe                   | 28.46 | 28.46         | 0.07         |   |
| 55   | Tunisia                  | 54.53 | 54.53         | 0.57         |   | 119  | Guatemala                  | 27.52 | 27.52         | 0.06         |   |
| 56   | Moldova, Rep.            | 52.61 | 52.61         | 0.56         |   | 120  | Ukraine                    | 27.50 | 27.50         | 0.06         | ○ |
| 57   | Uruguay                  | 52.26 | 52.26         | 0.56         |   | 121  | Bangladesh                 | 27.02 | 27.02         | 0.05         |   |
| 58   | Hungary                  | 51.25 | 51.25         | 0.55         |   | 122  | Yemen                      | 26.65 | 26.65         | 0.04         |   |
| 59   | Botswana                 | 50.53 | 50.53         | 0.54         |   | 123  | Iran, Islamic Rep.         | 25.25 | 25.25         | 0.03         | ○ |
| 60   | Mozambique               | 49.61 | 49.61         | 0.53         | ● | 124  | Ecuador                    | 25.17 | 25.17         | 0.02         | ○ |
| 61   | Lithuania                | 49.23 | 49.23         | 0.52         |   | 125  | Dominican Republic         | 23.55 | 23.55         | 0.02         | ○ |
| 62   | Brazil                   | 49.15 | 49.15         | 0.52         |   | 126  | Malawi                     | 22.25 | 22.25         | 0.01         | ○ |
| 63   | Côte d'Ivoire            | 49.13 | 49.13         | 0.51         | ● | 127  | Saudi Arabia               | 0.00  | 0.00          | 0.00         | ○ |
| 64   | Belarus                  | 49.08 | 49.08         | 0.50         |   |      |                            |       |               |              |   |

SOURCE: World Bank, *Ease of Doing Business Index 2017: Equal Opportunity for All*  
NOTE: ● indicates a strength; ○ a weakness

# 1.3.3 Ease of paying taxes

## Ease of paying taxes (distance to frontier) | 2016

| Rank | Country/Economy          | Value | Score (0–100) | Percent rank |   | Rank | Country/Economy            | Value | Score (0–100) | Percent rank |   |
|------|--------------------------|-------|---------------|--------------|---|------|----------------------------|-------|---------------|--------------|---|
| 1    | Qatar                    | 99.44 | 99.44         | 0.99         | ● | 65   | Bulgaria                   | 72.81 | 72.81         | 0.49         |   |
| 1    | United Arab Emirates     | 99.44 | 99.44         | 0.99         | ● | 66   | Ukraine                    | 72.72 | 72.72         | 0.48         |   |
| 3    | Hong Kong (China)        | 98.69 | 98.69         | 0.98         | ● | 67   | Armenia                    | 72.49 | 72.49         | 0.48         |   |
| 4    | Bahrain                  | 94.44 | 94.44         | 0.98         | ● | 68   | Brunei Darussalam          | 72.43 | 72.43         | 0.47         |   |
| 5    | Ireland                  | 94.40 | 94.40         | 0.97         | ● | 69   | Ethiopia                   | 72.06 | 72.06         | 0.46         |   |
| 6    | Kuwait                   | 92.48 | 92.48         | 0.96         | ● | 70   | Yemen                      | 71.64 | 71.64         | 0.45         | ● |
| 7    | Denmark                  | 92.11 | 92.11         | 0.95         |   | 71   | Guatemala                  | 71.55 | 71.55         | 0.44         |   |
| 8    | Singapore                | 91.85 | 91.85         | 0.94         |   | 72   | Israel                     | 71.00 | 71.00         | 0.44         | ○ |
| 9    | TFYR of Macedonia        | 91.67 | 91.67         | 0.94         | ● | 73   | Albania                    | 70.96 | 70.96         | 0.43         |   |
| 10   | United Kingdom           | 90.74 | 90.74         | 0.93         |   | 74   | Belarus                    | 70.40 | 70.40         | 0.42         |   |
| 11   | New Zealand              | 90.71 | 90.71         | 0.92         |   | 75   | Iran, Islamic Rep.         | 69.79 | 69.79         | 0.41         |   |
| 12   | Oman                     | 90.60 | 90.60         | 0.91         | ● | 76   | Malawi                     | 69.58 | 69.58         | 0.40         |   |
| 13   | Finland                  | 90.23 | 90.23         | 0.90         |   | 77   | Indonesia                  | 69.25 | 69.25         | 0.40         |   |
| 14   | Latvia                   | 89.79 | 89.79         | 0.90         | ● | 78   | Peru                       | 69.04 | 69.04         | 0.39         |   |
| 15   | Luxembourg               | 88.92 | 88.92         | 0.89         |   | 79   | Tunisia                    | 68.96 | 68.96         | 0.38         |   |
| 16   | Canada                   | 88.86 | 88.86         | 0.88         |   | 80   | Thailand                   | 68.68 | 68.68         | 0.37         |   |
| 17   | Switzerland              | 88.49 | 88.49         | 0.87         |   | 81   | Mozambique                 | 67.11 | 67.11         | 0.37         |   |
| 18   | Netherlands              | 88.07 | 88.07         | 0.87         |   | 82   | Uruguay                    | 66.08 | 66.08         | 0.36         |   |
| 19   | Estonia                  | 88.04 | 88.04         | 0.86         |   | 83   | Mexico                     | 65.81 | 65.81         | 0.35         |   |
| 20   | Georgia                  | 87.43 | 87.43         | 0.85         | ● | 84   | Philippines                | 65.74 | 65.74         | 0.34         |   |
| 21   | Korea, Rep.              | 86.56 | 86.56         | 0.84         |   | 85   | Jamaica                    | 65.18 | 65.18         | 0.33         |   |
| 22   | Slovenia                 | 86.55 | 86.55         | 0.83         |   | 86   | Madagascar                 | 64.80 | 64.80         | 0.33         |   |
| 23   | Australia                | 85.60 | 85.60         | 0.83         |   | 87   | Chile                      | 63.85 | 63.85         | 0.32         |   |
| 24   | Norway                   | 85.53 | 85.53         | 0.82         |   | 88   | Burundi                    | 62.20 | 62.20         | 0.31         |   |
| 25   | Lithuania                | 85.44 | 85.44         | 0.81         |   | 89   | Cambodia                   | 61.97 | 61.97         | 0.30         |   |
| 26   | Sweden                   | 85.28 | 85.28         | 0.80         |   | 90   | Kenya                      | 61.72 | 61.72         | 0.29         |   |
| 27   | Iceland                  | 84.88 | 84.88         | 0.79         |   | 91   | Italy                      | 61.65 | 61.65         | 0.29         | ○ |
| 28   | Moldova, Rep.            | 84.76 | 84.76         | 0.79         | ● | 92   | Turkey                     | 60.83 | 60.83         | 0.28         |   |
| 29   | Malta                    | 84.59 | 84.59         | 0.78         |   | 93   | Dominican Republic         | 60.70 | 60.70         | 0.27         |   |
| 30   | Cyprus                   | 84.45 | 84.45         | 0.77         |   | 94   | China                      | 60.46 | 60.46         | 0.26         |   |
| 31   | Mongolia                 | 84.19 | 84.19         | 0.76         |   | 95   | Bosnia and Herzegovina     | 60.08 | 60.08         | 0.25         |   |
| 32   | United States of America | 83.85 | 83.85         | 0.75         |   | 96   | Ecuador                    | 59.25 | 59.25         | 0.25         |   |
| 33   | Spain                    | 83.80 | 83.80         | 0.75         |   | 97   | Colombia                   | 58.91 | 58.91         | 0.24         |   |
| 34   | Portugal                 | 83.75 | 83.75         | 0.74         |   | 98   | Tajikistan                 | 58.79 | 58.79         | 0.23         |   |
| 35   | Azerbaijan               | 83.52 | 83.52         | 0.73         | ● | 99   | Nepal                      | 58.05 | 58.05         | 0.22         |   |
| 36   | Morocco                  | 83.51 | 83.51         | 0.72         | ● | 100  | Mali                       | 57.50 | 57.50         | 0.21         |   |
| 37   | Austria                  | 83.39 | 83.39         | 0.71         |   | 101  | Trinidad and Tobago        | 57.33 | 57.33         | 0.21         |   |
| 38   | Mauritius                | 82.96 | 82.96         | 0.70         |   | 102  | Kyrgyzstan                 | 56.43 | 56.43         | 0.20         |   |
| 38   | Russian Federation       | 82.96 | 82.96         | 0.70         |   | 103  | Burkina Faso               | 55.77 | 55.77         | 0.19         |   |
| 40   | Poland                   | 82.73 | 82.73         | 0.69         |   | 104  | Bangladesh                 | 55.56 | 55.56         | 0.18         |   |
| 41   | Germany                  | 82.10 | 82.10         | 0.68         |   | 105  | Honduras                   | 54.97 | 54.97         | 0.17         |   |
| 42   | Croatia                  | 81.74 | 81.74         | 0.67         |   | 106  | Paraguay                   | 54.64 | 54.64         | 0.17         |   |
| 43   | Romania                  | 81.64 | 81.64         | 0.67         |   | 107  | Tanzania, United Rep.      | 54.13 | 54.13         | 0.16         |   |
| 44   | South Africa             | 81.09 | 81.09         | 0.66         |   | 108  | Algeria                    | 53.99 | 53.99         | 0.15         |   |
| 45   | Czech Republic           | 80.69 | 80.69         | 0.65         |   | 109  | Pakistan                   | 53.40 | 53.40         | 0.14         |   |
| 46   | Botswana                 | 80.58 | 80.58         | 0.64         |   | 110  | Sri Lanka                  | 53.16 | 53.16         | 0.13         | ○ |
| 47   | Slovakia                 | 80.57 | 80.57         | 0.63         |   | 111  | Egypt                      | 51.96 | 51.96         | 0.13         |   |
| 48   | Montenegro               | 80.42 | 80.42         | 0.63         |   | 112  | Zimbabwe                   | 51.15 | 51.15         | 0.12         |   |
| 49   | Zambia                   | 80.16 | 80.16         | 0.62         | ● | 113  | Niger                      | 50.19 | 50.19         | 0.11         |   |
| 50   | Rwanda                   | 79.69 | 79.69         | 0.61         |   | 114  | El Salvador                | 49.51 | 49.51         | 0.10         |   |
| 51   | Kazakhstan               | 79.54 | 79.54         | 0.60         |   | 115  | Viet Nam                   | 49.39 | 49.39         | 0.10         | ○ |
| 52   | Malaysia                 | 79.20 | 79.20         | 0.60         |   | 116  | Togo                       | 48.22 | 48.22         | 0.09         |   |
| 53   | Costa Rica               | 78.98 | 78.98         | 0.59         |   | 117  | Panama                     | 48.09 | 48.09         | 0.08         |   |
| 54   | France                   | 78.72 | 78.72         | 0.58         |   | 118  | India                      | 46.58 | 46.58         | 0.07         | ○ |
| 55   | Greece                   | 78.22 | 78.22         | 0.57         |   | 119  | Benin                      | 44.61 | 44.61         | 0.06         |   |
| 56   | Belgium                  | 77.31 | 77.31         | 0.56         |   | 120  | Senegal                    | 43.70 | 43.70         | 0.06         | ○ |
| 57   | Lebanon                  | 77.17 | 77.17         | 0.56         |   | 121  | Côte d'Ivoire              | 43.35 | 43.35         | 0.05         | ○ |
| 58   | Saudi Arabia             | 77.04 | 77.04         | 0.55         |   | 122  | Argentina                  | 39.76 | 39.76         | 0.04         | ○ |
| 59   | Japan                    | 77.03 | 77.03         | 0.54         |   | 123  | Cameroon                   | 35.87 | 35.87         | 0.03         | ○ |
| 60   | Namibia                  | 74.97 | 74.97         | 0.53         |   | 124  | Brazil                     | 33.03 | 33.03         | 0.02         | ○ |
| 61   | Uganda                   | 74.71 | 74.71         | 0.52         |   | 125  | Nigeria                    | 28.09 | 28.09         | 0.02         | ○ |
| 62   | Hungary                  | 74.46 | 74.46         | 0.52         |   | 126  | Guinea                     | 24.28 | 24.28         | 0.01         | ○ |
| 63   | Serbia                   | 74.36 | 74.36         | 0.51         |   | 127  | Bolivia, Plurinational St. | 21.41 | 21.41         | 0.00         | ○ |
| 64   | Jordan                   | 73.94 | 73.94         | 0.50         |   |      |                            |       |               |              |   |

SOURCE: World Bank, *Ease of Doing Business Index 2017: Equal Opportunity for All*

NOTE: ● indicates a strength; ○ a weakness



# 2.1.1

## Expenditure on education

Government expenditure on education (% of GDP) | 2013

| Rank | Country/Economy                   | Value | Score (0–100) | Percent rank |   | Rank | Country/Economy              | Value | Score (0–100) | Percent rank |   |
|------|-----------------------------------|-------|---------------|--------------|---|------|------------------------------|-------|---------------|--------------|---|
| 1    | Botswana (2009)                   | 9.63  | 100.00        | 1.00         | ● | 65   | Croatia                      | 4.59  | 40.87         | 0.45         |   |
| 2    | Denmark                           | 8.61  | 88.03         | 0.99         | ● | 66   | Yemen (2008)                 | 4.56  | 40.56         | 0.44         | ● |
| 3    | Zimbabwe (2014)                   | 8.43  | 85.90         | 0.98         | ● | 67   | Ethiopia                     | 4.50  | 39.83         | 0.43         |   |
| 4    | Namibia (2010)                    | 8.35  | 84.96         | 0.97         | ● | 68   | Colombia (2015)              | 4.49  | 39.75         | 0.42         |   |
| 5    | Malta                             | 8.29  | 84.27         | 0.97         | ● | 69   | Uruguay (2011)               | 4.36  | 38.15         | 0.41         |   |
| 6    | Iceland                           | 7.81  | 78.65         | 0.96         |   | 70   | Algeria (2008)               | 4.34  | 37.94         | 0.41         |   |
| 7    | Sweden                            | 7.72  | 77.56         | 0.95         |   | 71   | Spain                        | 4.30  | 37.56         | 0.40         | ○ |
| 8    | Costa Rica (2015)                 | 7.59  | 76.05         | 0.94         | ● | 72   | Benin (2015)                 | 4.26  | 37.05         | 0.39         |   |
| 9    | Moldova, Rep. (2014)              | 7.46  | 74.59         | 0.93         | ● | 73   | Hungary                      | 4.23  | 36.67         | 0.38         |   |
| 10   | Norway                            | 7.37  | 73.49         | 0.92         |   | 74   | Serbia (2014)                | 4.18  | 36.10         | 0.37         |   |
| 11   | Bolivia, Plurinational St. (2014) | 7.29  | 72.49         | 0.91         | ● | 75   | Italy                        | 4.17  | 35.92         | 0.36         | ○ |
| 12   | Senegal (2014)                    | 7.22  | 71.76         | 0.91         | ● | 76   | Luxembourg (2012)            | 4.14  | 35.64         | 0.35         |   |
| 13   | Finland                           | 7.16  | 71.00         | 0.90         |   | 77   | Thailand                     | 4.13  | 35.49         | 0.34         |   |
| 14   | Niger (2014)                      | 6.72  | 65.81         | 0.89         | ● | 78   | Czech Republic               | 4.11  | 35.30         | 0.34         | ○ |
| 15   | Mozambique                        | 6.48  | 63.05         | 0.88         | ● | 79   | Slovakia                     | 4.11  | 35.22         | 0.33         | ○ |
| 16   | Cyprus                            | 6.44  | 62.58         | 0.87         |   | 80   | Bulgaria                     | 4.07  | 34.83         | 0.32         | ○ |
| 17   | Belgium (2011)                    | 6.38  | 61.86         | 0.86         |   | 81   | Peru (2015)                  | 3.92  | 33.05         | 0.31         |   |
| 18   | New Zealand (2014)                | 6.35  | 61.52         | 0.85         |   | 82   | Burkina Faso (2015)          | 3.91  | 32.94         | 0.30         |   |
| 19   | Tunisia (2012)                    | 6.25  | 60.36         | 0.84         | ● | 83   | Russian Federation (2012)    | 3.86  | 32.34         | 0.29         |   |
| 20   | South Africa (2014)               | 6.06  | 58.09         | 0.84         | ● | 84   | India                        | 3.84  | 32.13         | 0.28         |   |
| 21   | Brazil                            | 6.00  | 57.40         | 0.83         | ● | 85   | Japan (2014)                 | 3.77  | 31.31         | 0.28         | ○ |
| 22   | Ukraine (2014)                    | 5.95  | 56.85         | 0.82         |   | 86   | Egypt (2008)                 | 3.76  | 31.19         | 0.27         |   |
| 23   | Honduras                          | 5.87  | 55.96         | 0.81         | ● | 87   | Nepal (2015)                 | 3.75  | 31.03         | 0.26         |   |
| 24   | Israel                            | 5.86  | 55.76         | 0.80         |   | 88   | Brunei Darussalam (2016)     | 3.69  | 30.40         | 0.25         |   |
| 25   | United Kingdom (2014)             | 5.75  | 54.51         | 0.79         |   | 89   | Mali (2014)                  | 3.64  | 29.74         | 0.24         |   |
| 26   | Viet Nam                          | 5.65  | 53.35         | 0.78         | ● | 90   | Qatar (2014)                 | 3.55  | 28.70         | 0.23         |   |
| 27   | Malawi (2015)                     | 5.61  | 52.84         | 0.78         | ● | 91   | Albania                      | 3.54  | 28.57         | 0.22         |   |
| 28   | Netherlands                       | 5.61  | 52.83         | 0.77         |   | 92   | Tanzania, United Rep. (2014) | 3.48  | 27.91         | 0.22         |   |
| 29   | Austria                           | 5.56  | 52.33         | 0.76         |   | 93   | El Salvador (2014)           | 3.45  | 27.53         | 0.21         |   |
| 30   | Argentina (2014)                  | 5.55  | 52.12         | 0.75         | ● | 94   | Indonesia (2014)             | 3.29  | 25.66         | 0.20         |   |
| 31   | Kyrgyzstan (2014)                 | 5.53  | 51.94         | 0.74         | ● | 95   | Hong Kong (China) (2015)     | 3.26  | 25.37         | 0.19         | ○ |
| 32   | France                            | 5.51  | 51.63         | 0.73         |   | 96   | Guinea (2014)                | 3.21  | 24.74         | 0.18         |   |
| 33   | Slovenia                          | 5.49  | 51.43         | 0.72         |   | 97   | Panama (2011)                | 3.19  | 24.47         | 0.17         |   |
| 34   | Jamaica (2015)                    | 5.44  | 50.91         | 0.72         | ● | 98   | Cameroon                     | 3.03  | 22.60         | 0.16         |   |
| 35   | Burundi                           | 5.41  | 50.57         | 0.71         | ● | 99   | Guatemala (2015)             | 2.95  | 21.73         | 0.16         |   |
| 36   | Ireland                           | 5.34  | 49.70         | 0.70         |   | 100  | Romania (2012)               | 2.95  | 21.64         | 0.15         | ○ |
| 37   | Togo (2015)                       | 5.33  | 49.62         | 0.69         | ● | 101  | Iran, Islamic Rep. (2015)    | 2.92  | 21.33         | 0.14         |   |
| 38   | Portugal                          | 5.28  | 48.96         | 0.68         |   | 102  | Singapore                    | 2.91  | 21.24         | 0.13         | ○ |
| 39   | Kenya (2015)                      | 5.28  | 48.94         | 0.67         |   | 103  | Armenia (2015)               | 2.80  | 19.97         | 0.12         | ○ |
| 40   | Canada (2011)                     | 5.27  | 48.92         | 0.66         |   | 104  | Kazakhstan (2015)            | 2.79  | 19.80         | 0.11         | ○ |
| 41   | Australia                         | 5.27  | 48.88         | 0.66         |   | 105  | Pakistan (2015)              | 2.66  | 18.29         | 0.10         |   |
| 42   | Morocco (2009)                    | 5.26  | 48.76         | 0.65         |   | 106  | Philippines (2009)           | 2.65  | 18.20         | 0.09         | ○ |
| 43   | Tajikistan (2015)                 | 5.23  | 48.43         | 0.64         | ● | 107  | Bahrain (2012)               | 2.64  | 18.11         | 0.09         | ○ |
| 44   | Mexico (2012)                     | 5.17  | 47.65         | 0.63         |   | 108  | Azerbaijan (2014)            | 2.63  | 17.99         | 0.08         | ○ |
| 45   | Saudi Arabia (2008)               | 5.14  | 47.32         | 0.62         |   | 109  | Lebanon                      | 2.57  | 17.26         | 0.07         | ○ |
| 46   | Switzerland                       | 5.07  | 46.49         | 0.61         |   | 110  | Sri Lanka (2015)             | 2.18  | 12.69         | 0.06         | ○ |
| 47   | Rwanda                            | 5.03  | 46.03         | 0.60         |   | 111  | Bangladesh (2015)            | 2.18  | 12.65         | 0.05         |   |
| 48   | Oman                              | 5.01  | 45.81         | 0.59         |   | 112  | Madagascar                   | 2.08  | 11.49         | 0.04         |   |
| 49   | Malaysia (2015)                   | 4.98  | 45.47         | 0.59         |   | 113  | Dominican Republic (2007)    | 2.05  | 11.15         | 0.03         | ○ |
| 50   | Mauritius (2015)                  | 4.96  | 45.28         | 0.58         |   | 114  | Georgia (2012)               | 1.98  | 10.35         | 0.03         | ○ |
| 51   | Paraguay (2012)                   | 4.96  | 45.27         | 0.57         | ● | 115  | Cambodia (2014)              | 1.90  | 9.39          | 0.02         | ○ |
| 52   | Belarus (2015)                    | 4.95  | 45.11         | 0.56         |   | 116  | Uganda (2014)                | 1.70  | 7.09          | 0.01         | ○ |
| 53   | Germany                           | 4.94  | 45.06         | 0.55         |   | 117  | Zambia (2008)                | 1.10  | 0.00          | 0.00         | ○ |
| 54   | United States of America          | 4.94  | 45.05         | 0.54         |   | n/a  | Bosnia and Herzegovina       | n/a   | n/a           | n/a          |   |
| 55   | Poland                            | 4.94  | 45.02         | 0.53         |   | n/a  | China                        | n/a   | n/a           | n/a          |   |
| 56   | Ecuador (2015)                    | 4.92  | 44.77         | 0.53         |   | n/a  | Greece                       | n/a   | n/a           | n/a          |   |
| 57   | Latvia                            | 4.91  | 44.71         | 0.52         |   | n/a  | Jordan                       | n/a   | n/a           | n/a          |   |
| 58   | Estonia                           | 4.82  | 43.57         | 0.51         | ○ | n/a  | Kuwait                       | n/a   | n/a           | n/a          |   |
| 59   | Turkey                            | 4.77  | 43.06         | 0.50         |   | n/a  | Montenegro                   | n/a   | n/a           | n/a          |   |
| 60   | Chile (2014)                      | 4.76  | 42.94         | 0.49         |   | n/a  | Nigeria                      | n/a   | n/a           | n/a          |   |
| 61   | Côte d'Ivoire (2014)              | 4.72  | 42.42         | 0.48         | ● | n/a  | TFYR of Macedonia            | n/a   | n/a           | n/a          |   |
| 62   | Korea, Rep. (2012)                | 4.62  | 41.23         | 0.47         |   | n/a  | Trinidad and Tobago          | n/a   | n/a           | n/a          |   |
| 63   | Lithuania                         | 4.61  | 41.17         | 0.47         |   | n/a  | United Arab Emirates         | n/a   | n/a           | n/a          |   |
| 64   | Mongolia (2011)                   | 4.61  | 41.13         | 0.46         |   |      |                              |       |               |              |   |

SOURCE: UNESCO Institute for Statistics, *UIS online database*

NOTE: ● indicates a strength; ○ a weakness

## 2.1.2 Government expenditure on education per pupil, secondary

### Government expenditure per pupil, secondary (% of GDP per capita) | 2013

III: Data Tables

| Rank | Country/Economy                   | Value | Score (0–100) | Percent rank |   | Rank | Country/Economy              | Value | Score (0–100) | Percent rank |   |
|------|-----------------------------------|-------|---------------|--------------|---|------|------------------------------|-------|---------------|--------------|---|
| 1    | Niger (2014)                      | 72.56 | 100.00        | 1.00         | ● | 65   | Kuwait (2014)                | 17.62 | 18.74         | 0.39         |   |
| 2    | Mozambique                        | 52.02 | 69.62         | 0.99         | ● | 66   | Australia                    | 16.90 | 17.67         | 0.38         | ○ |
| 3    | Botswana (2007)                   | 41.95 | 54.72         | 0.98         | ● | 67   | India                        | 16.81 | 17.54         | 0.37         |   |
| 4    | Malta                             | 40.60 | 52.73         | 0.97         | ● | 68   | Singapore (2010)             | 16.68 | 17.35         | 0.36         | ○ |
| 5    | Moldova, Rep. (2015)              | 39.31 | 50.81         | 0.96         | ● | 69   | Mexico                       | 16.57 | 17.19         | 0.35         |   |
| 6    | Rwanda                            | 38.98 | 50.34         | 0.95         | ● | 70   | Paraguay (2012)              | 16.55 | 17.16         | 0.34         |   |
| 7    | Cyprus                            | 37.92 | 48.76         | 0.94         | ● | 71   | Jordan (2011)                | 16.47 | 17.04         | 0.33         |   |
| 8    | Belgium (2011)                    | 37.58 | 48.25         | 0.93         | ● | 72   | Hungary                      | 16.21 | 16.65         | 0.32         |   |
| 9    | Morocco (2012)                    | 36.13 | 46.11         | 0.92         | ● | 73   | Burkina Faso (2015)          | 16.20 | 16.63         | 0.31         |   |
| 10   | Zimbabwe                          | 35.13 | 44.63         | 0.91         | ● | 74   | Israel                       | 16.13 | 16.53         | 0.30         | ○ |
| 11   | Finland (2011)                    | 34.70 | 44.00         | 0.90         |   | 75   | Colombia (2015)              | 16.00 | 16.34         | 0.30         |   |
| 12   | Mauritius (2015)                  | 31.16 | 38.76         | 0.90         | ● | 76   | Namibia (2008)               | 15.95 | 16.27         | 0.29         |   |
| 13   | Burundi                           | 30.96 | 38.47         | 0.89         | ● | 77   | Togo (2011)                  | 15.64 | 15.81         | 0.28         |   |
| 14   | Portugal                          | 30.34 | 37.55         | 0.88         | ● | 78   | Mongolia (2010)              | 15.37 | 15.40         | 0.27         |   |
| 15   | Denmark                           | 28.23 | 34.42         | 0.87         |   | 79   | Pakistan (2015)              | 15.24 | 15.22         | 0.26         |   |
| 16   | Senegal (2011)                    | 27.56 | 33.44         | 0.86         | ● | 80   | Chile (2014)                 | 15.21 | 15.17         | 0.25         | ○ |
| 17   | Austria                           | 27.52 | 33.38         | 0.85         |   | 81   | Iran, Islamic Rep. (2015)    | 15.12 | 15.04         | 0.24         |   |
| 18   | Côte d'Ivoire (2014)              | 27.41 | 33.22         | 0.84         | ● | 82   | Armenia (2014)               | 15.00 | 14.86         | 0.23         |   |
| 19   | Jamaica (2015)                    | 27.15 | 32.83         | 0.83         | ● | 83   | Dominican Republic (2015)    | 14.98 | 14.83         | 0.22         |   |
| 20   | France                            | 26.83 | 32.36         | 0.82         |   | 84   | Turkey                       | 14.77 | 14.52         | 0.21         |   |
| 21   | Costa Rica (2015)                 | 26.70 | 32.17         | 0.81         |   | 85   | Georgia (2008)               | 14.24 | 13.74         | 0.20         |   |
| 22   | Ukraine (2014)                    | 26.25 | 31.50         | 0.80         |   | 86   | Peru (2015)                  | 14.12 | 13.56         | 0.19         |   |
| 23   | Switzerland (2012)                | 26.08 | 31.25         | 0.79         |   | 87   | Romania                      | 13.43 | 12.54         | 0.18         | ○ |
| 24   | Ireland (2012)                    | 25.98 | 31.10         | 0.78         |   | 88   | Serbia (2011)                | 13.06 | 11.99         | 0.17         | ○ |
| 25   | Slovenia                          | 25.92 | 31.02         | 0.77         |   | 89   | Yemen (2011)                 | 12.61 | 11.33         | 0.16         |   |
| 26   | Norway (2011)                     | 25.79 | 30.81         | 0.76         |   | 90   | Tanzania, United Rep. (2010) | 12.31 | 10.88         | 0.15         |   |
| 27   | Ethiopia (2012)                   | 25.68 | 30.66         | 0.75         | ● | 91   | Guinea (2014)                | 12.03 | 10.47         | 0.14         |   |
| 28   | Latvia                            | 25.51 | 30.40         | 0.74         |   | 92   | Benin (2015)                 | 11.42 | 9.56          | 0.13         |   |
| 29   | Japan (2014)                      | 25.12 | 29.83         | 0.73         |   | 93   | Nepal (2015)                 | 11.07 | 9.05          | 0.12         |   |
| 30   | Malawi (2015)                     | 25.08 | 29.77         | 0.72         | ● | 94   | Uganda (2014)                | 10.73 | 8.55          | 0.11         |   |
| 31   | Kenya (2012)                      | 24.87 | 29.45         | 0.71         |   | 95   | Qatar (2009)                 | 10.50 | 8.20          | 0.10         | ○ |
| 32   | Sweden                            | 24.64 | 29.12         | 0.70         |   | 96   | El Salvador (2014)           | 10.38 | 8.02          | 0.10         |   |
| 33   | Netherlands                       | 24.40 | 28.76         | 0.70         |   | 97   | Indonesia (2014)             | 9.93  | 7.36          | 0.09         | ○ |
| 34   | Tunisia (2008)                    | 24.36 | 28.70         | 0.69         | ● | 98   | Panama (2011)                | 9.21  | 6.29          | 0.08         |   |
| 35   | Germany                           | 23.69 | 27.72         | 0.68         |   | 99   | Philippines (2008)           | 9.13  | 6.18          | 0.07         | ○ |
| 36   | Czech Republic                    | 23.67 | 27.68         | 0.67         |   | 100  | Bangladesh (2015)            | 8.43  | 5.14          | 0.06         |   |
| 37   | Korea, Rep.                       | 23.37 | 27.24         | 0.66         |   | 101  | Madagascar (2012)            | 8.39  | 5.08          | 0.05         |   |
| 38   | Italy                             | 23.32 | 27.16         | 0.65         |   | 102  | Sri Lanka                    | 6.28  | 1.97          | 0.04         | ○ |
| 39   | United Kingdom (2014)             | 23.14 | 26.89         | 0.64         | ○ | 103  | Lebanon                      | 6.04  | 1.61          | 0.03         | ○ |
| 40   | Estonia                           | 23.10 | 26.84         | 0.63         |   | 104  | Albania                      | 5.87  | 1.35          | 0.02         | ○ |
| 41   | United States of America          | 22.66 | 26.20         | 0.62         |   | 105  | Guatemala (2014)             | 5.59  | 0.94          | 0.01         | ○ |
| 42   | Spain                             | 22.47 | 25.91         | 0.61         |   | 106  | Ecuador (2015)               | 4.95  | 0.00          | 0.00         | ○ |
| 43   | Argentina (2014)                  | 22.22 | 25.54         | 0.60         |   | n/a  | Algeria                      | n/a   | n/a           | n/a          |   |
| 44   | Bulgaria                          | 22.15 | 25.44         | 0.59         |   | n/a  | Azerbaijan                   | n/a   | n/a           | n/a          |   |
| 45   | Poland                            | 22.14 | 25.43         | 0.58         |   | n/a  | Bahrain                      | n/a   | n/a           | n/a          |   |
| 46   | Mali (2014)                       | 22.06 | 25.31         | 0.57         | ● | n/a  | Belarus                      | n/a   | n/a           | n/a          |   |
| 47   | New Zealand (2014)                | 21.97 | 25.18         | 0.56         |   | n/a  | Bosnia and Herzegovina       | n/a   | n/a           | n/a          |   |
| 48   | Brazil                            | 21.63 | 24.67         | 0.55         |   | n/a  | Cambodia                     | n/a   | n/a           | n/a          |   |
| 49   | Oman                              | 21.48 | 24.44         | 0.54         |   | n/a  | China                        | n/a   | n/a           | n/a          |   |
| 50   | South Africa (2012)               | 20.89 | 23.57         | 0.53         |   | n/a  | Croatia                      | n/a   | n/a           | n/a          |   |
| 51   | Hong Kong (China) (2015)          | 20.35 | 22.78         | 0.52         |   | n/a  | Egypt                        | n/a   | n/a           | n/a          |   |
| 52   | Brunei Darussalam (2016)          | 20.13 | 22.45         | 0.51         |   | n/a  | Greece                       | n/a   | n/a           | n/a          |   |
| 53   | Slovakia                          | 19.71 | 21.83         | 0.50         |   | n/a  | Kyrgyzstan                   | n/a   | n/a           | n/a          |   |
| 54   | Cameroon (2012)                   | 19.70 | 21.81         | 0.50         | ● | n/a  | Montenegro                   | n/a   | n/a           | n/a          |   |
| 55   | Luxembourg                        | 19.40 | 21.36         | 0.49         |   | n/a  | Nigeria                      | n/a   | n/a           | n/a          |   |
| 56   | Kazakhstan (2015)                 | 19.16 | 21.01         | 0.48         |   | n/a  | Russian Federation           | n/a   | n/a           | n/a          |   |
| 57   | Bolivia, Plurinational St. (2014) | 18.43 | 19.93         | 0.47         |   | n/a  | Tajikistan                   | n/a   | n/a           | n/a          |   |
| 58   | Malaysia (2015)                   | 18.39 | 19.87         | 0.46         |   | n/a  | TFYR of Macedonia            | n/a   | n/a           | n/a          |   |
| 59   | Iceland                           | 18.35 | 19.81         | 0.45         | ○ | n/a  | Trinidad and Tobago          | n/a   | n/a           | n/a          |   |
| 60   | Canada (2011)                     | 18.33 | 19.78         | 0.44         | ○ | n/a  | United Arab Emirates         | n/a   | n/a           | n/a          |   |
| 61   | Saudi Arabia (2007)               | 18.23 | 19.64         | 0.43         |   | n/a  | Uruguay                      | n/a   | n/a           | n/a          |   |
| 62   | Honduras                          | 18.15 | 19.51         | 0.42         |   | n/a  | Viet Nam                     | n/a   | n/a           | n/a          |   |
| 63   | Thailand                          | 17.83 | 19.05         | 0.41         |   | n/a  | Zambia                       | n/a   | n/a           | n/a          |   |
| 64   | Lithuania                         | 17.83 | 19.05         | 0.40         |   |      |                              |       |               |              |   |

SOURCE: UNESCO Institute for Statistics, *UIS online database*

NOTE: ● indicates a strength; ○ a weakness

# 2.1.3

## School life expectancy

School life expectancy, primary to tertiary education (years) | 2014

| Rank | Country/Economy           | Value | Score (0–100) | Percent rank |   | Rank | Country/Economy              | Value | Score (0–100) | Percent rank |   |
|------|---------------------------|-------|---------------|--------------|---|------|------------------------------|-------|---------------|--------------|---|
| 1    | Australia                 | 20.47 | 100.00        | 1.00         | ● | 65   | Peru (2010)                  | 13.39 | 53.26         | 0.44         |   |
| 2    | Belgium                   | 19.91 | 96.30         | 0.99         | ● | 66   | Mexico                       | 13.30 | 52.69         | 0.43         |   |
| 3    | Iceland (2013)            | 19.63 | 94.48         | 0.98         | ● | 67   | Armenia (2015)               | 13.19 | 51.97         | 0.42         |   |
| 4    | Finland (2015)            | 19.34 | 92.56         | 0.97         | ● | 68   | Kuwait (2013)                | 13.17 | 51.86         | 0.41         |   |
| 5    | New Zealand               | 19.23 | 91.81         | 0.96         | ● | 69   | El Salvador                  | 13.17 | 51.83         | 0.40         |   |
| 6    | Denmark                   | 19.19 | 91.55         | 0.96         | ● | 70   | Dominican Republic           | 13.17 | 51.83         | 0.39         |   |
| 7    | Ireland                   | 19.00 | 90.29         | 0.95         | ● | 71   | Egypt                        | 13.10 | 51.36         | 0.39         |   |
| 8    | Sweden                    | 18.22 | 85.18         | 0.94         |   | 72   | Kyrgyzstan                   | 13.09 | 51.29         | 0.38         |   |
| 9    | Netherlands (2012)        | 18.12 | 84.48         | 0.93         |   | 73   | Qatar (2011)                 | 13.08 | 51.21         | 0.37         |   |
| 10   | United Kingdom            | 17.94 | 83.29         | 0.92         |   | 74   | Malaysia (2015)              | 12.93 | 50.25         | 0.36         |   |
| 11   | Spain (2015)              | 17.88 | 82.95         | 0.91         | ● | 75   | Indonesia                    | 12.87 | 49.84         | 0.35         |   |
| 12   | Greece                    | 17.78 | 82.26         | 0.90         | ● | 76   | TFYR of Macedonia            | 12.80 | 49.41         | 0.34         |   |
| 13   | Norway (2015)             | 17.68 | 81.61         | 0.89         |   | 77   | Panama (2013)                | 12.80 | 49.38         | 0.33         |   |
| 14   | Slovenia                  | 17.35 | 79.41         | 0.89         | ● | 78   | Singapore (2009)             | 12.79 | 49.35         | 0.32         | ○ |
| 15   | Germany (2015)            | 17.29 | 79.00         | 0.88         |   | 79   | South Africa (2012)          | 12.78 | 49.24         | 0.32         |   |
| 16   | Argentina                 | 17.29 | 79.00         | 0.87         | ● | 80   | Jordan (2012)                | 12.76 | 49.15         | 0.31         |   |
| 17   | Czech Republic            | 16.81 | 75.88         | 0.86         |   | 81   | Philippines (2013)           | 12.75 | 49.06         | 0.30         |   |
| 18   | Korea, Rep. (2013)        | 16.59 | 74.40         | 0.85         |   | 82   | Paraguay (2010)              | 12.32 | 46.21         | 0.29         |   |
| 19   | Portugal                  | 16.57 | 74.24         | 0.84         |   | 83   | Nepal (2015)                 | 12.19 | 45.37         | 0.28         |   |
| 20   | United States of America  | 16.54 | 74.06         | 0.83         |   | 84   | Cameroon (2015)              | 12.15 | 45.12         | 0.27         |   |
| 21   | Lithuania                 | 16.52 | 73.96         | 0.82         | ● | 85   | Benin (2013)                 | 12.14 | 45.01         | 0.26         |   |
| 22   | Chile (2015)              | 16.48 | 73.67         | 0.82         |   | 86   | Morocco (2012)               | 12.05 | 44.47         | 0.25         |   |
| 23   | Italy                     | 16.42 | 73.27         | 0.81         |   | 87   | Botswana (2007)              | 12.05 | 44.47         | 0.25         |   |
| 24   | Turkey (2013)             | 16.39 | 73.06         | 0.80         |   | 88   | Togo (2011)                  | 11.97 | 43.89         | 0.24         |   |
| 25   | Poland (2013)             | 16.37 | 72.98         | 0.79         |   | 89   | India                        | 11.88 | 43.35         | 0.23         |   |
| 26   | Estonia (2015)            | 16.35 | 72.83         | 0.78         |   | 90   | Moldova, Rep. (2015)         | 11.63 | 41.70         | 0.22         |   |
| 27   | France                    | 16.27 | 72.26         | 0.77         |   | 91   | Tajikistan (2013)            | 11.26 | 39.24         | 0.21         |   |
| 28   | Saudi Arabia              | 16.11 | 71.25         | 0.76         | ● | 92   | Honduras                     | 11.24 | 39.08         | 0.20         |   |
| 29   | Latvia                    | 16.05 | 70.87         | 0.75         |   | 93   | Lebanon (2015)               | 11.13 | 38.37         | 0.19         |   |
| 30   | Switzerland               | 16.04 | 70.78         | 0.75         |   | 94   | Kenya (2009)                 | 11.07 | 38.00         | 0.18         |   |
| 31   | Austria (2015)            | 16.04 | 70.78         | 0.74         |   | 95   | Rwanda (2013)                | 11.03 | 37.73         | 0.18         |   |
| 32   | Thailand (2015)           | 16.03 | 70.71         | 0.73         |   | 96   | Malawi (2011)                | 10.72 | 35.68         | 0.17         |   |
| 33   | Israel                    | 16.00 | 70.50         | 0.72         |   | 97   | Guatemala (2013)             | 10.72 | 35.67         | 0.16         |   |
| 34   | Belarus (2015)            | 15.70 | 68.51         | 0.71         |   | 98   | Burundi (2013)               | 10.65 | 35.19         | 0.15         |   |
| 35   | Albania (2015)            | 15.52 | 67.37         | 0.70         | ● | 99   | Cambodia (2008)              | 10.52 | 34.32         | 0.14         |   |
| 36   | Uruguay (2010)            | 15.51 | 67.29         | 0.69         |   | 100  | Madagascar                   | 10.50 | 34.24         | 0.13         |   |
| 37   | Georgia (2015)            | 15.44 | 66.80         | 0.68         |   | 101  | Zimbabwe (2013)              | 10.31 | 32.99         | 0.12         |   |
| 38   | Hungary (2015)            | 15.37 | 66.35         | 0.68         |   | 102  | Uganda (2011)                | 10.01 | 30.99         | 0.11         |   |
| 39   | Japan                     | 15.36 | 66.28         | 0.67         |   | 103  | Bangladesh (2011)            | 9.86  | 29.98         | 0.11         |   |
| 40   | Ukraine                   | 15.31 | 65.93         | 0.66         |   | 104  | Mozambique                   | 9.57  | 28.07         | 0.10         |   |
| 41   | Brazil                    | 15.27 | 65.71         | 0.65         |   | 105  | Côte d'Ivoire (2015)         | 9.20  | 25.61         | 0.09         |   |
| 42   | Croatia                   | 15.26 | 65.62         | 0.64         |   | 106  | Yemen (2011)                 | 8.99  | 24.24         | 0.08         |   |
| 43   | Costa Rica (2015)         | 15.22 | 65.35         | 0.63         |   | 107  | Senegal (2015)               | 8.98  | 24.21         | 0.07         | ○ |
| 44   | Montenegro (2010)         | 15.13 | 64.79         | 0.62         |   | 108  | Guinea                       | 8.82  | 23.09         | 0.06         |   |
| 45   | Ecuador (2013)            | 15.11 | 64.60         | 0.61         | ● | 109  | Nigeria (2011)               | 8.63  | 21.86         | 0.05         |   |
| 46   | Malta (2015)              | 15.05 | 64.22         | 0.61         |   | 110  | Ethiopia (2012)              | 8.44  | 20.62         | 0.04         |   |
| 47   | Mongolia (2015)           | 15.01 | 63.98         | 0.60         |   | 111  | Tanzania, United Rep. (2013) | 8.36  | 20.07         | 0.04         |   |
| 48   | Kazakhstan (2016)         | 15.01 | 63.96         | 0.59         |   | 112  | Pakistan (2015)              | 8.24  | 19.32         | 0.03         | ○ |
| 49   | Slovakia                  | 14.96 | 63.68         | 0.58         |   | 113  | Mali (2011)                  | 7.72  | 15.86         | 0.02         | ○ |
| 50   | Russian Federation        | 14.95 | 63.60         | 0.57         |   | 114  | Burkina Faso (2013)          | 7.69  | 15.69         | 0.01         | ○ |
| 51   | Bulgaria (2015)           | 14.94 | 63.51         | 0.56         |   | 115  | Niger (2012)                 | 5.32  | 0.00          | 0.00         | ○ |
| 52   | Romania (2015)            | 14.93 | 63.48         | 0.55         |   | n/a  | Azerbaijan                   | n/a   | n/a           | n/a          |   |
| 53   | Iran, Islamic Rep. (2015) | 14.93 | 63.43         | 0.54         |   | n/a  | Bahrain                      | n/a   | n/a           | n/a          |   |
| 54   | Mauritius (2015)          | 14.89 | 63.19         | 0.54         |   | n/a  | Bolivia, Plurinational St.   | n/a   | n/a           | n/a          |   |
| 55   | Tunisia (2015)            | 14.75 | 62.29         | 0.53         |   | n/a  | Bosnia and Herzegovina       | n/a   | n/a           | n/a          |   |
| 56   | Brunei Darussalam (2015)  | 14.74 | 62.20         | 0.52         |   | n/a  | Canada                       | n/a   | n/a           | n/a          |   |
| 57   | Cyprus (2015)             | 14.57 | 61.07         | 0.51         |   | n/a  | Hong Kong (China)            | n/a   | n/a           | n/a          |   |
| 58   | Serbia (2015)             | 14.55 | 60.95         | 0.50         |   | n/a  | Jamaica                      | n/a   | n/a           | n/a          |   |
| 59   | Colombia (2015)           | 14.41 | 60.02         | 0.49         |   | n/a  | Namibia                      | n/a   | n/a           | n/a          |   |
| 60   | Algeria (2011)            | 14.36 | 59.67         | 0.48         | ● | n/a  | Trinidad and Tobago          | n/a   | n/a           | n/a          |   |
| 61   | Oman (2015)               | 14.14 | 58.20         | 0.47         |   | n/a  | United Arab Emirates         | n/a   | n/a           | n/a          |   |
| 62   | China (2015)              | 14.13 | 58.14         | 0.46         |   | n/a  | Viet Nam                     | n/a   | n/a           | n/a          |   |
| 63   | Sri Lanka (2013)          | 13.99 | 57.22         | 0.46         |   | n/a  | Zambia                       | n/a   | n/a           | n/a          |   |
| 64   | Luxembourg (2012)         | 13.86 | 56.41         | 0.45         |   |      |                              |       |               |              |   |

SOURCE: UNESCO Institute for Statistics, *UIS online database*

NOTE: ● indicates a strength; ○ a weakness

# 2.1.4 Assessment in reading, mathematics, and science

## PISA average scales in reading, mathematics, and science | 2015

| Rank | Country/Economy          | Value  | Score (0–100) | Percent rank |   | Rank | Country/Economy            | Value  | Score (0–100) | Percent rank |   |
|------|--------------------------|--------|---------------|--------------|---|------|----------------------------|--------|---------------|--------------|---|
| 1    | Singapore                | 551.62 | 100.00        | 1.00         | ● | 65   | Peru                       | 393.60 | 26.71         | 0.09         | ○ |
| 2    | Hong Kong (China)        | 532.63 | 91.19         | 0.99         | ● | 66   | Lebanon                    | 376.43 | 18.75         | 0.07         | ○ |
| 3    | Japan                    | 528.93 | 89.48         | 0.97         | ● | 67   | Tunisia                    | 371.43 | 16.43         | 0.06         | ○ |
| 4    | Estonia                  | 524.29 | 87.32         | 0.96         | ● | 68   | TFYR of Macedonia          | 368.91 | 15.26         | 0.04         | ○ |
| 5    | Canada                   | 523.34 | 86.88         | 0.94         |   | 69   | Algeria                    | 361.74 | 11.94         | 0.03         |   |
| 6    | Finland                  | 522.72 | 86.60         | 0.93         |   | 70   | Dominican Republic         | 339.03 | 1.40          | 0.01         | ○ |
| 7    | Korea, Rep.              | 519.12 | 84.93         | 0.91         |   | 71   | India (2010)               | 336.00 | 0.00          | 0.00         | ○ |
| 8    | China                    | 514.34 | 82.71         | 0.90         |   | n/a  | Armenia                    | n/a    | n/a           | n/a          |   |
| 9    | Slovenia                 | 509.33 | 80.39         | 0.89         | ● | n/a  | Azerbaijan                 | n/a    | n/a           | n/a          |   |
| 10   | Ireland                  | 509.04 | 80.25         | 0.87         |   | n/a  | Bahrain                    | n/a    | n/a           | n/a          |   |
| 11   | Germany                  | 508.07 | 79.80         | 0.86         |   | n/a  | Bangladesh                 | n/a    | n/a           | n/a          |   |
| 12   | Netherlands              | 507.93 | 79.74         | 0.84         |   | n/a  | Belarus                    | n/a    | n/a           | n/a          |   |
| 13   | Switzerland              | 506.32 | 78.99         | 0.83         |   | n/a  | Benin                      | n/a    | n/a           | n/a          |   |
| 14   | New Zealand              | 505.93 | 78.81         | 0.81         |   | n/a  | Bolivia, Plurinational St. | n/a    | n/a           | n/a          |   |
| 15   | Norway                   | 504.47 | 78.13         | 0.80         |   | n/a  | Bosnia and Herzegovina     | n/a    | n/a           | n/a          |   |
| 16   | Denmark                  | 504.28 | 78.04         | 0.79         |   | n/a  | Botswana                   | n/a    | n/a           | n/a          |   |
| 17   | Poland                   | 503.87 | 77.85         | 0.77         |   | n/a  | Brunei Darussalam          | n/a    | n/a           | n/a          |   |
| 18   | Belgium                  | 502.50 | 77.22         | 0.76         |   | n/a  | Burkina Faso               | n/a    | n/a           | n/a          |   |
| 19   | Australia                | 502.26 | 77.11         | 0.74         |   | n/a  | Burundi                    | n/a    | n/a           | n/a          |   |
| 20   | Viet Nam                 | 501.98 | 76.98         | 0.73         |   | n/a  | Cambodia                   | n/a    | n/a           | n/a          |   |
| 21   | United Kingdom           | 499.89 | 76.01         | 0.71         |   | n/a  | Cameroon                   | n/a    | n/a           | n/a          |   |
| 22   | Portugal                 | 496.95 | 74.65         | 0.70         |   | n/a  | Côte d'Ivoire              | n/a    | n/a           | n/a          |   |
| 23   | Sweden                   | 495.83 | 74.13         | 0.69         |   | n/a  | Ecuador                    | n/a    | n/a           | n/a          |   |
| 24   | France                   | 495.73 | 74.08         | 0.67         |   | n/a  | Egypt                      | n/a    | n/a           | n/a          |   |
| 25   | Austria                  | 492.22 | 72.45         | 0.66         |   | n/a  | El Salvador                | n/a    | n/a           | n/a          |   |
| 26   | Russian Federation       | 491.77 | 72.24         | 0.64         |   | n/a  | Ethiopia                   | n/a    | n/a           | n/a          |   |
| 27   | Spain                    | 491.40 | 72.07         | 0.63         |   | n/a  | Guatemala                  | n/a    | n/a           | n/a          |   |
| 28   | Czech Republic           | 490.80 | 71.79         | 0.61         |   | n/a  | Guinea                     | n/a    | n/a           | n/a          |   |
| 29   | United States of America | 487.60 | 70.31         | 0.60         |   | n/a  | Honduras                   | n/a    | n/a           | n/a          |   |
| 30   | Latvia                   | 486.76 | 69.92         | 0.59         |   | n/a  | Iran, Islamic Rep.         | n/a    | n/a           | n/a          |   |
| 31   | Italy                    | 485.01 | 69.11         | 0.57         |   | n/a  | Jamaica                    | n/a    | n/a           | n/a          |   |
| 32   | Luxembourg               | 483.34 | 68.33         | 0.56         |   | n/a  | Kenya                      | n/a    | n/a           | n/a          |   |
| 33   | Iceland                  | 480.93 | 67.21         | 0.54         |   | n/a  | Kuwait                     | n/a    | n/a           | n/a          |   |
| 34   | Croatia                  | 475.43 | 64.66         | 0.53         |   | n/a  | Kyrgyzstan                 | n/a    | n/a           | n/a          |   |
| 35   | Lithuania                | 475.40 | 64.65         | 0.51         |   | n/a  | Madagascar                 | n/a    | n/a           | n/a          |   |
| 36   | Hungary                  | 474.37 | 64.17         | 0.50         |   | n/a  | Malawi                     | n/a    | n/a           | n/a          |   |
| 37   | United Arab Emirates     | 474.28 | 64.13         | 0.49         |   | n/a  | Mali                       | n/a    | n/a           | n/a          |   |
| 38   | Israel                   | 471.73 | 62.95         | 0.47         | ○ | n/a  | Mauritius                  | n/a    | n/a           | n/a          |   |
| 39   | Argentina                | 468.94 | 61.65         | 0.46         |   | n/a  | Mongolia                   | n/a    | n/a           | n/a          |   |
| 40   | Malta                    | 463.36 | 59.07         | 0.44         |   | n/a  | Morocco                    | n/a    | n/a           | n/a          |   |
| 41   | Slovakia                 | 462.84 | 58.83         | 0.43         |   | n/a  | Mozambique                 | n/a    | n/a           | n/a          |   |
| 42   | Greece                   | 458.50 | 56.81         | 0.41         |   | n/a  | Namibia                    | n/a    | n/a           | n/a          |   |
| 43   | Serbia (2012)            | 446.60 | 51.29         | 0.40         |   | n/a  | Nepal                      | n/a    | n/a           | n/a          |   |
| 44   | Chile                    | 442.73 | 49.50         | 0.39         |   | n/a  | Niger                      | n/a    | n/a           | n/a          |   |
| 45   | Bulgaria                 | 439.56 | 48.03         | 0.37         | ○ | n/a  | Nigeria                    | n/a    | n/a           | n/a          |   |
| 46   | Cyprus                   | 437.51 | 47.08         | 0.36         |   | n/a  | Oman                       | n/a    | n/a           | n/a          |   |
| 47   | Romania                  | 437.49 | 47.07         | 0.34         |   | n/a  | Pakistan                   | n/a    | n/a           | n/a          |   |
| 48   | Uruguay                  | 429.98 | 43.58         | 0.33         |   | n/a  | Panama                     | n/a    | n/a           | n/a          |   |
| 49   | Turkey                   | 424.76 | 41.16         | 0.31         |   | n/a  | Paraguay                   | n/a    | n/a           | n/a          |   |
| 50   | Trinidad and Tobago      | 423.04 | 40.37         | 0.30         |   | n/a  | Philippines                | n/a    | n/a           | n/a          |   |
| 51   | Moldova, Rep.            | 421.30 | 39.56         | 0.29         |   | n/a  | Rwanda                     | n/a    | n/a           | n/a          |   |
| 52   | Montenegro               | 418.71 | 38.36         | 0.27         | ○ | n/a  | Saudi Arabia               | n/a    | n/a           | n/a          |   |
| 53   | Kazakhstan (2012)        | 416.41 | 37.29         | 0.26         |   | n/a  | Senegal                    | n/a    | n/a           | n/a          |   |
| 54   | Costa Rica               | 415.78 | 37.00         | 0.24         |   | n/a  | South Africa               | n/a    | n/a           | n/a          |   |
| 55   | Mexico                   | 415.67 | 36.95         | 0.23         | ○ | n/a  | Sri Lanka                  | n/a    | n/a           | n/a          |   |
| 56   | Thailand                 | 415.31 | 36.78         | 0.21         |   | n/a  | Tajikistan                 | n/a    | n/a           | n/a          |   |
| 57   | Albania                  | 415.21 | 36.74         | 0.20         |   | n/a  | Tanzania, United Rep.      | n/a    | n/a           | n/a          |   |
| 58   | Malaysia (2012)          | 412.74 | 35.59         | 0.19         | ○ | n/a  | Togo                       | n/a    | n/a           | n/a          |   |
| 59   | Colombia                 | 410.09 | 34.36         | 0.17         | ○ | n/a  | Uganda                     | n/a    | n/a           | n/a          |   |
| 60   | Qatar                    | 407.30 | 33.07         | 0.16         | ○ | n/a  | Ukraine                    | n/a    | n/a           | n/a          |   |
| 61   | Georgia                  | 405.42 | 32.19         | 0.14         |   | n/a  | Yemen                      | n/a    | n/a           | n/a          |   |
| 62   | Jordan                   | 399.01 | 29.22         | 0.13         | ○ | n/a  | Zambia                     | n/a    | n/a           | n/a          |   |
| 63   | Indonesia                | 395.49 | 27.59         | 0.11         |   | n/a  | Zimbabwe                   | n/a    | n/a           | n/a          |   |
| 64   | Brazil                   | 395.03 | 27.38         | 0.10         | ○ |      |                            |        |               |              |   |

SOURCE: OECD Programme for International Student Assessment (PISA)

NOTE: ● Indicates a strength; ○ a weakness

# 2.1.5 Pupil-teacher ratio, secondary

## Pupil-teacher ratio, secondary | 2015

| Rank | Country/Economy                 | Value | Score (0–100) | Percent rank |   | Rank | Country/Economy                   | Value | Score (0–100) | Percent rank |   |
|------|---------------------------------|-------|---------------|--------------|---|------|-----------------------------------|-------|---------------|--------------|---|
| 1    | Kazakhstan (2016)               | 6.79  | 100.00        | 1.00         | ● | 65   | Tajikistan (2011)                 | 15.44 | 74.83         | 0.42         |   |
| 2    | Ukraine                         | 6.97  | 99.49         | 0.99         | ● | 66   | Indonesia (2014)                  | 15.47 | 74.73         | 0.41         |   |
| 3    | Kuwait                          | 7.20  | 98.81         | 0.98         | ● | 67   | Panama (2013)                     | 15.52 | 74.59         | 0.40         |   |
| 4    | Georgia                         | 7.25  | 98.68         | 0.97         | ● | 68   | Korea, Rep. (2013)                | 15.61 | 74.32         | 0.39         |   |
| 5    | Lebanon (2014)                  | 7.74  | 97.24         | 0.96         | ● | 69   | United Kingdom (2014)             | 15.83 | 73.69         | 0.38         | ○ |
| 6    | Malta (2014)                    | 7.82  | 97.00         | 0.95         |   | 70   | Honduras                          | 16.10 | 72.90         | 0.37         |   |
| 7    | Croatia (2014)                  | 8.02  | 96.44         | 0.95         | ● | 71   | Mexico (2014)                     | 16.12 | 72.83         | 0.36         |   |
| 8    | Lithuania (2014)                | 8.08  | 96.26         | 0.94         | ● | 72   | Jamaica                           | 16.43 | 71.94         | 0.35         |   |
| 9    | Estonia (2013)                  | 8.10  | 96.20         | 0.93         |   | 73   | Brazil (2014)                     | 16.69 | 71.18         | 0.35         |   |
| 10   | Latvia (2014)                   | 8.21  | 95.86         | 0.92         | ● | 74   | Iran, Islamic Rep.                | 17.02 | 70.23         | 0.34         |   |
| 11   | Greece (2014)                   | 8.31  | 95.60         | 0.91         | ● | 75   | Sri Lanka (2012)                  | 17.28 | 69.46         | 0.33         |   |
| 12   | Belarus                         | 8.36  | 95.43         | 0.90         | ● | 76   | Bolivia, Plurinational St. (2007) | 18.17 | 66.89         | 0.32         |   |
| 13   | Serbia                          | 8.45  | 95.18         | 0.89         | ● | 77   | Paraguay (2012)                   | 18.40 | 66.19         | 0.31         |   |
| 14   | Russian Federation (2012)       | 8.76  | 94.26         | 0.88         | ● | 78   | Mali                              | 19.19 | 63.89         | 0.30         |   |
| 15   | Brunei Darussalam               | 8.84  | 94.05         | 0.87         | ● | 79   | Nigeria (2013)                    | 19.32 | 63.52         | 0.29         |   |
| 16   | Luxembourg (2014)               | 9.12  | 93.23         | 0.86         |   | 80   | Cameroon                          | 19.87 | 61.93         | 0.28         |   |
| 17   | Switzerland (2012)              | 9.33  | 92.62         | 0.85         |   | 81   | Turkey (2013)                     | 20.13 | 61.16         | 0.27         |   |
| 18   | Moldova, Rep.                   | 9.34  | 92.58         | 0.85         | ● | 82   | Senegal                           | 20.37 | 60.46         | 0.26         |   |
| 19   | Belgium (2014)                  | 9.42  | 92.34         | 0.84         |   | 83   | Chile (2013)                      | 21.00 | 58.63         | 0.25         | ○ |
| 20   | Poland (2013)                   | 9.53  | 92.02         | 0.83         | ● | 84   | Pakistan                          | 21.13 | 58.26         | 0.25         |   |
| 21   | TFYR of Macedonia (2014)        | 9.56  | 91.93         | 0.82         | ● | 85   | Rwanda (2014)                     | 21.65 | 56.74         | 0.24         |   |
| 22   | Austria                         | 9.58  | 91.90         | 0.81         |   | 86   | Uganda (2014)                     | 21.75 | 56.44         | 0.23         |   |
| 23   | Bahrain                         | 9.86  | 91.06         | 0.80         | ● | 87   | Dominican Republic                | 22.09 | 55.45         | 0.22         |   |
| 24   | Portugal (2014)                 | 9.89  | 90.97         | 0.79         |   | 88   | Ecuador (2016)                    | 22.35 | 54.71         | 0.21         |   |
| 25   | Slovenia (2013)                 | 10.07 | 90.47         | 0.78         |   | 89   | Zimbabwe (2013)                   | 22.48 | 54.31         | 0.20         |   |
| 26   | Bosnia and Herzegovina          | 10.15 | 90.24         | 0.77         | ● | 90   | Madagascar (2014)                 | 23.12 | 52.47         | 0.19         |   |
| 27   | Hungary                         | 10.29 | 89.82         | 0.76         |   | 91   | El Salvador (2011)                | 24.35 | 48.89         | 0.18         |   |
| 28   | Benin                           | 10.32 | 89.72         | 0.75         | ● | 92   | Namibia (2007)                    | 24.62 | 48.08         | 0.17         |   |
| 29   | Cyprus                          | 10.35 | 89.63         | 0.75         |   | 93   | South Africa (2009)               | 25.05 | 46.85         | 0.16         | ○ |
| 30   | Qatar                           | 10.69 | 88.66         | 0.74         |   | 94   | Burkina Faso                      | 25.20 | 46.41         | 0.15         |   |
| 31   | Saudi Arabia (2014)             | 10.96 | 87.86         | 0.73         |   | 95   | Colombia                          | 25.58 | 45.30         | 0.15         | ○ |
| 32   | Slovakia (2014)                 | 11.11 | 87.42         | 0.72         |   | 96   | Togo (2011)                       | 26.25 | 43.36         | 0.14         |   |
| 33   | United Arab Emirates            | 11.22 | 87.10         | 0.71         |   | 97   | Tanzania, United Rep. (2012)      | 26.39 | 42.93         | 0.13         |   |
| 34   | Denmark (2014)                  | 11.29 | 86.91         | 0.70         |   | 98   | Côte d'Ivoire                     | 26.61 | 42.29         | 0.12         |   |
| 35   | Uruguay (2010)                  | 11.32 | 86.82         | 0.69         |   | 99   | Philippines (2013)                | 26.99 | 41.19         | 0.11         | ○ |
| 36   | Italy (2013)                    | 11.38 | 86.66         | 0.68         |   | 100  | Niger                             | 27.96 | 38.37         | 0.10         |   |
| 37   | Czech Republic (2013)           | 11.55 | 86.15         | 0.67         |   | 101  | Thailand                          | 28.15 | 37.80         | 0.09         | ○ |
| 38   | Japan (2012)                    | 11.68 | 85.78         | 0.66         |   | 102  | Nepal (2016)                      | 28.90 | 35.62         | 0.08         |   |
| 39   | Spain                           | 11.98 | 84.89         | 0.65         |   | 103  | Cambodia (2007)                   | 28.92 | 35.56         | 0.07         |   |
| 40   | Malaysia                        | 12.02 | 84.79         | 0.65         |   | 104  | India (2014)                      | 31.77 | 27.26         | 0.06         | ○ |
| 41   | Romania                         | 12.10 | 84.56         | 0.64         |   | 105  | Guinea (2011)                     | 33.14 | 23.29         | 0.05         |   |
| 42   | Germany                         | 12.13 | 84.45         | 0.63         |   | 106  | Bangladesh (2013)                 | 35.20 | 17.27         | 0.05         | ○ |
| 43   | Argentina (2008)                | 12.24 | 84.15         | 0.62         |   | 107  | Burundi                           | 35.79 | 15.56         | 0.04         |   |
| 44   | Sweden (2013)                   | 12.30 | 83.97         | 0.61         | ○ | 108  | Mozambique                        | 39.69 | 4.22          | 0.03         | ○ |
| 45   | Kyrgyzstan (2014)               | 12.40 | 83.66         | 0.60         |   | 109  | Ethiopia (2012)                   | 40.35 | 2.28          | 0.02         |   |
| 46   | Israel (2014)                   | 12.44 | 83.55         | 0.59         |   | 110  | Malawi                            | 40.91 | 0.67          | 0.01         | ○ |
| 47   | Guatemala (2014)                | 12.66 | 82.90         | 0.58         |   | 111  | Kenya (2012)                      | 41.13 | 0.00          | 0.00         | ○ |
| 48   | Finland (2014)                  | 12.76 | 82.63         | 0.57         | ○ | n/a  | Algeria                           | n/a   | n/a           | n/a          |   |
| 49   | Mauritius                       | 12.88 | 82.29         | 0.56         |   | n/a  | Armenia                           | n/a   | n/a           | n/a          |   |
| 50   | France (2013)                   | 12.94 | 82.10         | 0.55         | ○ | n/a  | Australia                         | n/a   | n/a           | n/a          |   |
| 51   | Hong Kong (China)               | 12.96 | 82.05         | 0.55         |   | n/a  | Azerbaijan                        | n/a   | n/a           | n/a          |   |
| 52   | Bulgaria (2014)                 | 13.23 | 81.26         | 0.54         |   | n/a  | Canada                            | n/a   | n/a           | n/a          |   |
| 53   | Albania                         | 13.51 | 80.45         | 0.53         |   | n/a  | Iceland                           | n/a   | n/a           | n/a          |   |
| 54   | Tunisia (2011)                  | 13.62 | 80.11         | 0.52         |   | n/a  | Ireland                           | n/a   | n/a           | n/a          |   |
| 55   | China                           | 13.82 | 79.55         | 0.51         |   | n/a  | Jordan                            | n/a   | n/a           | n/a          |   |
| 56   | Botswana (2007)                 | 13.82 | 79.54         | 0.50         |   | n/a  | Montenegro                        | n/a   | n/a           | n/a          |   |
| 57   | Costa Rica                      | 13.95 | 79.16         | 0.49         |   | n/a  | Morocco                           | n/a   | n/a           | n/a          |   |
| 58   | New Zealand (2014)              | 13.96 | 79.13         | 0.48         | ○ | n/a  | Norway                            | n/a   | n/a           | n/a          |   |
| 59   | Peru                            | 14.09 | 78.75         | 0.47         |   | n/a  | Oman                              | n/a   | n/a           | n/a          |   |
| 60   | Egypt (2014)                    | 14.36 | 77.96         | 0.46         |   | n/a  | Trinidad and Tobago               | n/a   | n/a           | n/a          |   |
| 61   | Mongolia (2010)                 | 14.49 | 77.58         | 0.45         |   | n/a  | Viet Nam                          | n/a   | n/a           | n/a          |   |
| 62   | Netherlands (2014)              | 14.60 | 77.28         | 0.45         | ○ | n/a  | Yemen                             | n/a   | n/a           | n/a          |   |
| 63   | United States of America (2014) | 14.79 | 76.72         | 0.44         | ○ | n/a  | Zambia                            | n/a   | n/a           | n/a          |   |
| 64   | Singapore (2009)                | 14.91 | 76.37         | 0.43         | ○ |      |                                   |       |               |              |   |

SOURCE: UNESCO Institute for Statistics, *UIS online database*

NOTE: ● indicates a strength; ○ a weakness

# 2.2.1 Tertiary enrolment

## School enrolment, tertiary (% gross) | 2015

| Rank | Country/Economy           | Value  | Score (0–100) | Percent rank |   | Rank | Country/Economy              | Value | Score (0–100) | Percent rank |   |
|------|---------------------------|--------|---------------|--------------|---|------|------------------------------|-------|---------------|--------------|---|
| 1    | Greece (2014)             | 113.87 | 100.00        | 1.00         | ● | 65   | Ecuador (2013)               | 40.48 | 35.09         | 0.47         |   |
| 2    | Korea, Rep. (2013)        | 95.35  | 83.62         | 0.99         | ● | 66   | TFYR of Macedonia (2014)     | 39.59 | 34.31         | 0.46         |   |
| 3    | Australia (2014)          | 90.31  | 79.16         | 0.98         | ● | 67   | Panama (2013)                | 38.74 | 33.55         | 0.45         |   |
| 4    | Spain                     | 89.67  | 78.60         | 0.98         | ● | 68   | Lebanon                      | 38.48 | 33.33         | 0.44         |   |
| 5    | Chile                     | 88.58  | 77.63         | 0.97         | ● | 69   | Bahrain                      | 37.38 | 32.35         | 0.43         |   |
| 6    | Belarus                   | 87.94  | 77.07         | 0.96         | ● | 70   | Algeria                      | 36.92 | 31.95         | 0.43         |   |
| 7    | Finland                   | 87.29  | 76.49         | 0.95         |   | 71   | Mauritius                    | 36.67 | 31.72         | 0.42         |   |
| 8    | Turkey (2014)             | 86.31  | 75.62         | 0.94         | ● | 72   | Egypt                        | 36.23 | 31.33         | 0.41         |   |
| 9    | United States of America  | 85.80  | 75.17         | 0.93         |   | 73   | Philippines (2014)           | 35.75 | 30.91         | 0.40         |   |
| 10   | Slovenia (2014)           | 82.93  | 72.63         | 0.93         | ● | 74   | Paraguay (2010)              | 35.08 | 30.32         | 0.39         |   |
| 11   | Argentina (2014)          | 82.92  | 72.62         | 0.92         | ● | 75   | Tunisia                      | 34.61 | 29.90         | 0.38         |   |
| 12   | Ukraine (2014)            | 82.31  | 72.08         | 0.91         | ● | 76   | Oman                         | 31.92 | 27.53         | 0.38         |   |
| 13   | Austria                   | 81.54  | 71.41         | 0.90         |   | 77   | Indonesia (2014)             | 31.10 | 26.80         | 0.37         |   |
| 14   | Denmark (2014)            | 81.52  | 71.39         | 0.89         |   | 78   | Brunei Darussalam            | 30.84 | 26.57         | 0.36         |   |
| 15   | Iceland (2013)            | 81.26  | 71.16         | 0.88         |   | 79   | Mexico (2014)                | 29.94 | 25.77         | 0.35         |   |
| 16   | New Zealand (2014)        | 80.88  | 70.83         | 0.88         |   | 80   | Tajikistan (2016)            | 28.89 | 24.85         | 0.34         |   |
| 17   | Russian Federation (2014) | 78.65  | 68.85         | 0.87         | ● | 81   | El Salvador (2014)           | 28.85 | 24.81         | 0.33         |   |
| 18   | Netherlands (2012)        | 78.50  | 68.72         | 0.86         |   | 82   | Viet Nam                     | 28.84 | 24.80         | 0.33         |   |
| 19   | Ireland (2014)            | 77.63  | 67.95         | 0.85         |   | 83   | Morocco                      | 28.14 | 24.18         | 0.32         |   |
| 20   | Norway                    | 76.70  | 67.12         | 0.84         |   | 84   | Botswana (2014)              | 27.51 | 23.63         | 0.31         |   |
| 21   | Bulgaria                  | 73.93  | 64.68         | 0.83         | ● | 85   | Jamaica                      | 27.22 | 23.37         | 0.30         |   |
| 22   | Belgium (2014)            | 73.32  | 64.14         | 0.83         |   | 86   | Kuwait (2013)                | 27.03 | 23.20         | 0.29         |   |
| 23   | Iran, Islamic Rep.        | 71.88  | 62.86         | 0.82         | ● | 87   | Malaysia                     | 26.07 | 22.35         | 0.28         | ○ |
| 24   | Poland (2013)             | 71.16  | 62.23         | 0.81         | ● | 88   | India (2014)                 | 25.54 | 21.88         | 0.28         |   |
| 25   | Singapore (2013)          | 69.81  | 61.03         | 0.80         |   | 89   | Azerbaijan                   | 25.48 | 21.83         | 0.27         |   |
| 26   | Estonia                   | 69.55  | 60.80         | 0.79         |   | 90   | Honduras (2014)              | 21.18 | 18.03         | 0.26         |   |
| 27   | Croatia (2014)            | 69.54  | 60.80         | 0.78         |   | 91   | Sri Lanka                    | 19.80 | 16.80         | 0.25         |   |
| 28   | Mongolia                  | 68.57  | 59.93         | 0.78         |   | 92   | Luxembourg (2012)            | 19.41 | 16.46         | 0.24         | ○ |
| 29   | Lithuania (2014)          | 68.53  | 59.90         | 0.77         |   | 93   | South Africa (2014)          | 19.38 | 16.43         | 0.23         | ○ |
| 30   | Hong Kong (China)         | 68.48  | 59.85         | 0.76         |   | 94   | Guatemala (2013)             | 18.33 | 15.50         | 0.23         |   |
| 31   | Germany                   | 68.27  | 59.67         | 0.75         |   | 95   | Cameroon                     | 17.48 | 14.75         | 0.22         |   |
| 32   | Latvia (2014)             | 67.04  | 58.58         | 0.74         |   | 96   | Qatar                        | 17.22 | 14.52         | 0.21         |   |
| 33   | Israel (2014)             | 66.18  | 57.82         | 0.73         |   | 97   | Benin (2013)                 | 15.36 | 12.88         | 0.20         |   |
| 34   | Czech Republic (2014)     | 66.02  | 57.68         | 0.73         |   | 98   | Nepal                        | 14.94 | 12.51         | 0.19         |   |
| 35   | Portugal (2014)           | 65.61  | 57.32         | 0.72         |   | 99   | Bangladesh (2014)            | 13.44 | 11.18         | 0.18         |   |
| 36   | France (2014)             | 64.39  | 56.24         | 0.71         |   | 100  | Cambodia                     | 13.09 | 10.87         | 0.18         |   |
| 37   | Japan (2014)              | 63.36  | 55.33         | 0.70         |   | 101  | Guinea (2014)                | 10.85 | 8.89          | 0.17         |   |
| 38   | Uruguay (2010)            | 63.13  | 55.13         | 0.69         |   | 102  | Togo                         | 10.63 | 8.69          | 0.16         |   |
| 39   | Italy (2014)              | 63.10  | 55.09         | 0.68         |   | 103  | Senegal                      | 10.39 | 8.48          | 0.15         |   |
| 40   | Saudi Arabia              | 63.07  | 55.07         | 0.68         |   | 104  | Nigeria (2011)               | 10.07 | 8.20          | 0.14         |   |
| 41   | Sweden (2014)             | 62.35  | 54.44         | 0.67         |   | 105  | Yemen (2011)                 | 9.97  | 8.12          | 0.13         |   |
| 42   | Cyprus                    | 60.10  | 52.45         | 0.66         |   | 106  | Pakistan                     | 9.93  | 8.07          | 0.13         |   |
| 43   | Serbia                    | 58.29  | 50.84         | 0.65         |   | 107  | Namibia (2008)               | 9.33  | 7.55          | 0.12         |   |
| 44   | Albania                   | 58.11  | 50.69         | 0.64         |   | 108  | Côte d'Ivoire                | 9.16  | 7.39          | 0.11         |   |
| 45   | Switzerland (2014)        | 57.23  | 49.91         | 0.63         |   | 109  | Zimbabwe                     | 8.43  | 6.75          | 0.10         |   |
| 46   | United Kingdom (2014)     | 56.48  | 49.24         | 0.63         | ○ | 110  | Ethiopia (2014)              | 8.13  | 6.48          | 0.09         |   |
| 47   | Colombia                  | 55.59  | 48.46         | 0.62         |   | 111  | Rwanda (2013)                | 7.53  | 5.95          | 0.08         |   |
| 48   | Montenegro (2010)         | 55.34  | 48.24         | 0.61         |   | 112  | Mali (2012)                  | 6.87  | 5.37          | 0.08         |   |
| 49   | Costa Rica                | 53.63  | 46.72         | 0.60         |   | 113  | Mozambique (2014)            | 5.97  | 4.58          | 0.07         |   |
| 50   | Romania                   | 53.22  | 46.36         | 0.59         |   | 114  | Burkina Faso (2013)          | 4.78  | 3.52          | 0.06         | ○ |
| 51   | Slovakia (2014)           | 52.92  | 46.10         | 0.58         |   | 115  | Madagascar (2014)            | 4.78  | 3.52          | 0.05         |   |
| 52   | Hungary                   | 50.86  | 44.28         | 0.58         |   | 116  | Uganda (2011)                | 4.48  | 3.26          | 0.04         | ○ |
| 53   | Brazil (2014)             | 49.28  | 42.88         | 0.57         |   | 117  | Burundi (2013)               | 4.41  | 3.19          | 0.03         |   |
| 54   | Thailand                  | 48.86  | 42.50         | 0.56         |   | 118  | Kenya (2009)                 | 4.05  | 2.87          | 0.03         | ○ |
| 55   | Dominican Republic (2014) | 47.52  | 41.32         | 0.55         |   | 119  | Tanzania, United Rep. (2013) | 3.65  | 2.52          | 0.02         | ○ |
| 56   | Malta                     | 46.97  | 40.84         | 0.54         |   | 120  | Niger (2012)                 | 1.71  | 0.81          | 0.01         | ○ |
| 57   | Kazakhstan (2016)         | 46.26  | 40.21         | 0.53         |   | 121  | Malawi (2011)                | 0.80  | 0.00          | 0.00         | ○ |
| 58   | Kyrgyzstan (2014)         | 45.92  | 39.90         | 0.53         |   | n/a  | Bolivia, Plurinational St.   | n/a   | n/a           | n/a          |   |
| 59   | Jordan                    | 44.87  | 38.98         | 0.52         |   | n/a  | Bosnia and Herzegovina       | n/a   | n/a           | n/a          |   |
| 60   | Armenia                   | 44.31  | 38.48         | 0.51         |   | n/a  | Canada                       | n/a   | n/a           | n/a          |   |
| 61   | Georgia                   | 43.42  | 37.69         | 0.50         |   | n/a  | Trinidad and Tobago          | n/a   | n/a           | n/a          |   |
| 62   | China                     | 43.39  | 37.67         | 0.49         |   | n/a  | United Arab Emirates         | n/a   | n/a           | n/a          |   |
| 63   | Moldova, Rep.             | 41.21  | 35.74         | 0.48         |   | n/a  | Zambia                       | n/a   | n/a           | n/a          |   |
| 64   | Peru (2010)               | 40.51  | 35.12         | 0.48         |   |      |                              |       |               |              |   |

SOURCE: UNESCO Institute for Statistics, *UIS online database*

NOTE: ● indicates a strength; ○ a weakness



# 2.2.2

## Graduates in science and engineering

Tertiary graduates in science, engineering, manufacturing, and construction (% of total tertiary graduates) | 2013

| Rank | Country/Economy             | Value | Score (0–100) | Percent rank |   | Rank | Country/Economy               | Value | Score (0–100) | Percent rank |   |
|------|-----------------------------|-------|---------------|--------------|---|------|-------------------------------|-------|---------------|--------------|---|
| 1    | Oman (2014)                 | 48.69 | 100.00        | 1.00         | ● | 65   | Cyprus                        | 18.96 | 35.44         | 0.37         |   |
| 2    | Iran, Islamic Rep. (2014)   | 46.56 | 95.35         | 0.99         | ● | 66   | New Zealand (2012)            | 18.79 | 35.06         | 0.36         | ○ |
| 3    | Tunisia (2014)              | 44.09 | 89.99         | 0.98         | ● | 67   | Kyrgyzstan                    | 18.28 | 33.96         | 0.35         |   |
| 4    | Morocco (2010)              | 34.91 | 70.06         | 0.97         | ● | 68   | Latvia                        | 17.90 | 33.14         | 0.34         | ○ |
| 5    | Hong Kong (China) (2006)    | 34.67 | 69.54         | 0.96         |   | 69   | Burkina Faso                  | 17.55 | 32.38         | 0.33         |   |
| 6    | Brunei Darussalam (2014)    | 33.96 | 68.01         | 0.95         | ● | 70   | Botswana (2014)               | 17.49 | 32.25         | 0.32         |   |
| 7    | Malaysia                    | 33.26 | 66.49         | 0.94         | ● | 71   | Poland                        | 17.42 | 32.09         | 0.31         | ○ |
| 8    | Korea, Rep. (2011)          | 31.92 | 63.57         | 0.93         |   | 72   | Hungary (2012)                | 16.84 | 30.82         | 0.30         |   |
| 9    | Zimbabwe                    | 29.39 | 58.08         | 0.92         | ● | 73   | Albania (2014)                | 16.79 | 30.73         | 0.29         |   |
| 10   | India                       | 29.11 | 57.48         | 0.91         | ● | 74   | Guatemala (2007)              | 16.76 | 30.66         | 0.28         |   |
| 11   | Greece (2012)               | 28.66 | 56.50         | 0.90         | ● | 75   | Georgia (2014)                | 16.69 | 30.51         | 0.27         |   |
| 12   | Belarus (2014)              | 28.62 | 56.40         | 0.89         | ● | 76   | Belgium (2012)                | 16.44 | 29.97         | 0.26         | ○ |
| 13   | Russian Federation (2009)   | 28.11 | 55.30         | 0.88         | ● | 77   | Luxembourg                    | 16.25 | 29.55         | 0.25         | ○ |
| 14   | Tajikistan (2014)           | 28.07 | 55.22         | 0.87         | ● | 78   | Jordan (2011)                 | 16.12 | 29.27         | 0.24         | ○ |
| 15   | Austria                     | 27.87 | 54.77         | 0.86         |   | 79   | Australia (2011)              | 15.93 | 28.85         | 0.23         | ○ |
| 16   | Finland                     | 27.86 | 54.75         | 0.85         |   | 80   | Panama                        | 15.86 | 28.69         | 0.22         |   |
| 17   | Algeria (2014)              | 27.60 | 54.19         | 0.84         | ● | 81   | Iceland (2010)                | 15.64 | 28.21         | 0.21         | ○ |
| 18   | Qatar (2014)                | 27.56 | 54.11         | 0.83         |   | 82   | Bangladesh (2012)             | 15.62 | 28.18         | 0.20         |   |
| 19   | Mexico (2012)               | 26.88 | 52.64         | 0.82         | ● | 83   | Uruguay (2010)                | 15.60 | 28.14         | 0.19         | ○ |
| 20   | Saudi Arabia (2014)         | 26.85 | 52.57         | 0.81         | ● | 84   | Bosnia and Herzegovina (2014) | 15.38 | 27.65         | 0.18         |   |
| 21   | Kuwait                      | 26.74 | 52.32         | 0.80         | ● | 85   | United States of America      | 14.88 | 26.58         | 0.17         | ○ |
| 22   | Serbia (2014)               | 26.21 | 51.17         | 0.79         |   | 86   | Ecuador                       | 14.87 | 26.55         | 0.16         |   |
| 23   | Portugal                    | 26.09 | 50.92         | 0.78         |   | 87   | Dominican Republic (2014)     | 14.42 | 25.58         | 0.15         |   |
| 24   | Moldova, Rep.               | 25.73 | 50.13         | 0.77         | ● | 88   | Netherlands (2012)            | 14.42 | 25.57         | 0.14         | ○ |
| 25   | Sweden                      | 25.71 | 50.08         | 0.76         |   | 89   | Argentina                     | 14.14 | 24.97         | 0.13         |   |
| 26   | Kazakhstan (2014)           | 25.71 | 50.08         | 0.75         | ● | 90   | Armenia (2014)                | 14.14 | 24.96         | 0.12         | ○ |
| 27   | Philippines (2014)          | 25.53 | 49.70         | 0.74         | ● | 91   | Costa Rica (2014)             | 13.12 | 22.75         | 0.11         | ○ |
| 28   | Ukraine (2014)              | 25.52 | 49.67         | 0.73         |   | 92   | Benin (2011)                  | 12.67 | 21.78         | 0.10         |   |
| 29   | Romania                     | 25.49 | 49.62         | 0.72         |   | 93   | Cambodia (2008)               | 12.49 | 21.39         | 0.09         |   |
| 30   | United Kingdom              | 25.18 | 48.94         | 0.71         |   | 94   | Honduras (2014)               | 12.37 | 21.12         | 0.08         | ○ |
| 31   | Slovenia (2012)             | 24.74 | 47.98         | 0.70         |   | 95   | Nepal (2014)                  | 12.08 | 20.48         | 0.07         |   |
| 32   | France                      | 24.47 | 47.41         | 0.69         |   | 96   | Brazil (2012)                 | 11.96 | 20.23         | 0.06         | ○ |
| 33   | Croatia (2012)              | 23.85 | 46.05         | 0.68         |   | 97   | Egypt                         | 11.79 | 19.87         | 0.05         | ○ |
| 34   | Ireland (2012)              | 23.76 | 45.87         | 0.67         |   | 98   | Ethiopia (2008)               | 11.22 | 18.62         | 0.04         |   |
| 35   | Lebanon (2011)              | 23.35 | 44.96         | 0.66         |   | 99   | Mozambique (2014)             | 8.13  | 11.92         | 0.03         | ○ |
| 36   | Czech Republic              | 23.22 | 44.68         | 0.65         |   | 100  | Burundi                       | 6.37  | 8.09          | 0.02         |   |
| 37   | Mauritius (2014)            | 22.93 | 44.06         | 0.64         |   | 101  | Niger (2008)                  | 4.28  | 3.55          | 0.01         |   |
| 38   | Colombia (2014)             | 22.74 | 43.65         | 0.63         |   | 102  | Namibia (2008)                | 2.64  | 0.00          | 0.00         | ○ |
| 39   | Rwanda (2012)               | 22.45 | 43.01         | 0.62         |   | n/a  | Bolivia, Plurinational St.    | n/a   | n/a           | n/a          |   |
| 40   | Viet Nam (2014)             | 22.40 | 42.90         | 0.61         |   | n/a  | Canada                        | n/a   | n/a           | n/a          |   |
| 41   | El Salvador                 | 22.23 | 42.53         | 0.60         | ● | n/a  | China                         | n/a   | n/a           | n/a          |   |
| 42   | Spain (2012)                | 22.21 | 42.49         | 0.59         |   | n/a  | Côte d'Ivoire                 | n/a   | n/a           | n/a          |   |
| 43   | Lithuania                   | 22.20 | 42.47         | 0.58         |   | n/a  | Germany                       | n/a   | n/a           | n/a          |   |
| 44   | Estonia (2012)              | 22.12 | 42.30         | 0.57         |   | n/a  | Guinea                        | n/a   | n/a           | n/a          |   |
| 45   | Switzerland                 | 22.05 | 42.15         | 0.56         | ○ | n/a  | Israel                        | n/a   | n/a           | n/a          |   |
| 46   | Azerbaijan (2014)           | 22.02 | 42.08         | 0.55         |   | n/a  | Jamaica                       | n/a   | n/a           | n/a          |   |
| 47   | Indonesia (2009)            | 21.68 | 41.35         | 0.54         |   | n/a  | Kenya                         | n/a   | n/a           | n/a          |   |
| 48   | TFYR of Macedonia           | 21.23 | 40.35         | 0.53         |   | n/a  | Malawi                        | n/a   | n/a           | n/a          |   |
| 49   | Cameroon (2010)             | 21.02 | 39.91         | 0.52         | ● | n/a  | Mali                          | n/a   | n/a           | n/a          |   |
| 50   | Turkey (2012)               | 20.89 | 39.61         | 0.51         |   | n/a  | Montenegro                    | n/a   | n/a           | n/a          |   |
| 51   | Slovakia                    | 20.51 | 38.80         | 0.50         |   | n/a  | Nigeria                       | n/a   | n/a           | n/a          |   |
| 52   | United Arab Emirates (2014) | 20.43 | 38.61         | 0.50         |   | n/a  | Pakistan                      | n/a   | n/a           | n/a          |   |
| 53   | Denmark                     | 20.37 | 38.50         | 0.49         | ○ | n/a  | Paraguay                      | n/a   | n/a           | n/a          |   |
| 54   | Madagascar                  | 20.28 | 38.29         | 0.48         |   | n/a  | Peru                          | n/a   | n/a           | n/a          |   |
| 55   | Italy (2012)                | 20.18 | 38.08         | 0.47         |   | n/a  | Senegal                       | n/a   | n/a           | n/a          |   |
| 56   | Bulgaria                    | 20.13 | 37.97         | 0.46         |   | n/a  | Singapore                     | n/a   | n/a           | n/a          |   |
| 57   | Norway                      | 19.97 | 37.62         | 0.45         | ○ | n/a  | Tanzania, United Rep.         | n/a   | n/a           | n/a          |   |
| 58   | Sri Lanka (2014)            | 19.95 | 37.58         | 0.44         |   | n/a  | Thailand                      | n/a   | n/a           | n/a          |   |
| 59   | Japan                       | 19.93 | 37.55         | 0.43         | ○ | n/a  | Togo                          | n/a   | n/a           | n/a          |   |
| 60   | Bahrain (2014)              | 19.48 | 36.56         | 0.42         |   | n/a  | Trinidad and Tobago           | n/a   | n/a           | n/a          |   |
| 61   | Mongolia (2014)             | 19.48 | 36.56         | 0.41         |   | n/a  | Uganda                        | n/a   | n/a           | n/a          |   |
| 62   | Chile (2012)                | 19.18 | 35.91         | 0.40         |   | n/a  | Yemen                         | n/a   | n/a           | n/a          |   |
| 63   | Malta (2012)                | 19.12 | 35.77         | 0.39         | ○ | n/a  | Zambia                        | n/a   | n/a           | n/a          |   |
| 64   | South Africa                | 19.00 | 35.52         | 0.38         |   |      |                               |       |               |              |   |

SOURCE: UNESCO Institute for Statistics, *UIS online database*

NOTE: ● indicates a strength; ○ a weakness

## 2.2.3 Tertiary-level inbound mobility

### Tertiary-level inbound mobility ratio (%) | 2015

| Rank | Country/Economy           | Value | Score (0–100) | Percent rank |   | Rank | Country/Economy            | Value | Score (0–100) | Percent rank |   |
|------|---------------------------|-------|---------------|--------------|---|------|----------------------------|-------|---------------|--------------|---|
| 1    | Luxembourg (2012)         | 40.56 | 100.00        | 0.97         | ● | 65   | Dominican Republic (2014)  | 2.34  | 12.09         | 0.40         |   |
| 1    | Qatar                     | 37.71 | 100.00        | 0.97         | ● | 66   | Thailand                   | 2.10  | 10.85         | 0.39         |   |
| 1    | Singapore (2013)          | 19.17 | 100.00        | 0.97         | ● | 67   | Azerbaijan                 | 2.05  | 10.58         | 0.38         |   |
| 1    | United Arab Emirates      | 46.90 | 100.00        | 0.97         | ● | 68   | Kazakhstan (2016)          | 2.01  | 10.36         | 0.37         |   |
| 5    | New Zealand (2014)        | 18.74 | 97.80         | 0.96         | ● | 69   | Tunisia                    | 2.00  | 10.29         | 0.36         |   |
| 6    | Australia (2014)          | 18.30 | 95.50         | 0.95         | ● | 70   | Egypt (2014)               | 1.88  | 9.68          | 0.35         |   |
| 7    | United Kingdom (2014)     | 18.22 | 95.07         | 0.94         |   | 71   | Morocco (2014)             | 1.80  | 9.27          | 0.34         |   |
| 8    | Cyprus                    | 17.56 | 91.61         | 0.93         |   | 72   | Côte d'Ivoire              | 1.80  | 9.25          | 0.33         |   |
| 9    | Switzerland (2014)        | 17.11 | 89.24         | 0.92         |   | 73   | Madagascar (2014)          | 1.77  | 9.10          | 0.32         |   |
| 10   | Austria                   | 15.89 | 82.89         | 0.92         | ● | 74   | Albania                    | 1.69  | 8.66          | 0.31         |   |
| 11   | Senegal                   | 15.79 | 82.38         | 0.91         | ● | 75   | Korea, Rep. (2013)         | 1.66  | 8.54          | 0.30         | ○ |
| 12   | Bahrain                   | 13.87 | 72.35         | 0.90         | ● | 76   | Botswana (2014)            | 1.63  | 8.38          | 0.29         |   |
| 13   | Jordan                    | 12.91 | 67.32         | 0.89         | ● | 77   | Poland (2013)              | 1.46  | 7.48          | 0.28         | ○ |
| 14   | Belgium (2014)            | 11.19 | 58.35         | 0.88         |   | 78   | Togo (2007)                | 1.41  | 7.23          | 0.27         |   |
| 15   | Uganda (2011)             | 10.73 | 55.94         | 0.87         | ● | 79   | Malawi (2010)              | 1.14  | 5.79          | 0.26         |   |
| 16   | Hong Kong (China)         | 10.70 | 55.77         | 0.86         |   | 80   | Cameroon (2012)            | 1.13  | 5.77          | 0.25         |   |
| 17   | Namibia (2008)            | 10.17 | 52.99         | 0.85         | ● | 81   | Burundi (2013)             | 1.00  | 5.07          | 0.25         |   |
| 18   | Denmark (2014)            | 9.93  | 51.76         | 0.84         |   | 82   | Rwanda (2013)              | 0.96  | 4.85          | 0.24         |   |
| 19   | Lebanon                   | 9.85  | 51.35         | 0.83         | ● | 83   | Guinea (2012)              | 0.92  | 4.66          | 0.23         |   |
| 20   | France (2014)             | 9.84  | 51.28         | 0.82         |   | 84   | Turkey (2014)              | 0.88  | 4.46          | 0.22         |   |
| 21   | Czech Republic (2014)     | 9.83  | 51.22         | 0.81         |   | 85   | Honduras (2014)            | 0.69  | 3.48          | 0.21         |   |
| 22   | Benin (2010)              | 7.92  | 41.24         | 0.80         | ● | 86   | Mongolia                   | 0.69  | 3.48          | 0.20         |   |
| 23   | Germany                   | 7.68  | 40.00         | 0.79         |   | 87   | Tajikistan (2016)          | 0.63  | 3.16          | 0.19         |   |
| 24   | Finland                   | 7.65  | 39.83         | 0.78         |   | 88   | Algeria                    | 0.62  | 3.08          | 0.18         |   |
| 25   | Bosnia and Herzegovina    | 7.47  | 38.90         | 0.77         | ● | 89   | Ecuador (2012)             | 0.59  | 2.94          | 0.17         |   |
| 26   | Malaysia                  | 7.37  | 38.36         | 0.76         |   | 90   | Mali (2011)                | 0.53  | 2.61          | 0.16         |   |
| 27   | Netherlands (2012)        | 7.25  | 37.72         | 0.75         |   | 91   | Zimbabwe                   | 0.47  | 2.29          | 0.15         |   |
| 28   | Hungary                   | 7.05  | 36.71         | 0.75         |   | 92   | El Salvador (2014)         | 0.40  | 1.94          | 0.14         |   |
| 29   | Ireland (2014)            | 7.00  | 36.42         | 0.74         |   | 93   | Croatia (2014)             | 0.38  | 1.87          | 0.13         | ○ |
| 30   | Iceland (2013)            | 6.54  | 34.03         | 0.73         |   | 94   | Mozambique (2014)          | 0.37  | 1.79          | 0.12         |   |
| 31   | Malta                     | 6.21  | 32.32         | 0.72         |   | 95   | Sri Lanka                  | 0.32  | 1.53          | 0.11         | ○ |
| 32   | Sweden (2014)             | 5.91  | 30.71         | 0.71         |   | 96   | Chile                      | 0.31  | 1.48          | 0.10         | ○ |
| 33   | Slovakia (2014)           | 5.61  | 29.19         | 0.70         |   | 97   | Iran, Islamic Rep.         | 0.29  | 1.35          | 0.09         |   |
| 34   | Niger (2012)              | 5.43  | 28.21         | 0.69         | ● | 98   | China                      | 0.28  | 1.34          | 0.08         | ○ |
| 35   | Estonia                   | 5.18  | 26.91         | 0.68         |   | 99   | Mexico (2013)              | 0.24  | 1.12          | 0.08         | ○ |
| 36   | Latvia (2014)             | 4.99  | 25.94         | 0.67         |   | 100  | Brazil (2014)              | 0.24  | 1.09          | 0.07         | ○ |
| 37   | Brunei Darussalam         | 4.87  | 25.29         | 0.66         |   | 101  | Colombia                   | 0.18  | 0.82          | 0.06         | ○ |
| 38   | Saudi Arabia              | 4.78  | 24.85         | 0.65         |   | 102  | India (2014)               | 0.13  | 0.53          | 0.05         | ○ |
| 39   | Italy (2014)              | 4.72  | 24.52         | 0.64         |   | 103  | Viet Nam                   | 0.12  | 0.46          | 0.04         | ○ |
| 40   | United States of America  | 4.65  | 24.13         | 0.63         |   | 104  | Indonesia (2012)           | 0.12  | 0.46          | 0.03         | ○ |
| 41   | Kyrgyzstan (2014)         | 4.51  | 23.40         | 0.62         |   | 105  | Philippines (2008)         | 0.10  | 0.38          | 0.02         | ○ |
| 42   | Romania                   | 4.26  | 22.11         | 0.61         |   | 106  | Bangladesh (2009)          | 0.10  | 0.38          | 0.01         | ○ |
| 43   | Yemen (2011)              | 4.26  | 22.11         | 0.60         | ● | 107  | Nepal (2011)               | 0.03  | 0.00          | 0.00         | ○ |
| 44   | Bulgaria                  | 4.25  | 22.04         | 0.59         |   | n/a  | Argentina                  | n/a   | n/a           | n/a          |   |
| 45   | Greece (2013)             | 4.19  | 21.73         | 0.58         |   | n/a  | Bolivia, Plurinational St. | n/a   | n/a           | n/a          |   |
| 46   | South Africa (2014)       | 4.18  | 21.71         | 0.58         |   | n/a  | Cambodia                   | n/a   | n/a           | n/a          |   |
| 47   | Armenia                   | 4.14  | 21.49         | 0.57         |   | n/a  | Canada                     | n/a   | n/a           | n/a          |   |
| 48   | Serbia                    | 4.13  | 21.41         | 0.56         |   | n/a  | Costa Rica                 | n/a   | n/a           | n/a          |   |
| 49   | Portugal (2014)           | 4.11  | 21.33         | 0.55         |   | n/a  | Ethiopia                   | n/a   | n/a           | n/a          |   |
| 50   | Mauritius                 | 4.02  | 20.88         | 0.54         |   | n/a  | Guatemala                  | n/a   | n/a           | n/a          |   |
| 51   | Georgia                   | 3.75  | 19.42         | 0.53         |   | n/a  | Jamaica                    | n/a   | n/a           | n/a          |   |
| 52   | Norway                    | 3.55  | 18.40         | 0.52         | ○ | n/a  | Kenya                      | n/a   | n/a           | n/a          |   |
| 53   | Japan (2014)              | 3.44  | 17.81         | 0.51         |   | n/a  | Kuwait                     | n/a   | n/a           | n/a          |   |
| 54   | Belarus                   | 3.33  | 17.25         | 0.50         |   | n/a  | Montenegro                 | n/a   | n/a           | n/a          |   |
| 55   | Ukraine                   | 3.24  | 16.80         | 0.49         |   | n/a  | Nigeria                    | n/a   | n/a           | n/a          |   |
| 56   | Russian Federation (2014) | 3.05  | 15.79         | 0.48         |   | n/a  | Pakistan                   | n/a   | n/a           | n/a          |   |
| 57   | Burkina Faso (2013)       | 2.90  | 15.01         | 0.47         |   | n/a  | Panama                     | n/a   | n/a           | n/a          |   |
| 58   | Spain (2013)              | 2.86  | 14.81         | 0.46         | ○ | n/a  | Paraguay                   | n/a   | n/a           | n/a          |   |
| 59   | TFYR of Macedonia (2014)  | 2.84  | 14.68         | 0.45         |   | n/a  | Peru                       | n/a   | n/a           | n/a          |   |
| 60   | Oman                      | 2.81  | 14.55         | 0.44         |   | n/a  | Tanzania, United Rep.      | n/a   | n/a           | n/a          |   |
| 61   | Israel (2014)             | 2.78  | 14.37         | 0.43         | ○ | n/a  | Trinidad and Tobago        | n/a   | n/a           | n/a          |   |
| 62   | Slovenia (2014)           | 2.75  | 14.21         | 0.42         |   | n/a  | Uruguay                    | n/a   | n/a           | n/a          |   |
| 63   | Moldova, Rep.             | 2.50  | 12.91         | 0.42         |   | n/a  | Zambia                     | n/a   | n/a           | n/a          |   |
| 64   | Lithuania (2013)          | 2.45  | 12.67         | 0.41         |   |      |                            |       |               |              |   |

SOURCE: UNESCO Institute for Statistics, *UIS online database*

NOTE: ● indicates a strength; ○ a weakness

# 2.3.1

## Researchers

Researchers, full-time equivalence (FTE) (per million population) | 2015

| Rank | Country/Economy                 | Value    | Score (0–100) | Percent rank |   | Rank | Country/Economy                   | Value  | Score (0–100) | Percent rank |   |
|------|---------------------------------|----------|---------------|--------------|---|------|-----------------------------------|--------|---------------|--------------|---|
| 1    | Israel (2012)                   | 8,255.40 | 100.00        | 1.00         | ● | 65   | South Africa (2013)               | 437.06 | 5.15          | 0.36         |   |
| 2    | Denmark                         | 7,483.58 | 90.64         | 0.99         | ● | 66   | Ecuador (2014)                    | 400.72 | 4.71          | 0.35         |   |
| 3    | Korea, Rep.                     | 7,087.35 | 85.83         | 0.98         | ● | 67   | Bahrain (2014)                    | 361.99 | 4.24          | 0.34         |   |
| 4    | Sweden                          | 7,021.88 | 85.04         | 0.97         | ● | 68   | Senegal (2010)                    | 361.12 | 4.23          | 0.33         |   |
| 5    | Finland                         | 6,816.77 | 82.55         | 0.96         |   | 69   | Bosnia and Herzegovina            | 328.70 | 3.84          | 0.32         |   |
| 6    | Singapore (2014)                | 6,658.50 | 80.63         | 0.95         |   | 70   | Jordan                            | 307.98 | 3.59          | 0.31         |   |
| 7    | Norway                          | 5,915.60 | 71.62         | 0.94         |   | 71   | Pakistan                          | 294.36 | 3.42          | 0.30         |   |
| 8    | Iceland                         | 5,902.53 | 71.46         | 0.93         |   | 72   | Mexico (2013)                     | 241.80 | 2.78          | 0.29         |   |
| 9    | Japan                           | 5,230.72 | 63.31         | 0.92         |   | 73   | Kenya (2010)                      | 230.73 | 2.65          | 0.28         |   |
| 10   | Luxembourg                      | 5,058.28 | 61.21         | 0.91         |   | 74   | Oman                              | 201.97 | 2.30          | 0.27         |   |
| 11   | Austria                         | 4,955.03 | 59.96         | 0.90         |   | 75   | Philippines (2013)                | 189.41 | 2.15          | 0.26         |   |
| 12   | Belgium                         | 4,875.34 | 59.00         | 0.89         |   | 76   | Paraguay                          | 184.06 | 2.08          | 0.25         |   |
| 13   | Ireland                         | 4,575.20 | 55.35         | 0.88         |   | 77   | Mauritius (2012)                  | 181.11 | 2.05          | 0.24         |   |
| 14   | Netherlands                     | 4,548.14 | 55.03         | 0.87         |   | 78   | Botswana (2013)                   | 175.51 | 1.98          | 0.23         |   |
| 15   | Australia (2010)                | 4,530.73 | 54.81         | 0.86         |   | 79   | Bolivia, Plurinational St. (2010) | 165.95 | 1.86          | 0.22         |   |
| 16   | Canada (2013)                   | 4,518.51 | 54.67         | 0.85         |   | 80   | Albania (2008)                    | 157.34 | 1.76          | 0.21         |   |
| 17   | Switzerland (2012)              | 4,481.07 | 54.21         | 0.84         |   | 81   | India (2010)                      | 156.64 | 1.75          | 0.20         |   |
| 18   | United Kingdom                  | 4,470.78 | 54.09         | 0.83         |   | 82   | Namibia (2014)                    | 141.41 | 1.57          | 0.19         |   |
| 19   | Germany                         | 4,431.08 | 53.61         | 0.82         |   | 83   | Kuwait (2012)                     | 128.38 | 1.41          | 0.18         |   |
| 20   | United States of America (2014) | 4,231.99 | 51.19         | 0.81         |   | 84   | Colombia (2014)                   | 114.89 | 1.24          | 0.17         | ○ |
| 21   | France (2014)                   | 4,168.78 | 50.42         | 0.80         |   | 85   | Sri Lanka (2013)                  | 110.91 | 1.20          | 0.16         |   |
| 22   | New Zealand (2013)              | 4,008.71 | 48.48         | 0.79         |   | 86   | Zimbabwe (2012)                   | 89.61  | 0.94          | 0.15         |   |
| 23   | Portugal                        | 3,824.19 | 46.24         | 0.78         |   | 87   | Indonesia (2009)                  | 89.53  | 0.94          | 0.14         |   |
| 24   | Slovenia                        | 3,820.99 | 46.20         | 0.77         |   | 88   | Madagascar (2011)                 | 51.02  | 0.47          | 0.13         |   |
| 25   | Czech Republic                  | 3,611.91 | 43.67         | 0.76         |   | 89   | Malawi (2010)                     | 49.57  | 0.45          | 0.12         |   |
| 26   | Hong Kong (China) (2014)        | 3,297.56 | 39.85         | 0.75         |   | 90   | Burkina Faso (2010)               | 47.50  | 0.43          | 0.11         |   |
| 27   | Greece                          | 3,201.27 | 38.69         | 0.74         |   | 91   | Ethiopia (2013)                   | 45.12  | 0.40          | 0.10         |   |
| 28   | Estonia                         | 3,189.19 | 38.54         | 0.73         |   | 92   | Mozambique                        | 41.53  | 0.35          | 0.09         |   |
| 29   | Russian Federation              | 3,131.11 | 37.84         | 0.72         |   | 93   | Zambia (2008)                     | 40.87  | 0.35          | 0.08         |   |
| 30   | Lithuania                       | 2,822.40 | 34.09         | 0.71         |   | 94   | Panama (2013)                     | 39.41  | 0.33          | 0.07         | ○ |
| 31   | Slovakia                        | 2,654.78 | 32.06         | 0.70         |   | 95   | Nigeria (2007)                    | 38.58  | 0.32          | 0.06         |   |
| 32   | Spain                           | 2,654.65 | 32.06         | 0.69         |   | 96   | Togo (2014)                       | 38.17  | 0.31          | 0.05         |   |
| 33   | Hungary                         | 2,568.84 | 31.01         | 0.68         |   | 97   | Uganda (2010)                     | 38.09  | 0.31          | 0.04         | ○ |
| 34   | Poland                          | 2,139.10 | 25.80         | 0.67         |   | 98   | Mali (2010)                       | 29.17  | 0.20          | 0.03         | ○ |
| 35   | Serbia                          | 2,071.22 | 24.98         | 0.66         |   | 99   | Guatemala (2012)                  | 26.74  | 0.18          | 0.02         | ○ |
| 36   | Italy                           | 2,018.09 | 24.33         | 0.65         |   | 100  | Tanzania, United Rep. (2013)      | 18.49  | 0.08          | 0.01         | ○ |
| 37   | Malaysia (2014)                 | 2,017.42 | 24.32         | 0.64         |   | 101  | Rwanda (2009)                     | 12.29  | 0.00          | 0.00         | ○ |
| 38   | United Arab Emirates            | 2,003.39 | 24.15         | 0.63         |   | n/a  | Algeria                           | n/a    | n/a           | n/a          |   |
| 39   | Bulgaria                        | 1,989.43 | 23.99         | 0.62         |   | n/a  | Armenia                           | n/a    | n/a           | n/a          |   |
| 40   | Malta                           | 1,951.42 | 23.52         | 0.61         |   | n/a  | Azerbaijan                        | n/a    | n/a           | n/a          |   |
| 41   | Latvia                          | 1,833.54 | 22.09         | 0.60         |   | n/a  | Bangladesh                        | n/a    | n/a           | n/a          |   |
| 42   | Tunisia                         | 1,787.26 | 21.53         | 0.59         |   | n/a  | Belarus                           | n/a    | n/a           | n/a          |   |
| 43   | Croatia                         | 1,501.54 | 18.07         | 0.58         |   | n/a  | Benin                             | n/a    | n/a           | n/a          |   |
| 44   | Argentina (2014)                | 1,202.07 | 14.43         | 0.57         |   | n/a  | Brunei Darussalam                 | n/a    | n/a           | n/a          |   |
| 45   | China                           | 1,176.58 | 14.12         | 0.56         |   | n/a  | Burundi                           | n/a    | n/a           | n/a          |   |
| 46   | Turkey (2014)                   | 1,156.51 | 13.88         | 0.55         |   | n/a  | Cambodia                          | n/a    | n/a           | n/a          |   |
| 47   | Morocco (2014)                  | 1,032.54 | 12.38         | 0.54         |   | n/a  | Cameroon                          | n/a    | n/a           | n/a          |   |
| 48   | Cyprus                          | 1,013.77 | 12.15         | 0.53         |   | n/a  | Côte d'Ivoire                     | n/a    | n/a           | n/a          |   |
| 49   | Ukraine                         | 1,006.00 | 12.05         | 0.52         |   | n/a  | Dominican Republic                | n/a    | n/a           | n/a          |   |
| 50   | Romania                         | 894.81   | 10.71         | 0.51         |   | n/a  | El Salvador                       | n/a    | n/a           | n/a          |   |
| 51   | Thailand                        | 874.29   | 10.46         | 0.50         |   | n/a  | Guinea                            | n/a    | n/a           | n/a          |   |
| 52   | TFYR of Macedonia               | 858.81   | 10.27         | 0.49         |   | n/a  | Honduras                          | n/a    | n/a           | n/a          |   |
| 53   | Montenegro                      | 835.76   | 9.99          | 0.48         |   | n/a  | Jamaica                           | n/a    | n/a           | n/a          |   |
| 54   | Kazakhstan (2013)               | 734.05   | 8.76          | 0.47         |   | n/a  | Kyrgyzstan                        | n/a    | n/a           | n/a          |   |
| 55   | Brazil (2010)                   | 698.10   | 8.32          | 0.46         |   | n/a  | Lebanon                           | n/a    | n/a           | n/a          |   |
| 56   | Iran, Islamic Rep. (2012)       | 691.41   | 8.24          | 0.45         |   | n/a  | Mongolia                          | n/a    | n/a           | n/a          |   |
| 57   | Egypt                           | 679.81   | 8.10          | 0.44         |   | n/a  | Nepal                             | n/a    | n/a           | n/a          |   |
| 58   | Viet Nam (2013)                 | 674.81   | 8.04          | 0.43         |   | n/a  | Niger                             | n/a    | n/a           | n/a          |   |
| 59   | Moldova, Rep.                   | 662.10   | 7.88          | 0.42         |   | n/a  | Peru                              | n/a    | n/a           | n/a          |   |
| 60   | Qatar (2012)                    | 597.06   | 7.09          | 0.41         |   | n/a  | Saudi Arabia                      | n/a    | n/a           | n/a          |   |
| 61   | Georgia (2014)                  | 585.41   | 6.95          | 0.40         |   | n/a  | Tajikistan                        | n/a    | n/a           | n/a          |   |
| 62   | Costa Rica (2014)               | 572.98   | 6.80          | 0.39         |   | n/a  | Trinidad and Tobago               | n/a    | n/a           | n/a          |   |
| 63   | Uruguay                         | 524.25   | 6.21          | 0.38         |   | n/a  | Yemen                             | n/a    | n/a           | n/a          |   |
| 64   | Chile                           | 455.50   | 5.38          | 0.37         |   |      |                                   |        |               |              |   |

SOURCE: UNESCO Institute for Statistics, *UIS online database*

NOTE: ● indicates a strength; ○ a weakness

## 2.3.2 Gross expenditure on R&D (GERD)

GERD: Gross expenditure on R&D (% of GDP) | 2015

| Rank | Country/Economy              | Value | Score (0–100) | Percent rank |   | Rank | Country/Economy                   | Value | Score (0–100) | Percent rank |   |
|------|------------------------------|-------|---------------|--------------|---|------|-----------------------------------|-------|---------------|--------------|---|
| 1    | Israel                       | 4.30  | 100.00        | 1.00         | ● | 65   | Uganda (2010)                     | 0.48  | 10.75         | 0.41         |   |
| 2    | Korea, Rep.                  | 4.23  | 98.40         | 0.99         | ● | 66   | Qatar (2012)                      | 0.47  | 10.61         | 0.40         |   |
| 3    | Japan                        | 3.49  | 81.17         | 0.98         | ● | 67   | Cyprus                            | 0.46  | 10.42         | 0.39         |   |
| 4    | Sweden                       | 3.28  | 76.24         | 0.97         | ● | 68   | Ecuador (2014)                    | 0.45  | 10.06         | 0.39         |   |
| 5    | Austria                      | 3.10  | 71.91         | 0.96         | ● | 69   | TFYR of Macedonia                 | 0.44  | 9.99          | 0.38         |   |
| 6    | Denmark                      | 3.02  | 70.12         | 0.95         |   | 70   | Jordan (2008)                     | 0.43  | 9.79          | 0.37         |   |
| 7    | Switzerland (2012)           | 2.97  | 68.87         | 0.94         |   | 71   | Chile                             | 0.39  | 8.67          | 0.36         |   |
| 8    | Finland                      | 2.93  | 68.01         | 0.94         |   | 72   | Montenegro                        | 0.38  | 8.51          | 0.35         |   |
| 9    | Germany                      | 2.88  | 66.89         | 0.93         |   | 73   | Viet Nam (2013)                   | 0.37  | 8.37          | 0.34         |   |
| 10   | United States of America     | 2.80  | 65.04         | 0.92         |   | 74   | Moldova, Rep.                     | 0.37  | 8.29          | 0.33         |   |
| 11   | Belgium                      | 2.46  | 57.06         | 0.91         | ● | 75   | Mozambique                        | 0.34  | 7.58          | 0.32         |   |
| 12   | France                       | 2.23  | 51.63         | 0.90         |   | 76   | Namibia (2014)                    | 0.34  | 7.55          | 0.31         |   |
| 13   | Iceland                      | 2.22  | 51.34         | 0.89         |   | 77   | Uruguay (2014)                    | 0.34  | 7.48          | 0.30         |   |
| 14   | Slovenia                     | 2.21  | 51.30         | 0.88         |   | 78   | Iran, Islamic Rep. (2012)         | 0.33  | 7.23          | 0.29         |   |
| 15   | Singapore (2014)             | 2.20  | 50.91         | 0.87         |   | 79   | Nepal (2010)                      | 0.30  | 6.70          | 0.28         |   |
| 16   | Australia (2013)             | 2.20  | 50.89         | 0.86         |   | 80   | Kuwait (2013)                     | 0.30  | 6.69          | 0.28         |   |
| 17   | China                        | 2.09  | 48.51         | 0.85         |   | 81   | Zambia (2008)                     | 0.28  | 6.14          | 0.27         |   |
| 18   | Netherlands                  | 2.01  | 46.52         | 0.84         |   | 82   | Togo (2014)                       | 0.27  | 5.99          | 0.26         |   |
| 19   | Czech Republic               | 1.98  | 45.91         | 0.83         |   | 83   | Armenia                           | 0.25  | 5.48          | 0.25         |   |
| 20   | Norway                       | 1.93  | 44.59         | 0.83         |   | 84   | Pakistan                          | 0.25  | 5.40          | 0.24         |   |
| 21   | United Kingdom               | 1.71  | 39.50         | 0.82         |   | 85   | Oman                              | 0.24  | 5.37          | 0.23         |   |
| 22   | Canada (2014)                | 1.61  | 37.29         | 0.81         |   | 86   | Colombia                          | 0.24  | 5.29          | 0.22         | ○ |
| 23   | Ireland (2014)               | 1.55  | 35.71         | 0.80         |   | 87   | Azerbaijan                        | 0.22  | 4.84          | 0.21         |   |
| 24   | Estonia                      | 1.48  | 34.18         | 0.79         |   | 88   | Bosnia and Herzegovina            | 0.22  | 4.82          | 0.20         |   |
| 25   | Hungary                      | 1.39  | 32.07         | 0.78         |   | 89   | Nigeria (2007)                    | 0.22  | 4.76          | 0.19         |   |
| 26   | Italy                        | 1.34  | 30.87         | 0.77         |   | 90   | Burkina Faso (2009)               | 0.20  | 4.32          | 0.18         |   |
| 27   | Luxembourg                   | 1.29  | 29.70         | 0.76         |   | 91   | Mauritius (2012)                  | 0.18  | 3.88          | 0.17         | ○ |
| 28   | Portugal                     | 1.28  | 29.43         | 0.75         |   | 92   | Kazakhstan (2013)                 | 0.17  | 3.53          | 0.17         |   |
| 29   | Malaysia (2014)              | 1.26  | 29.11         | 0.74         |   | 93   | Bolivia, Plurinational St. (2009) | 0.16  | 3.31          | 0.16         |   |
| 30   | Spain                        | 1.22  | 28.08         | 0.73         |   | 94   | Mongolia                          | 0.15  | 3.26          | 0.15         |   |
| 31   | Slovakia                     | 1.19  | 27.36         | 0.72         |   | 95   | Albania (2008)                    | 0.15  | 3.25          | 0.14         |   |
| 32   | Brazil (2014)                | 1.17  | 26.91         | 0.72         | ● | 96   | Philippines (2013)                | 0.14  | 2.87          | 0.13         |   |
| 33   | New Zealand (2013)           | 1.15  | 26.59         | 0.71         |   | 97   | Peru                              | 0.13  | 2.75          | 0.12         | ○ |
| 34   | Russian Federation           | 1.13  | 26.06         | 0.70         |   | 98   | Paraguay                          | 0.13  | 2.61          | 0.11         |   |
| 35   | Lithuania                    | 1.04  | 23.93         | 0.69         |   | 99   | Burundi (2011)                    | 0.12  | 2.48          | 0.10         |   |
| 36   | Poland                       | 1.01  | 23.20         | 0.68         |   | 100  | Kyrgyzstan                        | 0.12  | 2.47          | 0.09         |   |
| 37   | Turkey (2014)                | 1.01  | 23.14         | 0.67         |   | 101  | Tajikistan (2013)                 | 0.12  | 2.40          | 0.08         |   |
| 38   | Bulgaria                     | 0.98  | 22.54         | 0.66         |   | 102  | Sri Lanka (2013)                  | 0.10  | 2.00          | 0.07         | ○ |
| 39   | Greece                       | 0.96  | 21.97         | 0.65         |   | 103  | Bahrain (2014)                    | 0.10  | 1.98          | 0.06         | ○ |
| 40   | Serbia                       | 0.88  | 20.20         | 0.64         |   | 104  | Georgia (2014)                    | 0.10  | 1.95          | 0.06         | ○ |
| 41   | United Arab Emirates         | 0.87  | 19.85         | 0.63         |   | 105  | Indonesia (2013)                  | 0.08  | 1.63          | 0.05         | ○ |
| 42   | Croatia                      | 0.85  | 19.57         | 0.62         |   | 106  | El Salvador (2014)                | 0.08  | 1.62          | 0.04         | ○ |
| 43   | India (2011)                 | 0.83  | 19.05         | 0.61         |   | 107  | Trinidad and Tobago (2014)        | 0.08  | 1.47          | 0.03         | ○ |
| 44   | Saudi Arabia (2013)          | 0.82  | 18.73         | 0.61         |   | 108  | Panama (2013)                     | 0.06  | 1.12          | 0.02         | ○ |
| 45   | Kenya (2010)                 | 0.79  | 17.99         | 0.60         |   | 109  | Guatemala (2012)                  | 0.04  | 0.69          | 0.01         | ○ |
| 46   | Malta (2014)                 | 0.76  | 17.44         | 0.59         |   | 110  | Madagascar (2014)                 | 0.02  | 0.00          | 0.00         | ○ |
| 47   | Hong Kong (China) (2014)     | 0.74  | 16.93         | 0.58         |   | n/a  | Algeria                           | n/a   | n/a           | n/a          |   |
| 48   | South Africa (2013)          | 0.73  | 16.59         | 0.57         |   | n/a  | Bangladesh                        | n/a   | n/a           | n/a          |   |
| 49   | Egypt                        | 0.72  | 16.51         | 0.56         |   | n/a  | Benin                             | n/a   | n/a           | n/a          |   |
| 50   | Morocco (2010)               | 0.71  | 16.32         | 0.55         |   | n/a  | Brunei Darussalam                 | n/a   | n/a           | n/a          |   |
| 51   | Tunisia (2014)               | 0.65  | 14.92         | 0.54         |   | n/a  | Cambodia                          | n/a   | n/a           | n/a          |   |
| 52   | Thailand                     | 0.63  | 14.24         | 0.53         |   | n/a  | Cameroon                          | n/a   | n/a           | n/a          |   |
| 53   | Latvia                       | 0.62  | 14.23         | 0.52         |   | n/a  | Côte d'Ivoire                     | n/a   | n/a           | n/a          |   |
| 54   | Ukraine                      | 0.62  | 14.06         | 0.51         |   | n/a  | Dominican Republic                | n/a   | n/a           | n/a          |   |
| 55   | Argentina (2014)             | 0.61  | 13.95         | 0.50         |   | n/a  | Guinea                            | n/a   | n/a           | n/a          |   |
| 56   | Ethiopia (2013)              | 0.60  | 13.76         | 0.50         |   | n/a  | Honduras                          | n/a   | n/a           | n/a          |   |
| 57   | Costa Rica (2014)            | 0.58  | 13.28         | 0.49         |   | n/a  | Jamaica                           | n/a   | n/a           | n/a          |   |
| 58   | Mali (2010)                  | 0.58  | 13.27         | 0.48         |   | n/a  | Lebanon                           | n/a   | n/a           | n/a          |   |
| 59   | Mexico                       | 0.55  | 12.51         | 0.47         |   | n/a  | Malawi                            | n/a   | n/a           | n/a          |   |
| 60   | Botswana (2013)              | 0.54  | 12.27         | 0.46         |   | n/a  | Niger                             | n/a   | n/a           | n/a          |   |
| 61   | Senegal (2010)               | 0.54  | 12.27         | 0.45         |   | n/a  | Rwanda                            | n/a   | n/a           | n/a          |   |
| 62   | Tanzania, United Rep. (2013) | 0.53  | 12.00         | 0.44         |   | n/a  | Yemen                             | n/a   | n/a           | n/a          |   |
| 63   | Belarus                      | 0.52  | 11.71         | 0.43         |   | n/a  | Zimbabwe                          | n/a   | n/a           | n/a          |   |
| 64   | Romania                      | 0.49  | 11.03         | 0.42         |   |      |                                   |       |               |              |   |

SOURCE: UNESCO Institute for Statistics, *UIS online database*

NOTE: ● indicates a strength; ○ a weakness

## 2.3.3 Global R&D companies, average expenditure top 3

### Average expenditure of the top 3 global companies by R&D, mn \$US | 2016

| Rank | Country/Economy            | Value     | Score (0–100) | Percent rank |   | Rank | Country/Economy       | Value | Score (0–100) | Percent rank |   |
|------|----------------------------|-----------|---------------|--------------|---|------|-----------------------|-------|---------------|--------------|---|
| 1    | United States of America   | 11,774.73 | 100.00        | 1.00         | ● | 43   | Dominican Republic    | 0.00  | 0.00          | 0.00         | ○ |
| 2    | Germany                    | 8,986.88  | 97.12         | 0.99         | ● | 43   | Ecuador               | 0.00  | 0.00          | 0.00         | ○ |
| 3    | Switzerland                | 6,880.31  | 94.27         | 0.98         | ● | 43   | Egypt                 | 0.00  | 0.00          | 0.00         | ○ |
| 4    | Japan                      | 6,236.99  | 93.22         | 0.98         | ● | 43   | El Salvador           | 0.00  | 0.00          | 0.00         | ○ |
| 5    | Korea, Rep.                | 5,969.54  | 92.75         | 0.97         |   | 43   | Estonia               | 0.00  | 0.00          | 0.00         | ○ |
| 6    | China                      | 4,251.64  | 89.13         | 0.96         |   | 43   | Ethiopia              | 0.00  | 0.00          | 0.00         | ○ |
| 7    | United Kingdom             | 3,826.19  | 88.01         | 0.95         |   | 43   | Georgia               | 0.00  | 0.00          | 0.00         | ○ |
| 8    | France                     | 3,510.28  | 87.09         | 0.94         | ● | 43   | Guatemala             | 0.00  | 0.00          | 0.00         | ○ |
| 9    | Italy                      | 2,756.74  | 84.51         | 0.94         | ● | 43   | Guinea                | 0.00  | 0.00          | 0.00         | ○ |
| 10   | Netherlands                | 2,382.30  | 82.96         | 0.93         |   | 43   | Honduras              | 0.00  | 0.00          | 0.00         | ○ |
| 11   | Sweden                     | 2,177.94  | 82.00         | 0.92         |   | 43   | Hong Kong (China)     | 0.00  | 0.00          | 0.00         | ○ |
| 12   | Ireland                    | 1,999.59  | 81.09         | 0.91         |   | 43   | Indonesia             | 0.00  | 0.00          | 0.00         | ○ |
| 13   | Spain                      | 1,118.38  | 74.90         | 0.90         | ● | 43   | Iran, Islamic Rep.    | 0.00  | 0.00          | 0.00         | ○ |
| 14   | India                      | 1,024.65  | 73.96         | 0.90         | ● | 43   | Jamaica               | 0.00  | 0.00          | 0.00         | ○ |
| 15   | Finland                    | 980.14    | 73.49         | 0.89         |   | 43   | Jordan                | 0.00  | 0.00          | 0.00         | ○ |
| 16   | Canada                     | 955.01    | 73.21         | 0.88         |   | 43   | Kazakhstan            | 0.00  | 0.00          | 0.00         | ○ |
| 17   | Denmark                    | 880.30    | 72.34         | 0.87         |   | 43   | Kenya                 | 0.00  | 0.00          | 0.00         | ○ |
| 18   | Israel                     | 658.14    | 69.25         | 0.87         |   | 43   | Kuwait                | 0.00  | 0.00          | 0.00         | ○ |
| 19   | Australia                  | 621.34    | 68.63         | 0.86         |   | 43   | Kyrgyzstan            | 0.00  | 0.00          | 0.00         | ○ |
| 20   | Belgium                    | 517.07    | 66.68         | 0.85         |   | 43   | Latvia                | 0.00  | 0.00          | 0.00         | ○ |
| 21   | Brazil                     | 489.77    | 66.10         | 0.84         | ● | 43   | Lebanon               | 0.00  | 0.00          | 0.00         | ○ |
| 22   | Singapore                  | 403.62    | 64.04         | 0.83         |   | 43   | Lithuania             | 0.00  | 0.00          | 0.00         | ○ |
| 23   | Saudi Arabia               | 330.37    | 61.91         | 0.83         | ● | 43   | Madagascar            | 0.00  | 0.00          | 0.00         | ○ |
| 24   | Norway                     | 186.62    | 55.84         | 0.82         |   | 43   | Malawi                | 0.00  | 0.00          | 0.00         | ○ |
| 25   | Russian Federation         | 182.99    | 55.63         | 0.81         |   | 43   | Mali                  | 0.00  | 0.00          | 0.00         | ○ |
| 26   | Luxembourg                 | 155.41    | 53.90         | 0.80         |   | 43   | Mauritius             | 0.00  | 0.00          | 0.00         | ○ |
| 27   | Austria                    | 126.49    | 51.72         | 0.79         |   | 43   | Moldova, Rep.         | 0.00  | 0.00          | 0.00         | ○ |
| 28   | Slovenia                   | 122.34    | 51.37         | 0.79         |   | 43   | Mongolia              | 0.00  | 0.00          | 0.00         | ○ |
| 29   | Turkey                     | 119.93    | 51.16         | 0.78         |   | 43   | Montenegro            | 0.00  | 0.00          | 0.00         | ○ |
| 30   | Hungary                    | 118.71    | 51.05         | 0.77         |   | 43   | Morocco               | 0.00  | 0.00          | 0.00         | ○ |
| 31   | South Africa               | 103.40    | 49.59         | 0.76         |   | 43   | Mozambique            | 0.00  | 0.00          | 0.00         | ○ |
| 32   | New Zealand                | 75.80     | 46.31         | 0.75         |   | 43   | Namibia               | 0.00  | 0.00          | 0.00         | ○ |
| 33   | Colombia                   | 73.29     | 45.96         | 0.75         |   | 43   | Nepal                 | 0.00  | 0.00          | 0.00         | ○ |
| 34   | Iceland                    | 62.16     | 44.23         | 0.74         |   | 43   | Niger                 | 0.00  | 0.00          | 0.00         | ○ |
| 35   | Argentina                  | 58.77     | 43.64         | 0.73         | ● | 43   | Nigeria               | 0.00  | 0.00          | 0.00         | ○ |
| 36   | Thailand                   | 53.99     | 42.75         | 0.72         |   | 43   | Oman                  | 0.00  | 0.00          | 0.00         | ○ |
| 37   | Mexico                     | 52.85     | 42.52         | 0.71         |   | 43   | Pakistan              | 0.00  | 0.00          | 0.00         | ○ |
| 38   | Greece                     | 39.45     | 39.47         | 0.71         |   | 43   | Panama                | 0.00  | 0.00          | 0.00         | ○ |
| 39   | Portugal                   | 34.15     | 37.97         | 0.70         |   | 43   | Paraguay              | 0.00  | 0.00          | 0.00         | ○ |
| 40   | Czech Republic             | 32.58     | 37.49         | 0.69         |   | 43   | Peru                  | 0.00  | 0.00          | 0.00         | ○ |
| 41   | Malta                      | 32.44     | 37.44         | 0.68         |   | 43   | Philippines           | 0.00  | 0.00          | 0.00         | ○ |
| 42   | Malaysia                   | 26.88     | 35.50         | 0.67         |   | 43   | Poland                | 0.00  | 0.00          | 0.00         | ○ |
| 43   | Albania                    | 0.00      | 0.00          | 0.00         | ○ | 43   | Qatar                 | 0.00  | 0.00          | 0.00         | ○ |
| 43   | Algeria                    | 0.00      | 0.00          | 0.00         | ○ | 43   | Romania               | 0.00  | 0.00          | 0.00         | ○ |
| 43   | Armenia                    | 0.00      | 0.00          | 0.00         | ○ | 43   | Rwanda                | 0.00  | 0.00          | 0.00         | ○ |
| 43   | Azerbaijan                 | 0.00      | 0.00          | 0.00         | ○ | 43   | Senegal               | 0.00  | 0.00          | 0.00         | ○ |
| 43   | Bahrain                    | 0.00      | 0.00          | 0.00         | ○ | 43   | Serbia                | 0.00  | 0.00          | 0.00         | ○ |
| 43   | Bangladesh                 | 0.00      | 0.00          | 0.00         | ○ | 43   | Slovakia              | 0.00  | 0.00          | 0.00         | ○ |
| 43   | Belarus                    | 0.00      | 0.00          | 0.00         | ○ | 43   | Sri Lanka             | 0.00  | 0.00          | 0.00         | ○ |
| 43   | Benin                      | 0.00      | 0.00          | 0.00         | ○ | 43   | Tajikistan            | 0.00  | 0.00          | 0.00         | ○ |
| 43   | Bolivia, Plurinational St. | 0.00      | 0.00          | 0.00         | ○ | 43   | Tanzania, United Rep. | 0.00  | 0.00          | 0.00         | ○ |
| 43   | Bosnia and Herzegovina     | 0.00      | 0.00          | 0.00         | ○ | 43   | TFYR of Macedonia     | 0.00  | 0.00          | 0.00         | ○ |
| 43   | Botswana                   | 0.00      | 0.00          | 0.00         | ○ | 43   | Togo                  | 0.00  | 0.00          | 0.00         | ○ |
| 43   | Brunei Darussalam          | 0.00      | 0.00          | 0.00         | ○ | 43   | Trinidad and Tobago   | 0.00  | 0.00          | 0.00         | ○ |
| 43   | Bulgaria                   | 0.00      | 0.00          | 0.00         | ○ | 43   | Tunisia               | 0.00  | 0.00          | 0.00         | ○ |
| 43   | Burkina Faso               | 0.00      | 0.00          | 0.00         | ○ | 43   | Uganda                | 0.00  | 0.00          | 0.00         | ○ |
| 43   | Burundi                    | 0.00      | 0.00          | 0.00         | ○ | 43   | Ukraine               | 0.00  | 0.00          | 0.00         | ○ |
| 43   | Cambodia                   | 0.00      | 0.00          | 0.00         | ○ | 43   | United Arab Emirates  | 0.00  | 0.00          | 0.00         | ○ |
| 43   | Cameroon                   | 0.00      | 0.00          | 0.00         | ○ | 43   | Uruguay               | 0.00  | 0.00          | 0.00         | ○ |
| 43   | Chile                      | 0.00      | 0.00          | 0.00         | ○ | 43   | Viet Nam              | 0.00  | 0.00          | 0.00         | ○ |
| 43   | Costa Rica                 | 0.00      | 0.00          | 0.00         | ○ | 43   | Yemen                 | 0.00  | 0.00          | 0.00         | ○ |
| 43   | Côte d'Ivoire              | 0.00      | 0.00          | 0.00         | ○ | 43   | Zambia                | 0.00  | 0.00          | 0.00         | ○ |
| 43   | Croatia                    | 0.00      | 0.00          | 0.00         | ○ | 43   | Zimbabwe              | 0.00  | 0.00          | 0.00         | ○ |
| 43   | Cyprus                     | 0.00      | 0.00          | 0.00         | ○ |      |                       |       |               |              |   |

SOURCE: EU JRC Industrial R&D Investment Scoreboard 2016

NOTE: ● indicates a strength; ○ a weakness

## 2.3.4 QS university ranking average score top 3 universities

Average score of the top 3 universities at the QS world university ranking | 2016

| Rank | Country/Economy          | Value | Score (0–100) | Percent rank |   | Rank | Country/Economy            | Value | Score (0–100) | Percent rank |   |
|------|--------------------------|-------|---------------|--------------|---|------|----------------------------|-------|---------------|--------------|---|
| 1    | United States of America | 99.00 | 99.00         | 1.00         | ● | 65   | Croatia                    | 6.43  | 6.43          | 0.49         |   |
| 2    | United Kingdom           | 96.53 | 96.53         | 0.99         | ● | 66   | Bulgaria                   | 6.23  | 6.23          | 0.48         |   |
| 3    | Switzerland              | 84.37 | 84.37         | 0.98         | ● | 67   | Latvia                     | 6.10  | 6.10          | 0.48         |   |
| 4    | China                    | 82.23 | 82.23         | 0.98         | ● | 68   | Slovakia                   | 6.07  | 6.07          | 0.47         |   |
| 5    | Canada                   | 81.97 | 81.97         | 0.97         | ● | 69   | Bangladesh                 | 5.60  | 5.60          | 0.46         |   |
| 6    | Hong Kong (China)        | 81.77 | 81.77         | 0.96         |   | 70   | Kuwait                     | 5.33  | 5.33          | 0.45         |   |
| 7    | Australia                | 81.57 | 81.57         | 0.95         | ● | 71   | Serbia                     | 5.07  | 5.07          | 0.44         |   |
| 8    | Japan                    | 79.73 | 79.73         | 0.94         |   | 72   | Sri Lanka                  | 4.90  | 4.90          | 0.44         |   |
| 9    | Korea, Rep.              | 75.67 | 75.67         | 0.94         |   | 73   | Kenya                      | 4.30  | 4.30          | 0.43         |   |
| 10   | France                   | 71.40 | 71.40         | 0.93         | ● | 74   | Uganda                     | 3.07  | 3.07          | 0.42         |   |
| 11   | Germany                  | 70.77 | 70.77         | 0.92         |   | 75   | Albania                    | 0.00  | 0.00          | 0.00         | ○ |
| 12   | Singapore                | 70.33 | 70.33         | 0.91         |   | 75   | Algeria                    | 0.00  | 0.00          | 0.00         | ○ |
| 13   | Netherlands              | 69.70 | 69.70         | 0.90         |   | 75   | Armenia                    | 0.00  | 0.00          | 0.00         | ○ |
| 14   | Sweden                   | 65.00 | 65.00         | 0.90         |   | 75   | Benin                      | 0.00  | 0.00          | 0.00         | ○ |
| 15   | Denmark                  | 63.83 | 63.83         | 0.89         |   | 75   | Bolivia, Plurinational St. | 0.00  | 0.00          | 0.00         | ○ |
| 16   | Belgium                  | 59.63 | 59.63         | 0.88         |   | 75   | Bosnia and Herzegovina     | 0.00  | 0.00          | 0.00         | ○ |
| 17   | Finland                  | 54.83 | 54.83         | 0.87         |   | 75   | Botswana                   | 0.00  | 0.00          | 0.00         | ○ |
| 18   | New Zealand              | 54.67 | 54.67         | 0.87         |   | 75   | Brunei Darussalam          | 0.00  | 0.00          | 0.00         | ○ |
| 19   | Ireland                  | 51.17 | 51.17         | 0.86         |   | 75   | Burkina Faso               | 0.00  | 0.00          | 0.00         | ○ |
| 20   | Norway                   | 49.80 | 49.80         | 0.85         |   | 75   | Burundi                    | 0.00  | 0.00          | 0.00         | ○ |
| 21   | India                    | 49.00 | 49.00         | 0.84         | ● | 75   | Cambodia                   | 0.00  | 0.00          | 0.00         | ○ |
| 22   | Israel                   | 48.43 | 48.43         | 0.83         |   | 75   | Cameroon                   | 0.00  | 0.00          | 0.00         | ○ |
| 23   | Spain                    | 48.20 | 48.20         | 0.83         |   | 75   | Côte d'Ivoire              | 0.00  | 0.00          | 0.00         | ○ |
| 24   | Brazil                   | 47.43 | 47.43         | 0.82         | ● | 75   | Cyprus                     | 0.00  | 0.00          | 0.00         | ○ |
| 25   | Russian Federation       | 46.50 | 46.50         | 0.81         |   | 75   | Dominican Republic         | 0.00  | 0.00          | 0.00         | ○ |
| 26   | Austria                  | 46.33 | 46.33         | 0.80         |   | 75   | El Salvador                | 0.00  | 0.00          | 0.00         | ○ |
| 27   | Italy                    | 46.27 | 46.27         | 0.79         |   | 75   | Ethiopia                   | 0.00  | 0.00          | 0.00         | ○ |
| 28   | Argentina                | 46.00 | 46.00         | 0.79         | ● | 75   | Georgia                    | 0.00  | 0.00          | 0.00         | ○ |
| 29   | Malaysia                 | 44.43 | 44.43         | 0.78         |   | 75   | Guatemala                  | 0.00  | 0.00          | 0.00         | ○ |
| 30   | Saudi Arabia             | 43.10 | 43.10         | 0.77         | ● | 75   | Guinea                     | 0.00  | 0.00          | 0.00         | ○ |
| 31   | Chile                    | 42.50 | 42.50         | 0.76         |   | 75   | Honduras                   | 0.00  | 0.00          | 0.00         | ○ |
| 32   | Mexico                   | 41.57 | 41.57         | 0.75         |   | 75   | Iceland                    | 0.00  | 0.00          | 0.00         | ○ |
| 33   | South Africa             | 37.03 | 37.03         | 0.75         |   | 75   | Jamaica                    | 0.00  | 0.00          | 0.00         | ○ |
| 34   | Colombia                 | 35.87 | 35.87         | 0.74         |   | 75   | Kyrgyzstan                 | 0.00  | 0.00          | 0.00         | ○ |
| 35   | Kazakhstan               | 35.13 | 35.13         | 0.73         | ● | 75   | Luxembourg                 | 0.00  | 0.00          | 0.00         | ○ |
| 36   | Portugal                 | 33.97 | 33.97         | 0.72         |   | 75   | Madagascar                 | 0.00  | 0.00          | 0.00         | ○ |
| 37   | Thailand                 | 33.37 | 33.37         | 0.71         |   | 75   | Malawi                     | 0.00  | 0.00          | 0.00         | ○ |
| 38   | Indonesia                | 29.77 | 29.77         | 0.71         | ● | 75   | Mali                       | 0.00  | 0.00          | 0.00         | ○ |
| 39   | Lebanon                  | 29.27 | 29.27         | 0.70         |   | 75   | Malta                      | 0.00  | 0.00          | 0.00         | ○ |
| 40   | United Arab Emirates     | 28.93 | 28.93         | 0.69         |   | 75   | Mauritius                  | 0.00  | 0.00          | 0.00         | ○ |
| 41   | Turkey                   | 28.00 | 28.00         | 0.68         |   | 75   | Moldova, Rep.              | 0.00  | 0.00          | 0.00         | ○ |
| 42   | Czech Republic           | 27.57 | 27.57         | 0.67         |   | 75   | Mongolia                   | 0.00  | 0.00          | 0.00         | ○ |
| 43   | Ukraine                  | 27.40 | 27.40         | 0.67         |   | 75   | Montenegro                 | 0.00  | 0.00          | 0.00         | ○ |
| 44   | Poland                   | 26.90 | 26.90         | 0.66         |   | 75   | Morocco                    | 0.00  | 0.00          | 0.00         | ○ |
| 45   | Iran, Islamic Rep.       | 25.93 | 25.93         | 0.65         | ● | 75   | Mozambique                 | 0.00  | 0.00          | 0.00         | ○ |
| 46   | Greece                   | 24.80 | 24.80         | 0.64         |   | 75   | Namibia                    | 0.00  | 0.00          | 0.00         | ○ |
| 47   | Philippines              | 24.40 | 24.40         | 0.63         |   | 75   | Nepal                      | 0.00  | 0.00          | 0.00         | ○ |
| 48   | Egypt                    | 22.87 | 22.87         | 0.63         | ● | 75   | Niger                      | 0.00  | 0.00          | 0.00         | ○ |
| 49   | Hungary                  | 20.77 | 20.77         | 0.62         |   | 75   | Nigeria                    | 0.00  | 0.00          | 0.00         | ○ |
| 50   | Lithuania                | 20.07 | 20.07         | 0.61         |   | 75   | Panama                     | 0.00  | 0.00          | 0.00         | ○ |
| 51   | Pakistan                 | 18.97 | 18.97         | 0.60         | ● | 75   | Paraguay                   | 0.00  | 0.00          | 0.00         | ○ |
| 52   | Costa Rica               | 18.10 | 18.10         | 0.60         |   | 75   | Rwanda                     | 0.00  | 0.00          | 0.00         | ○ |
| 53   | Estonia                  | 17.93 | 17.93         | 0.59         |   | 75   | Senegal                    | 0.00  | 0.00          | 0.00         | ○ |
| 54   | Peru                     | 16.60 | 16.60         | 0.58         |   | 75   | Tajikistan                 | 0.00  | 0.00          | 0.00         | ○ |
| 55   | Belarus                  | 16.37 | 16.37         | 0.57         |   | 75   | Tanzania, United Rep.      | 0.00  | 0.00          | 0.00         | ○ |
| 56   | Azerbaijan               | 14.67 | 14.67         | 0.56         |   | 75   | TFYR of Macedonia          | 0.00  | 0.00          | 0.00         | ○ |
| 57   | Bahrain                  | 13.73 | 13.73         | 0.56         |   | 75   | Togo                       | 0.00  | 0.00          | 0.00         | ○ |
| 58   | Jordan                   | 13.27 | 13.27         | 0.55         |   | 75   | Trinidad and Tobago        | 0.00  | 0.00          | 0.00         | ○ |
| 59   | Romania                  | 12.77 | 12.77         | 0.54         |   | 75   | Tunisia                    | 0.00  | 0.00          | 0.00         | ○ |
| 60   | Uruguay                  | 12.60 | 12.60         | 0.53         |   | 75   | Viet Nam                   | 0.00  | 0.00          | 0.00         | ○ |
| 61   | Slovenia                 | 11.63 | 11.63         | 0.52         |   | 75   | Yemen                      | 0.00  | 0.00          | 0.00         | ○ |
| 62   | Ecuador                  | 11.10 | 11.10         | 0.52         |   | 75   | Zambia                     | 0.00  | 0.00          | 0.00         | ○ |
| 63   | Qatar                    | 10.20 | 10.20         | 0.51         |   | 75   | Zimbabwe                   | 0.00  | 0.00          | 0.00         | ○ |
| 64   | Oman                     | 9.07  | 9.07          | 0.50         |   |      |                            |       |               |              |   |

SOURCE: QS Quacquarelli Symonds Ltd, QS World University Ranking 2016/2017, Top Universities

NOTE: ● Indicates a strength; ○ a weakness



# 3.1.1 ICT access

## ICT access index | 2016

| Rank | Country/Economy          | Value | Score (0–100) | Percent rank |   | Rank | Country/Economy            | Value | Score (0–100) | Percent rank |   |
|------|--------------------------|-------|---------------|--------------|---|------|----------------------------|-------|---------------|--------------|---|
| 1    | Luxembourg               | 9.54  | 95.40         | 1.00         | ● | 65   | Costa Rica                 | 6.44  | 64.40         | 0.49         |   |
| 2    | Iceland                  | 9.42  | 94.20         | 0.99         | ● | 66   | Brazil                     | 6.42  | 64.20         | 0.48         |   |
| 3    | United Kingdom           | 9.24  | 92.40         | 0.98         | ● | 67   | Georgia                    | 6.29  | 62.90         | 0.47         |   |
| 4    | Hong Kong (China)        | 9.16  | 91.60         | 0.98         |   | 68   | Iran, Islamic Rep.         | 6.26  | 62.60         | 0.46         |   |
| 5    | Germany                  | 9.09  | 90.90         | 0.97         | ● | 69   | Turkey                     | 6.20  | 62.00         | 0.46         |   |
| 6    | Malta                    | 9.04  | 90.40         | 0.96         | ● | 70   | Jordan                     | 6.10  | 61.00         | 0.45         |   |
| 7    | Netherlands              | 9.02  | 90.20         | 0.95         |   | 71   | Morocco                    | 6.07  | 60.70         | 0.44         |   |
| 8    | Korea, Rep.              | 8.99  | 89.90         | 0.94         |   | 72   | Panama                     | 5.99  | 59.90         | 0.43         |   |
| 9    | Switzerland              | 8.95  | 89.50         | 0.94         |   | 73   | Colombia                   | 5.83  | 58.30         | 0.42         |   |
| 10   | Japan                    | 8.80  | 88.00         | 0.93         |   | 74   | Bosnia and Herzegovina     | 5.78  | 57.80         | 0.42         |   |
| 11   | France                   | 8.70  | 87.00         | 0.91         |   | 75   | Thailand                   | 5.50  | 55.00         | 0.41         |   |
| 11   | Singapore                | 8.70  | 87.00         | 0.91         |   | 76   | South Africa               | 5.46  | 54.60         | 0.40         |   |
| 13   | Sweden                   | 8.69  | 86.90         | 0.90         |   | 77   | China                      | 5.45  | 54.50         | 0.39         |   |
| 14   | Denmark                  | 8.52  | 85.20         | 0.90         |   | 78   | Egypt                      | 5.30  | 53.00         | 0.38         |   |
| 15   | Austria                  | 8.35  | 83.50         | 0.89         |   | 79   | Tunisia                    | 5.29  | 52.90         | 0.38         |   |
| 16   | Belgium                  | 8.34  | 83.40         | 0.88         |   | 80   | Mongolia                   | 5.12  | 51.20         | 0.37         |   |
| 17   | New Zealand              | 8.32  | 83.20         | 0.87         |   | 81   | Mexico                     | 5.08  | 50.80         | 0.36         |   |
| 18   | Israel                   | 8.28  | 82.80         | 0.86         |   | 82   | Algeria                    | 5.03  | 50.30         | 0.35         |   |
| 19   | United States of America | 8.27  | 82.70         | 0.86         |   | 83   | El Salvador                | 4.95  | 49.50         | 0.34         |   |
| 20   | Australia                | 8.23  | 82.30         | 0.85         |   | 84   | Ecuador                    | 4.90  | 49.00         | 0.34         |   |
| 21   | Norway                   | 8.21  | 82.10         | 0.84         |   | 85   | Jamaica                    | 4.83  | 48.30         | 0.33         |   |
| 22   | Ireland                  | 8.19  | 81.90         | 0.83         |   | 86   | Peru                       | 4.80  | 48.00         | 0.32         |   |
| 23   | United Arab Emirates     | 8.14  | 81.40         | 0.82         |   | 87   | Albania                    | 4.73  | 47.30         | 0.31         |   |
| 24   | Estonia                  | 8.02  | 80.20         | 0.82         |   | 88   | Indonesia                  | 4.71  | 47.10         | 0.30         |   |
| 25   | Canada                   | 7.99  | 79.90         | 0.81         |   | 89   | Philippines                | 4.70  | 47.00         | 0.30         |   |
| 26   | Portugal                 | 7.93  | 79.30         | 0.79         |   | 90   | Viet Nam                   | 4.60  | 46.00         | 0.29         |   |
| 26   | Slovenia                 | 7.93  | 79.30         | 0.79         |   | 91   | Paraguay                   | 4.59  | 45.90         | 0.28         |   |
| 28   | Spain                    | 7.92  | 79.20         | 0.78         |   | 92   | Sri Lanka                  | 4.51  | 45.10         | 0.27         |   |
| 29   | Bahrain                  | 7.91  | 79.10         | 0.77         |   | 93   | Guatemala                  | 4.47  | 44.70         | 0.26         |   |
| 29   | Qatar                    | 7.91  | 79.10         | 0.77         |   | 94   | Dominican Republic         | 4.38  | 43.80         | 0.26         |   |
| 31   | Greece                   | 7.85  | 78.50         | 0.76         |   | 95   | Bolivia, Plurinational St. | 4.37  | 43.70         | 0.25         |   |
| 32   | Belarus                  | 7.80  | 78.00         | 0.75         |   | 96   | Botswana                   | 4.33  | 43.30         | 0.24         |   |
| 33   | Finland                  | 7.69  | 76.90         | 0.74         |   | 97   | Kyrgyzstan                 | 4.25  | 42.50         | 0.22         |   |
| 33   | Italy                    | 7.69  | 76.90         | 0.74         |   | 97   | Namibia                    | 4.25  | 42.50         | 0.22         |   |
| 35   | Hungary                  | 7.62  | 76.20         | 0.73         |   | 99   | Cambodia                   | 4.21  | 42.10         | 0.22         |   |
| 36   | Croatia                  | 7.58  | 75.80         | 0.72         |   | 100  | Honduras                   | 4.17  | 41.70         | 0.21         |   |
| 37   | Kazakhstan               | 7.56  | 75.60         | 0.71         |   | 101  | Côte d'Ivoire              | 3.79  | 37.90         | 0.20         |   |
| 38   | Czech Republic           | 7.46  | 74.60         | 0.70         |   | 102  | Senegal                    | 3.59  | 35.90         | 0.19         |   |
| 39   | Kuwait                   | 7.40  | 74.00         | 0.70         |   | 103  | Kenya                      | 3.54  | 35.40         | 0.18         |   |
| 40   | Latvia                   | 7.38  | 73.80         | 0.69         |   | 104  | Pakistan                   | 3.39  | 33.90         | 0.18         |   |
| 41   | Oman                     | 7.37  | 73.70         | 0.68         | ● | 105  | Zimbabwe                   | 3.35  | 33.50         | 0.17         |   |
| 42   | Saudi Arabia             | 7.29  | 72.90         | 0.67         |   | 106  | India                      | 3.32  | 33.20         | 0.16         |   |
| 43   | Uruguay                  | 7.25  | 72.50         | 0.66         |   | 107  | Mali                       | 3.30  | 33.00         | 0.15         |   |
| 44   | Russian Federation       | 7.23  | 72.30         | 0.66         |   | 108  | Nepal                      | 3.16  | 31.60         | 0.14         |   |
| 45   | Serbia                   | 7.22  | 72.20         | 0.64         |   | 109  | Bangladesh                 | 3.06  | 30.60         | 0.14         |   |
| 45   | Slovakia                 | 7.22  | 72.20         | 0.64         |   | 110  | Nigeria                    | 2.96  | 29.60         | 0.13         |   |
| 47   | Brunei Darussalam        | 7.21  | 72.10         | 0.63         |   | 111  | Mozambique                 | 2.90  | 29.00         | 0.12         |   |
| 48   | Poland                   | 7.09  | 70.90         | 0.62         |   | 112  | Burkina Faso               | 2.87  | 28.70         | 0.11         |   |
| 49   | Lithuania                | 7.08  | 70.80         | 0.62         |   | 113  | Benin                      | 2.86  | 28.60         | 0.10         |   |
| 50   | Trinidad and Tobago      | 7.03  | 70.30         | 0.61         | ● | 114  | Zambia                     | 2.84  | 28.40         | 0.10         |   |
| 51   | Cyprus                   | 7.02  | 70.20         | 0.60         |   | 115  | Cameroon                   | 2.77  | 27.70         | 0.09         |   |
| 52   | Romania                  | 6.90  | 69.00         | 0.59         |   | 116  | Yemen                      | 2.66  | 26.60         | 0.08         |   |
| 53   | Bulgaria                 | 6.86  | 68.60         | 0.58         |   | 117  | Rwanda                     | 2.65  | 26.50         | 0.06         | ○ |
| 53   | Mauritius                | 6.86  | 68.60         | 0.58         |   | 117  | Tanzania, United Rep.      | 2.65  | 26.50         | 0.06         | ○ |
| 55   | Montenegro               | 6.85  | 68.50         | 0.57         |   | 119  | Togo                       | 2.59  | 25.90         | 0.06         | ○ |
| 56   | Chile                    | 6.81  | 68.10         | 0.56         |   | 120  | Guinea                     | 2.57  | 25.70         | 0.05         | ○ |
| 57   | Azerbaijan               | 6.78  | 67.80         | 0.55         |   | 121  | Madagascar                 | 2.39  | 23.90         | 0.04         | ○ |
| 58   | Argentina                | 6.77  | 67.70         | 0.54         |   | 122  | Uganda                     | 2.37  | 23.70         | 0.03         | ○ |
| 59   | Malaysia                 | 6.75  | 67.50         | 0.54         |   | 123  | Burundi                    | 2.14  | 21.40         | 0.02         | ○ |
| 60   | TFYR of Macedonia        | 6.68  | 66.80         | 0.53         |   | 124  | Ethiopia                   | 2.11  | 21.10         | 0.02         | ○ |
| 61   | Moldova, Rep.            | 6.64  | 66.40         | 0.52         |   | 125  | Niger                      | 2.04  | 20.40         | 0.01         | ○ |
| 62   | Armenia                  | 6.57  | 65.70         | 0.50         |   | 126  | Malawi                     | 2.03  | 20.30         | 0.00         | ○ |
| 62   | Lebanon                  | 6.57  | 65.70         | 0.50         |   | n/a  | Tajikistan                 | n/a   | n/a           | n/a          | ○ |
| 64   | Ukraine                  | 6.48  | 64.80         | 0.50         |   |      |                            |       |               |              |   |

SOURCE: International Telecommunication Union, *Measuring the Information Society 2016*, ICT Development Index 2016

NOTE: ● Indicates a strength; ○ a weakness

# 3.1.2 ICT use

## ICT use index | 2016

| Rank | Country/Economy          | Value | Score (0–100) | Percent rank |   | Rank | Country/Economy            | Value | Score (0–100) | Percent rank |   |
|------|--------------------------|-------|---------------|--------------|---|------|----------------------------|-------|---------------|--------------|---|
| 1    | Denmark                  | 8.91  | 89.10         | 1.00         | ● | 65   | Mexico                     | 4.24  | 42.40         | 0.49         |   |
| 2    | Switzerland              | 8.67  | 86.70         | 0.99         | ● | 66   | Bosnia and Herzegovina     | 4.21  | 42.10         | 0.48         |   |
| 3    | Korea, Rep.              | 8.57  | 85.70         | 0.98         | ● | 67   | Turkey                     | 4.18  | 41.80         | 0.47         |   |
| 4    | Norway                   | 8.48  | 84.80         | 0.98         | ● | 68   | Georgia                    | 4.00  | 40.00         | 0.46         |   |
| 5    | Iceland                  | 8.44  | 84.40         | 0.97         |   | 68   | South Africa               | 4.00  | 40.00         | 0.46         |   |
| 6    | Sweden                   | 8.36  | 83.60         | 0.96         |   | 70   | Tunisia                    | 3.95  | 39.50         | 0.45         |   |
| 7    | Finland                  | 8.18  | 81.80         | 0.95         |   | 71   | Albania                    | 3.88  | 38.80         | 0.44         |   |
| 8    | Japan                    | 8.14  | 81.40         | 0.94         |   | 72   | Armenia                    | 3.85  | 38.50         | 0.42         |   |
| 9    | United Kingdom           | 8.09  | 80.90         | 0.94         |   | 72   | Colombia                   | 3.85  | 38.50         | 0.42         |   |
| 10   | Luxembourg               | 8.05  | 80.50         | 0.93         |   | 74   | Mauritius                  | 3.78  | 37.80         | 0.42         |   |
| 11   | New Zealand              | 8.03  | 80.30         | 0.92         |   | 75   | Mongolia                   | 3.64  | 36.40         | 0.41         |   |
| 12   | Hong Kong (China)        | 7.94  | 79.40         | 0.91         |   | 76   | Jamaica                    | 3.55  | 35.50         | 0.40         |   |
| 13   | Estonia                  | 7.87  | 78.70         | 0.90         |   | 77   | Viet Nam                   | 3.51  | 35.10         | 0.39         |   |
| 14   | Netherlands              | 7.77  | 77.70         | 0.90         |   | 78   | Dominican Republic         | 3.41  | 34.10         | 0.38         |   |
| 15   | Australia                | 7.70  | 77.00         | 0.89         |   | 79   | Morocco                    | 3.40  | 34.00         | 0.38         |   |
| 16   | France                   | 7.61  | 76.10         | 0.88         |   | 80   | Ecuador                    | 3.31  | 33.10         | 0.37         |   |
| 17   | United States of America | 7.57  | 75.70         | 0.87         |   | 81   | Botswana                   | 3.26  | 32.60         | 0.36         |   |
| 18   | Singapore                | 7.54  | 75.40         | 0.86         |   | 82   | Panama                     | 3.24  | 32.40         | 0.35         |   |
| 19   | Germany                  | 7.49  | 74.90         | 0.86         |   | 83   | Jordan                     | 3.20  | 32.00         | 0.34         |   |
| 20   | Bahrain                  | 7.48  | 74.80         | 0.85         | ● | 84   | Egypt                      | 3.14  | 31.40         | 0.34         |   |
| 21   | Ireland                  | 7.38  | 73.80         | 0.84         |   | 85   | Brunei Darussalam          | 2.97  | 29.70         | 0.33         |   |
| 22   | Belgium                  | 7.10  | 71.00         | 0.83         |   | 86   | Paraguay                   | 2.96  | 29.60         | 0.32         |   |
| 23   | Spain                    | 6.93  | 69.30         | 0.82         |   | 87   | Peru                       | 2.94  | 29.40         | 0.31         |   |
| 24   | Canada                   | 6.85  | 68.50         | 0.82         |   | 88   | Philippines                | 2.93  | 29.30         | 0.30         |   |
| 25   | United Arab Emirates     | 6.82  | 68.20         | 0.81         |   | 89   | Algeria                    | 2.92  | 29.20         | 0.30         |   |
| 26   | Malta                    | 6.75  | 67.50         | 0.80         |   | 90   | Namibia                    | 2.91  | 29.10         | 0.29         |   |
| 27   | Austria                  | 6.67  | 66.70         | 0.79         |   | 91   | Iran, Islamic Rep.         | 2.74  | 27.40         | 0.28         |   |
| 28   | Czech Republic           | 6.55  | 65.50         | 0.78         |   | 92   | Bolivia, Plurinational St. | 2.72  | 27.20         | 0.27         |   |
| 29   | Lithuania                | 6.40  | 64.00         | 0.78         |   | 93   | Ukraine                    | 2.57  | 25.70         | 0.26         |   |
| 30   | Slovakia                 | 6.38  | 63.80         | 0.77         |   | 94   | Nigeria                    | 2.28  | 22.80         | 0.26         |   |
| 31   | Qatar                    | 6.32  | 63.20         | 0.75         |   | 95   | Kyrgyzstan                 | 2.25  | 22.50         | 0.25         |   |
| 31   | Saudi Arabia             | 6.32  | 63.20         | 0.75         |   | 96   | Indonesia                  | 2.19  | 21.90         | 0.24         |   |
| 33   | Latvia                   | 6.27  | 62.70         | 0.74         |   | 97   | Cambodia                   | 2.09  | 20.90         | 0.23         |   |
| 34   | Italy                    | 6.25  | 62.50         | 0.74         |   | 98   | Côte d'Ivoire              | 2.08  | 20.80         | 0.22         |   |
| 35   | Uruguay                  | 6.20  | 62.00         | 0.73         | ● | 99   | Kenya                      | 2.05  | 20.50         | 0.22         |   |
| 36   | Kuwait                   | 6.15  | 61.50         | 0.72         | ● | 100  | Zimbabwe                   | 1.91  | 19.10         | 0.21         |   |
| 37   | Croatia                  | 6.13  | 61.30         | 0.71         |   | 101  | El Salvador                | 1.87  | 18.70         | 0.20         |   |
| 38   | Israel                   | 6.02  | 60.20         | 0.70         |   | 102  | Sri Lanka                  | 1.70  | 17.00         | 0.19         |   |
| 39   | Belarus                  | 5.88  | 58.80         | 0.70         |   | 103  | Senegal                    | 1.64  | 16.40         | 0.18         |   |
| 40   | Russian Federation       | 5.87  | 58.70         | 0.69         |   | 104  | Rwanda                     | 1.47  | 14.70         | 0.18         |   |
| 41   | Malaysia                 | 5.86  | 58.60         | 0.68         |   | 105  | Guatemala                  | 1.40  | 14.00         | 0.17         |   |
| 42   | Bulgaria                 | 5.84  | 58.40         | 0.67         |   | 106  | Honduras                   | 1.38  | 13.80         | 0.16         |   |
| 43   | Costa Rica               | 5.80  | 58.00         | 0.66         |   | 107  | Nepal                      | 1.35  | 13.50         | 0.15         |   |
| 44   | Slovenia                 | 5.71  | 57.10         | 0.66         |   | 108  | Uganda                     | 1.27  | 12.70         | 0.14         |   |
| 45   | Azerbaijan               | 5.70  | 57.00         | 0.65         |   | 109  | India                      | 1.25  | 12.50         | 0.14         |   |
| 46   | Portugal                 | 5.67  | 56.70         | 0.64         |   | 110  | Zambia                     | 1.17  | 11.70         | 0.13         |   |
| 47   | Brazil                   | 5.60  | 56.00         | 0.63         |   | 111  | Yemen                      | 1.12  | 11.20         | 0.12         |   |
| 48   | Lebanon                  | 5.51  | 55.10         | 0.62         |   | 112  | Pakistan                   | 1.09  | 10.90         | 0.11         |   |
| 49   | Serbia                   | 5.50  | 55.00         | 0.62         |   | 113  | Bangladesh                 | 1.06  | 10.60         | 0.10         |   |
| 50   | Cyprus                   | 5.46  | 54.60         | 0.60         |   | 114  | Mali                       | 0.97  | 9.70          | 0.10         |   |
| 50   | Greece                   | 5.46  | 54.60         | 0.60         |   | 115  | Burkina Faso               | 0.90  | 9.00          | 0.09         |   |
| 52   | Argentina                | 5.45  | 54.50         | 0.59         |   | 116  | Malawi                     | 0.86  | 8.60          | 0.08         |   |
| 53   | Oman                     | 5.39  | 53.90         | 0.58         |   | 117  | Cameroon                   | 0.84  | 8.40          | 0.07         |   |
| 54   | Poland                   | 5.35  | 53.50         | 0.58         |   | 118  | Ethiopia                   | 0.82  | 8.20          | 0.06         |   |
| 55   | Hungary                  | 5.28  | 52.80         | 0.57         |   | 119  | Guinea                     | 0.62  | 6.20          | 0.05         |   |
| 56   | TFYR of Macedonia        | 5.17  | 51.70         | 0.56         |   | 119  | Mozambique                 | 0.62  | 6.20          | 0.05         |   |
| 57   | Kazakhstan               | 5.15  | 51.50         | 0.55         |   | 121  | Togo                       | 0.49  | 4.90          | 0.04         |   |
| 58   | Romania                  | 5.08  | 50.80         | 0.54         |   | 122  | Madagascar                 | 0.44  | 4.40          | 0.03         | ○ |
| 59   | Chile                    | 4.91  | 49.10         | 0.54         |   | 123  | Burundi                    | 0.42  | 4.20          | 0.02         |   |
| 60   | Montenegro               | 4.61  | 46.10         | 0.53         |   | 124  | Benin                      | 0.40  | 4.00          | 0.02         | ○ |
| 61   | China                    | 4.58  | 45.80         | 0.52         |   | 125  | Tanzania, United Rep.      | 0.30  | 3.00          | 0.01         | ○ |
| 62   | Trinidad and Tobago      | 4.53  | 45.30         | 0.51         |   | 126  | Niger                      | 0.14  | 1.40          | 0.00         | ○ |
| 63   | Thailand                 | 4.33  | 43.30         | 0.50         |   | n/a  | Tajikistan                 | n/a   | n/a           | n/a          |   |
| 64   | Moldova, Rep.            | 4.26  | 42.60         | 0.50         |   |      |                            |       |               |              |   |

SOURCE: International Telecommunication Union, *Measuring the Information Society 2016*, ICT Development Index 2016

NOTE: ● Indicates a strength; ○ a weakness

# 3.1.3 Government's online service

## Government's online service index | 2016

| Rank | Country/Economy          | Value | Score (0–100) | Percent rank |   | Rank | Country/Economy            | Value | Score (0–100) | Percent rank |   |
|------|--------------------------|-------|---------------|--------------|---|------|----------------------------|-------|---------------|--------------|---|
| 1    | United Kingdom           | 1.00  | 100.00        | 1.00         | ● | 64   | Switzerland                | 0.60  | 60.15         | 0.48         | ○ |
| 2    | Australia                | 0.98  | 97.83         | 0.99         | ● | 64   | Turkey                     | 0.60  | 60.15         | 0.48         | ○ |
| 3    | Singapore                | 0.97  | 97.10         | 0.98         | ● | 67   | Albania                    | 0.59  | 59.42         | 0.46         | ○ |
| 4    | Canada                   | 0.96  | 95.65         | 0.98         | ● | 67   | Moldova, Rep.              | 0.59  | 59.42         | 0.46         | ○ |
| 5    | Finland                  | 0.94  | 94.20         | 0.94         | ● | 67   | Oman                       | 0.59  | 59.42         | 0.46         | ○ |
| 5    | France                   | 0.94  | 94.20         | 0.94         | ● | 70   | Ukraine                    | 0.59  | 58.70         | 0.45         | ○ |
| 5    | Korea, Rep.              | 0.94  | 94.20         | 0.94         | ● | 71   | Greece                     | 0.58  | 57.97         | 0.44         | ○ |
| 5    | New Zealand              | 0.94  | 94.20         | 0.94         | ● | 72   | Tanzania, United Rep.      | 0.57  | 57.25         | 0.42         | ○ |
| 9    | Netherlands              | 0.93  | 92.75         | 0.93         | ● | 72   | Viet Nam                   | 0.57  | 57.25         | 0.42         | ○ |
| 9    | United States of America | 0.93  | 92.75         | 0.93         | ● | 74   | Bulgaria                   | 0.57  | 56.52         | 0.42         | ○ |
| 11   | Austria                  | 0.91  | 91.30         | 0.91         | ● | 75   | Kenya                      | 0.56  | 55.80         | 0.40         | ○ |
| 11   | Spain                    | 0.91  | 91.30         | 0.91         | ● | 75   | South Africa               | 0.56  | 55.80         | 0.40         | ○ |
| 13   | Estonia                  | 0.89  | 89.13         | 0.90         | ● | 77   | Thailand                   | 0.55  | 55.07         | 0.39         | ○ |
| 13   | United Arab Emirates     | 0.89  | 89.13         | 0.90         | ● | 78   | Cyprus                     | 0.54  | 53.62         | 0.38         | ○ |
| 15   | Japan                    | 0.88  | 87.68         | 0.88         | ● | 79   | Ethiopia                   | 0.53  | 52.90         | 0.37         | ○ |
| 15   | Sweden                   | 0.88  | 87.68         | 0.88         | ● | 79   | Trinidad and Tobago        | 0.53  | 52.90         | 0.37         | ○ |
| 17   | Italy                    | 0.87  | 86.96         | 0.87         | ● | 81   | Lebanon                    | 0.51  | 51.45         | 0.35         | ○ |
| 18   | Israel                   | 0.86  | 86.23         | 0.86         | ● | 81   | Mongolia                   | 0.51  | 51.45         | 0.35         | ○ |
| 19   | Mexico                   | 0.85  | 84.78         | 0.85         | ● | 83   | Brunei Darussalam          | 0.51  | 50.73         | 0.34         | ○ |
| 19   | Slovenia                 | 0.85  | 84.78         | 0.85         | ● | 83   | Dominican Republic         | 0.51  | 50.73         | 0.34         | ○ |
| 21   | Germany                  | 0.84  | 84.06         | 0.84         | ● | 85   | Uganda                     | 0.50  | 50.00         | 0.33         | ○ |
| 22   | Bahrain                  | 0.83  | 82.61         | 0.82         | ● | 86   | Bolivia, Plurinational St. | 0.49  | 49.28         | 0.32         | ○ |
| 22   | Lithuania                | 0.83  | 82.61         | 0.82         | ● | 87   | Belarus                    | 0.49  | 48.55         | 0.30         | ○ |
| 24   | Serbia                   | 0.82  | 81.88         | 0.82         | ● | 87   | El Salvador                | 0.49  | 48.55         | 0.30         | ○ |
| 25   | Norway                   | 0.80  | 80.44         | 0.81         | ● | 89   | Czech Republic             | 0.48  | 47.83         | 0.30         | ○ |
| 26   | Malta                    | 0.80  | 79.71         | 0.80         | ● | 90   | Egypt                      | 0.47  | 47.10         | 0.29         | ○ |
| 27   | Colombia                 | 0.79  | 78.99         | 0.79         | ● | 91   | Jordan                     | 0.46  | 45.65         | 0.26         | ○ |
| 28   | Chile                    | 0.78  | 77.54         | 0.77         | ● | 91   | Romania                    | 0.46  | 45.65         | 0.26         | ○ |
| 28   | Denmark                  | 0.78  | 77.54         | 0.77         | ● | 91   | Rwanda                     | 0.46  | 45.65         | 0.26         | ○ |
| 28   | Uruguay                  | 0.78  | 77.54         | 0.77         | ● | 94   | Bosnia and Herzegovina     | 0.45  | 44.93         | 0.26         | ○ |
| 31   | China                    | 0.77  | 76.81         | 0.75         | ● | 95   | Slovakia                   | 0.44  | 44.20         | 0.25         | ○ |
| 31   | Kazakhstan               | 0.77  | 76.81         | 0.75         | ● | 96   | Armenia                    | 0.43  | 42.75         | 0.23         | ○ |
| 33   | Croatia                  | 0.75  | 74.64         | 0.73         | ● | 96   | Kyrgyzstan                 | 0.43  | 42.75         | 0.23         | ○ |
| 33   | India                    | 0.75  | 74.64         | 0.73         | ● | 98   | Nigeria                    | 0.41  | 41.30         | 0.22         | ○ |
| 33   | Portugal                 | 0.75  | 74.64         | 0.73         | ● | 99   | Nepal                      | 0.40  | 39.86         | 0.22         | ○ |
| 36   | Morocco                  | 0.74  | 73.91         | 0.72         | ● | 100  | Senegal                    | 0.38  | 37.68         | 0.21         | ○ |
| 37   | Brazil                   | 0.73  | 73.19         | 0.70         | ● | 101  | Zambia                     | 0.37  | 36.96         | 0.20         | ○ |
| 37   | Russian Federation       | 0.73  | 73.19         | 0.70         | ● | 102  | Indonesia                  | 0.36  | 36.23         | 0.19         | ○ |
| 39   | Ireland                  | 0.72  | 72.46         | 0.70         | ● | 103  | Jamaica                    | 0.36  | 35.51         | 0.18         | ○ |
| 40   | Luxembourg               | 0.72  | 71.74         | 0.67         | ● | 104  | Iran, Islamic Rep.         | 0.33  | 33.33         | 0.17         | ○ |
| 40   | Malaysia                 | 0.72  | 71.74         | 0.67         | ● | 104  | Panama                     | 0.33  | 33.33         | 0.17         | ○ |
| 40   | Tunisia                  | 0.72  | 71.74         | 0.67         | ● | 106  | Pakistan                   | 0.33  | 32.61         | 0.16         | ○ |
| 43   | Argentina                | 0.71  | 71.01         | 0.66         | ● | 107  | Togo                       | 0.32  | 31.88         | 0.15         | ○ |
| 43   | Belgium                  | 0.71  | 71.01         | 0.66         | ● | 108  | Honduras                   | 0.31  | 31.16         | 0.14         | ○ |
| 45   | Mauritius                | 0.70  | 70.29         | 0.64         | ● | 109  | Botswana                   | 0.28  | 28.26         | 0.13         | ○ |
| 45   | Poland                   | 0.70  | 70.29         | 0.64         | ● | 109  | Namibia                    | 0.28  | 28.26         | 0.13         | ○ |
| 47   | Azerbaijan               | 0.68  | 68.12         | 0.62         | ● | 111  | Zimbabwe                   | 0.26  | 26.09         | 0.12         | ○ |
| 47   | Montenegro               | 0.68  | 68.12         | 0.62         | ● | 112  | Madagascar                 | 0.22  | 22.46         | 0.11         | ○ |
| 49   | Qatar                    | 0.67  | 67.39         | 0.61         | ● | 113  | Cameroon                   | 0.22  | 21.74         | 0.10         | ○ |
| 49   | Saudi Arabia             | 0.67  | 67.39         | 0.61         | ● | 113  | Malawi                     | 0.22  | 21.74         | 0.10         | ○ |
| 51   | Guatemala                | 0.67  | 66.67         | 0.59         | ● | 115  | Mozambique                 | 0.20  | 20.29         | 0.09         | ○ |
| 51   | Philippines              | 0.67  | 66.67         | 0.59         | ● | 116  | Burkina Faso               | 0.19  | 18.84         | 0.07         | ○ |
| 53   | Kuwait                   | 0.65  | 65.22         | 0.58         | ● | 116  | Côte d'Ivoire              | 0.19  | 18.84         | 0.07         | ○ |
| 53   | Sri Lanka                | 0.65  | 65.22         | 0.58         | ● | 118  | Burundi                    | 0.15  | 15.22         | 0.06         | ○ |
| 55   | Costa Rica               | 0.64  | 63.77         | 0.56         | ● | 119  | Benin                      | 0.14  | 14.49         | 0.05         | ○ |
| 55   | Georgia                  | 0.64  | 63.77         | 0.56         | ● | 119  | Yemen                      | 0.14  | 14.49         | 0.05         | ○ |
| 57   | Ecuador                  | 0.63  | 63.04         | 0.54         | ● | 121  | Tajikistan                 | 0.12  | 12.32         | 0.04         | ○ |
| 57   | Hungary                  | 0.63  | 63.04         | 0.54         | ● | 122  | Mali                       | 0.09  | 9.42          | 0.03         | ○ |
| 57   | Peru                     | 0.63  | 63.04         | 0.54         | ● | 123  | Guinea                     | 0.09  | 8.70          | 0.02         | ○ |
| 60   | Bangladesh               | 0.62  | 62.32         | 0.52         | ● | 124  | Niger                      | 0.07  | 7.25          | 0.02         | ○ |
| 60   | Iceland                  | 0.62  | 62.32         | 0.52         | ● | 125  | Algeria                    | 0.07  | 6.52          | 0.01         | ○ |
| 62   | Latvia                   | 0.61  | 60.87         | 0.50         | ● | 126  | Cambodia                   | 0.05  | 5.07          | 0.00         | ○ |
| 62   | TFYR of Macedonia        | 0.61  | 60.87         | 0.50         | ● | n/a  | Hong Kong (China)          | n/a   | n/a           | n/a          | ○ |
| 64   | Paraguay                 | 0.60  | 60.15         | 0.48         | ● |      |                            |       |               |              |   |

SOURCE: United Nations Public Administration Network, e-Government Survey 2016

NOTE: ● indicates a strength; ○ a weakness

# 3.1.4 Online e-participation

## E-Participation Index | 2016

| Rank | Country/Economy          | Value | Score (0–100) | Percent rank |   | Rank | Country/Economy            | Value | Score (0–100) | Percent rank |   |
|------|--------------------------|-------|---------------|--------------|---|------|----------------------------|-------|---------------|--------------|---|
| 1    | United Kingdom           | 1.00  | 100.00        | 1.00         | ● | 65   | Kazakhstan                 | 0.59  | 59.32         | 0.46         |   |
| 2    | Australia                | 0.98  | 98.31         | 0.98         | ● | 65   | Kyrgyzstan                 | 0.59  | 59.32         | 0.46         |   |
| 2    | Japan                    | 0.98  | 98.31         | 0.98         | ● | 65   | Philippines                | 0.59  | 59.32         | 0.46         |   |
| 4    | Korea, Rep.              | 0.97  | 96.61         | 0.98         | ● | 65   | Tanzania, United Rep.      | 0.59  | 59.32         | 0.46         |   |
| 5    | Netherlands              | 0.95  | 94.92         | 0.96         | ● | 65   | Thailand                   | 0.59  | 59.32         | 0.46         |   |
| 5    | New Zealand              | 0.95  | 94.92         | 0.96         |   | 70   | Bolivia, Plurinational St. | 0.58  | 57.63         | 0.42         |   |
| 7    | Spain                    | 0.93  | 93.22         | 0.95         | ● | 70   | Ecuador                    | 0.58  | 57.63         | 0.42         |   |
| 8    | Canada                   | 0.92  | 91.53         | 0.92         |   | 70   | Paraguay                   | 0.58  | 57.63         | 0.42         |   |
| 8    | Finland                  | 0.92  | 91.53         | 0.92         |   | 70   | Switzerland                | 0.58  | 57.63         | 0.42         | ○ |
| 8    | Italy                    | 0.92  | 91.53         | 0.92         | ● | 74   | Belarus                    | 0.56  | 55.93         | 0.38         |   |
| 8    | Singapore                | 0.92  | 91.53         | 0.92         |   | 74   | Czech Republic             | 0.56  | 55.93         | 0.38         | ○ |
| 12   | France                   | 0.90  | 89.83         | 0.90         |   | 74   | El Salvador                | 0.56  | 55.93         | 0.38         |   |
| 12   | United States of America | 0.90  | 89.83         | 0.90         |   | 74   | Georgia                    | 0.56  | 55.93         | 0.38         |   |
| 14   | Austria                  | 0.88  | 88.14         | 0.88         |   | 74   | Oman                       | 0.56  | 55.93         | 0.38         |   |
| 14   | Mexico                   | 0.88  | 88.14         | 0.88         | ● | 74   | South Africa               | 0.56  | 55.93         | 0.38         |   |
| 14   | Poland                   | 0.88  | 88.14         | 0.88         | ● | 80   | Peru                       | 0.54  | 54.24         | 0.36         |   |
| 17   | Israel                   | 0.83  | 83.05         | 0.84         | ● | 80   | Slovakia                   | 0.54  | 54.24         | 0.36         |   |
| 17   | Lithuania                | 0.83  | 83.05         | 0.84         | ● | 82   | Armenia                    | 0.53  | 52.54         | 0.32         |   |
| 17   | Montenegro               | 0.83  | 83.05         | 0.84         | ● | 82   | Bangladesh                 | 0.53  | 52.54         | 0.32         |   |
| 17   | Morocco                  | 0.83  | 83.05         | 0.84         | ● | 82   | Cyprus                     | 0.53  | 52.54         | 0.32         |   |
| 17   | Serbia                   | 0.83  | 83.05         | 0.84         | ● | 82   | Kenya                      | 0.53  | 52.54         | 0.32         |   |
| 22   | China                    | 0.81  | 81.36         | 0.82         |   | 82   | Latvia                     | 0.53  | 52.54         | 0.32         | ○ |
| 22   | Denmark                  | 0.81  | 81.36         | 0.82         |   | 87   | Bosnia and Herzegovina     | 0.51  | 50.85         | 0.30         |   |
| 22   | Estonia                  | 0.81  | 81.36         | 0.82         |   | 87   | Nepal                      | 0.51  | 50.85         | 0.30         |   |
| 25   | Croatia                  | 0.78  | 77.97         | 0.80         | ● | 89   | Dominican Republic         | 0.49  | 49.15         | 0.26         |   |
| 25   | Malta                    | 0.78  | 77.97         | 0.80         |   | 89   | Ethiopia                   | 0.49  | 49.15         | 0.26         |   |
| 27   | Colombia                 | 0.76  | 76.27         | 0.76         |   | 89   | Hungary                    | 0.49  | 49.15         | 0.26         | ○ |
| 27   | Germany                  | 0.76  | 76.27         | 0.76         |   | 89   | Lebanon                    | 0.49  | 49.15         | 0.26         |   |
| 27   | India                    | 0.76  | 76.27         | 0.76         |   | 89   | Rwanda                     | 0.49  | 49.15         | 0.26         |   |
| 27   | Norway                   | 0.76  | 76.27         | 0.76         |   | 89   | Uganda                     | 0.49  | 49.15         | 0.26         |   |
| 27   | Sweden                   | 0.76  | 76.27         | 0.76         |   | 95   | Jordan                     | 0.46  | 45.76         | 0.25         |   |
| 32   | Bahrain                  | 0.75  | 74.58         | 0.72         |   | 96   | Trinidad and Tobago        | 0.44  | 44.07         | 0.24         |   |
| 32   | Chile                    | 0.75  | 74.58         | 0.72         |   | 97   | Egypt                      | 0.41  | 40.68         | 0.23         |   |
| 32   | Russian Federation       | 0.75  | 74.58         | 0.72         |   | 98   | Honduras                   | 0.39  | 38.98         | 0.21         |   |
| 32   | Ukraine                  | 0.75  | 74.58         | 0.72         |   | 98   | Senegal                    | 0.39  | 38.98         | 0.21         |   |
| 32   | United Arab Emirates     | 0.75  | 74.58         | 0.72         |   | 98   | Togo                       | 0.39  | 38.98         | 0.21         |   |
| 37   | Brazil                   | 0.73  | 72.88         | 0.70         | ● | 101  | Brunei Darussalam          | 0.37  | 37.29         | 0.18         |   |
| 37   | Slovenia                 | 0.73  | 72.88         | 0.70         |   | 101  | Indonesia                  | 0.37  | 37.29         | 0.18         |   |
| 39   | Ireland                  | 0.71  | 71.19         | 0.67         |   | 101  | Pakistan                   | 0.37  | 37.29         | 0.18         |   |
| 39   | Mongolia                 | 0.71  | 71.19         | 0.67         |   | 101  | Panama                     | 0.37  | 37.29         | 0.18         |   |
| 39   | Saudi Arabia             | 0.71  | 71.19         | 0.67         |   | 105  | Nigeria                    | 0.36  | 35.59         | 0.16         |   |
| 39   | Uruguay                  | 0.71  | 71.19         | 0.67         |   | 105  | Zambia                     | 0.36  | 35.59         | 0.16         |   |
| 43   | Bulgaria                 | 0.69  | 69.49         | 0.64         |   | 107  | Botswana                   | 0.29  | 28.81         | 0.14         |   |
| 43   | Luxembourg               | 0.69  | 69.49         | 0.64         |   | 107  | Malawi                     | 0.29  | 28.81         | 0.14         |   |
| 43   | Tunisia                  | 0.69  | 69.49         | 0.64         |   | 107  | Zimbabwe                   | 0.29  | 28.81         | 0.14         |   |
| 43   | Viet Nam                 | 0.69  | 69.49         | 0.64         |   | 110  | Jamaica                    | 0.27  | 27.12         | 0.13         | ○ |
| 47   | Azerbaijan               | 0.68  | 67.80         | 0.62         |   | 111  | Burkina Faso               | 0.24  | 23.73         | 0.11         |   |
| 47   | Malaysia                 | 0.68  | 67.80         | 0.62         |   | 111  | Namibia                    | 0.24  | 23.73         | 0.11         |   |
| 49   | Iceland                  | 0.66  | 66.10         | 0.58         |   | 113  | Iran, Islamic Rep.         | 0.20  | 20.34         | 0.08         | ○ |
| 49   | Mauritius                | 0.66  | 66.10         | 0.58         |   | 113  | Madagascar                 | 0.20  | 20.34         | 0.08         |   |
| 49   | Moldova, Rep.            | 0.66  | 66.10         | 0.58         |   | 113  | Mozambique                 | 0.20  | 20.34         | 0.08         |   |
| 49   | Portugal                 | 0.66  | 66.10         | 0.58         |   | 113  | Tajikistan                 | 0.20  | 20.34         | 0.08         |   |
| 49   | Sri Lanka                | 0.66  | 66.10         | 0.58         |   | 117  | Benin                      | 0.17  | 16.95         | 0.06         |   |
| 54   | Albania                  | 0.64  | 64.41         | 0.54         |   | 117  | Cameroon                   | 0.17  | 16.95         | 0.06         |   |
| 54   | Belgium                  | 0.64  | 64.41         | 0.54         | ○ | 119  | Burundi                    | 0.15  | 15.25         | 0.05         |   |
| 54   | Costa Rica               | 0.64  | 64.41         | 0.54         |   | 119  | Côte d'Ivoire              | 0.15  | 15.25         | 0.05         | ○ |
| 54   | Kuwait                   | 0.64  | 64.41         | 0.54         |   | 121  | Yemen                      | 0.14  | 13.56         | 0.04         |   |
| 54   | Qatar                    | 0.64  | 64.41         | 0.54         |   | 122  | Algeria                    | 0.12  | 11.86         | 0.03         |   |
| 59   | Argentina                | 0.63  | 62.71         | 0.51         |   | 123  | Guinea                     | 0.08  | 8.48          | 0.02         | ○ |
| 59   | Guatemala                | 0.63  | 62.71         | 0.51         |   | 123  | Niger                      | 0.08  | 8.48          | 0.02         |   |
| 59   | Romania                  | 0.63  | 62.71         | 0.51         |   | 125  | Cambodia                   | 0.07  | 6.78          | 0.00         | ○ |
| 59   | Turkey                   | 0.63  | 62.71         | 0.51         |   | 125  | Mali                       | 0.07  | 6.78          | 0.00         | ○ |
| 63   | Greece                   | 0.61  | 61.02         | 0.50         |   | n/a  | Hong Kong (China)          | n/a   | n/a           | n/a          |   |
| 63   | TFYR of Macedonia        | 0.61  | 61.02         | 0.50         |   |      |                            |       |               |              |   |

SOURCE: United Nations Public Administration Network, e-Government Survey 2016

NOTE: ● Indicates a strength; ○ a weakness

# 3.2.1 Electricity output

## Electricity output (kWh per capita) | 2014

| Rank | Country/Economy          | Value     | Score (0–100) | Percent rank |   | Rank | Country/Economy            | Value    | Score (0–100) | Percent rank |   |
|------|--------------------------|-----------|---------------|--------------|---|------|----------------------------|----------|---------------|--------------|---|
| 1    | Iceland                  | 56,966.67 | 100.00        | 0.99         | ● | 65   | Azerbaijan                 | 2,592.03 | 9.27          | 0.46         |   |
| 1    | Norway                   | 27,803.66 | 100.00        | 0.99         | ● | 66   | TFYR of Macedonia          | 2,583.65 | 9.24          | 0.45         |   |
| 3    | Bahrain                  | 20,038.97 | 72.06         | 0.98         | ● | 67   | Latvia                     | 2,583.42 | 9.23          | 0.44         |   |
| 4    | Qatar                    | 17,830.41 | 64.11         | 0.97         | ● | 68   | Armenia                    | 2,574.75 | 9.20          | 0.43         |   |
| 5    | Canada                   | 17,594.07 | 63.26         | 0.97         | ● | 69   | Thailand                   | 2,563.58 | 9.16          | 0.42         |   |
| 6    | Kuwait                   | 17,370.67 | 62.45         | 0.96         | ● | 70   | Mexico                     | 2,538.55 | 9.07          | 0.42         |   |
| 7    | Sweden                   | 16,520.68 | 59.39         | 0.95         |   | 71   | Kyrgyzstan                 | 2,499.49 | 8.93          | 0.41         |   |
| 8    | United States of America | 13,342.40 | 47.96         | 0.94         |   | 72   | Panama                     | 2,399.74 | 8.57          | 0.40         |   |
| 9    | Finland                  | 12,494.72 | 44.90         | 0.93         |   | 73   | Mauritius                  | 2,328.57 | 8.32          | 0.39         |   |
| 10   | United Arab Emirates     | 12,098.90 | 43.48         | 0.92         | ● | 74   | Georgia                    | 2,304.67 | 8.23          | 0.38         |   |
| 11   | Korea, Rep.              | 10,756.72 | 38.65         | 0.92         |   | 75   | Luxembourg                 | 2,289.47 | 8.18          | 0.37         |   |
| 12   | Brunei Darussalam        | 10,728.57 | 38.55         | 0.91         | ● | 76   | Costa Rica                 | 2,146.43 | 7.66          | 0.36         |   |
| 13   | Australia                | 10,388.17 | 37.32         | 0.90         |   | 77   | Tajikistan                 | 1,984.58 | 7.08          | 0.36         |   |
| 14   | Saudi Arabia             | 10,094.08 | 36.27         | 0.89         | ● | 78   | Egypt                      | 1,917.25 | 6.84          | 0.35         |   |
| 15   | New Zealand              | 9,821.33  | 35.28         | 0.88         |   | 79   | Mongolia                   | 1,847.42 | 6.59          | 0.34         |   |
| 16   | Singapore                | 9,027.42  | 32.43         | 0.87         |   | 80   | Dominican Republic         | 1,784.15 | 6.36          | 0.33         |   |
| 17   | France                   | 8,470.55  | 30.42         | 0.86         |   | 81   | Tunisia                    | 1,729.45 | 6.16          | 0.32         |   |
| 18   | Paraguay                 | 8,440.00  | 30.31         | 0.86         | ● | 82   | Algeria                    | 1,650.19 | 5.88          | 0.31         |   |
| 19   | Switzerland              | 7,975.42  | 28.64         | 0.85         |   | 83   | Albania                    | 1,634.60 | 5.82          | 0.31         |   |
| 20   | Japan                    | 7,948.11  | 28.54         | 0.84         |   | 84   | Viet Nam                   | 1,553.10 | 5.53          | 0.30         |   |
| 21   | Germany                  | 7,915.44  | 28.42         | 0.83         |   | 85   | Ecuador                    | 1,528.74 | 5.44          | 0.29         |   |
| 22   | Estonia                  | 7,891.67  | 28.34         | 0.82         |   | 86   | Jamaica                    | 1,516.18 | 5.39          | 0.28         |   |
| 23   | Israel                   | 7,849.70  | 28.19         | 0.81         |   | 87   | Moldova, Rep.              | 1,503.09 | 5.35          | 0.27         |   |
| 24   | Czech Republic           | 7,823.01  | 28.09         | 0.81         |   | 88   | Peru                       | 1,470.04 | 5.23          | 0.26         |   |
| 25   | Russian Federation       | 7,386.55  | 26.52         | 0.80         |   | 89   | Colombia                   | 1,463.07 | 5.20          | 0.25         |   |
| 26   | Trinidad and Tobago      | 7,326.67  | 26.31         | 0.79         | ● | 90   | Lithuania                  | 1,265.53 | 4.49          | 0.25         | ○ |
| 27   | Austria                  | 7,206.53  | 25.87         | 0.78         |   | 91   | Botswana                   | 1,064.41 | 3.77          | 0.24         |   |
| 28   | Slovenia                 | 7,153.14  | 25.68         | 0.77         |   | 92   | El Salvador                | 1,018.49 | 3.60          | 0.23         |   |
| 29   | Oman                     | 6,869.81  | 24.66         | 0.76         | ● | 93   | Honduras                   | 1,009.80 | 3.57          | 0.22         |   |
| 30   | Bulgaria                 | 6,499.58  | 23.33         | 0.75         |   | 94   | India                      | 993.91   | 3.51          | 0.21         |   |
| 31   | Netherlands              | 6,497.52  | 23.32         | 0.75         |   | 95   | Zambia                     | 919.34   | 3.25          | 0.20         |   |
| 32   | Ireland                  | 6,102.15  | 21.90         | 0.74         |   | 96   | Indonesia                  | 898.20   | 3.17          | 0.19         |   |
| 33   | Kazakhstan               | 6,076.81  | 21.81         | 0.73         | ● | 97   | Morocco                    | 847.46   | 2.99          | 0.19         | ○ |
| 34   | Belgium                  | 5,969.55  | 21.42         | 0.72         |   | 98   | Bolivia, Plurinational St. | 829.07   | 2.92          | 0.18         |   |
| 35   | Spain                    | 5,940.70  | 21.32         | 0.71         |   | 99   | Philippines                | 779.32   | 2.74          | 0.17         |   |
| 36   | Hong Kong (China)        | 5,511.33  | 19.77         | 0.70         |   | 100  | Guatemala                  | 669.48   | 2.35          | 0.16         |   |
| 37   | Malta                    | 5,220.93  | 18.73         | 0.69         |   | 101  | Zimbabwe                   | 657.25   | 2.30          | 0.15         |   |
| 38   | United Kingdom           | 5,155.45  | 18.49         | 0.69         |   | 102  | Mozambique                 | 651.87   | 2.28          | 0.14         |   |
| 39   | Montenegro               | 5,119.35  | 18.36         | 0.68         |   | 103  | Namibia                    | 624.17   | 2.18          | 0.14         |   |
| 40   | Denmark                  | 5,075.97  | 18.21         | 0.67         |   | 104  | Sri Lanka                  | 603.73   | 2.11          | 0.13         | ○ |
| 41   | Cyprus                   | 5,058.14  | 18.14         | 0.66         |   | 105  | Pakistan                   | 569.09   | 1.99          | 0.12         |   |
| 42   | Malaysia                 | 4,932.07  | 17.69         | 0.65         |   | 106  | Côte d'Ivoire              | 373.92   | 1.28          | 0.11         |   |
| 43   | Portugal                 | 4,900.29  | 17.57         | 0.64         |   | 107  | Bangladesh                 | 351.05   | 1.20          | 0.10         |   |
| 44   | Slovakia                 | 4,787.32  | 17.17         | 0.64         |   | 108  | Cameroon                   | 304.00   | 1.03          | 0.09         |   |
| 45   | Serbia                   | 4,690.88  | 16.82         | 0.63         |   | 109  | Yemen                      | 292.06   | 0.99          | 0.08         |   |
| 46   | South Africa             | 4,619.83  | 16.56         | 0.62         |   | 110  | Senegal                    | 254.19   | 0.85          | 0.08         |   |
| 47   | Italy                    | 4,597.36  | 16.48         | 0.61         |   | 111  | Kenya                      | 206.38   | 0.68          | 0.07         | ○ |
| 48   | Greece                   | 4,374.43  | 15.68         | 0.60         |   | 112  | Cambodia                   | 199.54   | 0.66          | 0.06         | ○ |
| 49   | Poland                   | 4,263.42  | 15.28         | 0.59         |   | 113  | Nigeria                    | 171.23   | 0.55          | 0.05         |   |
| 50   | Bosnia and Herzegovina   | 4,230.37  | 15.16         | 0.58         |   | 114  | Nepal                      | 134.74   | 0.42          | 0.04         | ○ |
| 51   | China                    | 4,152.95  | 14.88         | 0.58         |   | 115  | Tanzania, United Rep.      | 120.01   | 0.37          | 0.03         |   |
| 52   | Chile                    | 4,118.79  | 14.76         | 0.57         |   | 116  | Ethiopia                   | 99.16    | 0.29          | 0.03         |   |
| 53   | Ukraine                  | 4,011.73  | 14.38         | 0.56         |   | 117  | Niger                      | 36.11    | 0.07          | 0.02         |   |
| 54   | Lebanon                  | 3,945.49  | 14.14         | 0.55         |   | 118  | Togo                       | 19.94    | 0.01          | 0.01         | ○ |
| 55   | Uruguay                  | 3,804.39  | 13.63         | 0.54         |   | 119  | Benin                      | 17.36    | 0.00          | 0.00         | ○ |
| 56   | Belarus                  | 3,667.90  | 13.14         | 0.53         |   | n/a  | Burkina Faso               | n/a      | n/a           | n/a          |   |
| 57   | Iran, Islamic Rep.       | 3,514.32  | 12.59         | 0.53         |   | n/a  | Burundi                    | n/a      | n/a           | n/a          |   |
| 58   | Turkey                   | 3,351.70  | 12.00         | 0.52         |   | n/a  | Guinea                     | n/a      | n/a           | n/a          |   |
| 59   | Argentina                | 3,286.64  | 11.77         | 0.51         |   | n/a  | Madagascar                 | n/a      | n/a           | n/a          |   |
| 60   | Romania                  | 3,274.84  | 11.72         | 0.50         |   | n/a  | Malawi                     | n/a      | n/a           | n/a          |   |
| 61   | Croatia                  | 3,168.87  | 11.34         | 0.49         |   | n/a  | Mali                       | n/a      | n/a           | n/a          |   |
| 62   | Hungary                  | 3,061.97  | 10.96         | 0.48         |   | n/a  | Rwanda                     | n/a      | n/a           | n/a          |   |
| 63   | Brazil                   | 2,866.03  | 10.25         | 0.47         |   | n/a  | Uganda                     | n/a      | n/a           | n/a          |   |
| 64   | Jordan                   | 2,756.43  | 9.86          | 0.47         |   |      |                            |          |               |              |   |

SOURCE: International Energy Agency (IEA) *World Energy Balances on-line data service, 2015 edition*

NOTE: ● indicates a strength; ○ a weakness

## 3.2.2 Logistics performance

### Logistics Performance Index | 2016

| Rank | Country/Economy          | Value | Score (0–100) | Percent rank |   | Rank | Country/Economy            | Value | Score (0–100) | Percent rank |   |
|------|--------------------------|-------|---------------|--------------|---|------|----------------------------|-------|---------------|--------------|---|
| 1    | Germany                  | 4.23  | 100.00        | 1.00         | ● | 65   | Argentina                  | 2.96  | 41.60         | 0.49         |   |
| 2    | Luxembourg               | 4.22  | 99.70         | 0.99         | ● | 66   | Jordan                     | 2.96  | 41.32         | 0.48         |   |
| 3    | Sweden                   | 4.20  | 99.01         | 0.98         | ● | 67   | Pakistan                   | 2.92  | 39.78         | 0.48         |   |
| 4    | Netherlands              | 4.19  | 98.22         | 0.98         | ● | 68   | Peru                       | 2.89  | 38.40         | 0.47         |   |
| 5    | Singapore                | 4.14  | 96.19         | 0.97         |   | 69   | Brunei Darussalam          | 2.87  | 37.34         | 0.46         |   |
| 6    | Belgium                  | 4.11  | 94.57         | 0.96         | ● | 70   | Philippines                | 2.86  | 36.68         | 0.45         |   |
| 7    | Austria                  | 4.10  | 94.08         | 0.95         | ● | 71   | Malawi (2014)              | 2.81  | 34.68         | 0.44         |   |
| 8    | United Kingdom           | 4.07  | 92.77         | 0.94         |   | 72   | Bulgaria                   | 2.81  | 34.44         | 0.44         |   |
| 9    | Hong Kong (China)        | 4.07  | 92.75         | 0.94         |   | 73   | Cambodia                   | 2.80  | 34.11         | 0.43         |   |
| 10   | United States of America | 3.99  | 89.19         | 0.93         |   | 74   | Ecuador                    | 2.78  | 33.11         | 0.42         |   |
| 11   | Switzerland              | 3.99  | 88.96         | 0.92         |   | 75   | Algeria                    | 2.77  | 32.68         | 0.41         |   |
| 12   | Japan                    | 3.97  | 88.19         | 0.91         |   | 76   | Serbia                     | 2.76  | 32.35         | 0.40         |   |
| 13   | United Arab Emirates     | 3.94  | 86.86         | 0.90         | ● | 77   | Kazakhstan                 | 2.75  | 31.86         | 0.40         |   |
| 14   | Canada                   | 3.93  | 86.35         | 0.90         |   | 78   | Namibia                    | 2.74  | 31.53         | 0.39         |   |
| 15   | Finland                  | 3.92  | 85.89         | 0.89         |   | 79   | Ukraine                    | 2.74  | 31.15         | 0.38         |   |
| 16   | France                   | 3.90  | 84.98         | 0.88         |   | 80   | Burkina Faso               | 2.73  | 30.88         | 0.37         |   |
| 17   | Denmark                  | 3.82  | 81.04         | 0.87         |   | 81   | Lebanon                    | 2.72  | 30.26         | 0.37         |   |
| 18   | Ireland                  | 3.79  | 80.07         | 0.87         |   | 82   | El Salvador                | 2.71  | 29.72         | 0.36         |   |
| 19   | Australia                | 3.79  | 80.00         | 0.86         |   | 83   | Sri Lanka (2014)           | 2.70  | 29.24         | 0.35         |   |
| 20   | South Africa             | 3.78  | 79.17         | 0.85         | ● | 84   | Mozambique                 | 2.68  | 28.72         | 0.34         |   |
| 21   | Italy                    | 3.76  | 78.25         | 0.84         |   | 85   | Morocco                    | 2.67  | 27.89         | 0.33         |   |
| 22   | Norway                   | 3.73  | 77.17         | 0.83         |   | 86   | Bangladesh                 | 2.66  | 27.79         | 0.33         |   |
| 23   | Spain                    | 3.73  | 76.95         | 0.83         |   | 87   | Costa Rica                 | 2.65  | 27.10         | 0.32         |   |
| 24   | Korea, Rep.              | 3.72  | 76.48         | 0.82         |   | 88   | Nigeria                    | 2.63  | 26.13         | 0.31         |   |
| 25   | Czech Republic           | 3.67  | 74.50         | 0.81         |   | 89   | Dominican Republic         | 2.63  | 26.10         | 0.30         |   |
| 26   | China                    | 3.66  | 73.89         | 0.80         |   | 90   | Togo                       | 2.62  | 25.66         | 0.29         |   |
| 27   | Israel                   | 3.66  | 73.85         | 0.79         |   | 91   | Moldova, Rep.              | 2.61  | 25.50         | 0.29         |   |
| 28   | Lithuania                | 3.63  | 72.53         | 0.79         |   | 92   | Colombia                   | 2.61  | 25.41         | 0.28         |   |
| 29   | Qatar                    | 3.60  | 71.03         | 0.78         |   | 93   | Côte d'Ivoire              | 2.60  | 24.95         | 0.27         |   |
| 30   | Hungary                  | 3.43  | 63.16         | 0.77         |   | 94   | Iran, Islamic Rep.         | 2.60  | 24.89         | 0.26         |   |
| 31   | Malaysia                 | 3.43  | 63.03         | 0.76         |   | 95   | Bosnia and Herzegovina     | 2.60  | 24.66         | 0.25         |   |
| 32   | Poland                   | 3.43  | 63.01         | 0.75         |   | 96   | Russian Federation         | 2.57  | 23.49         | 0.25         | ○ |
| 33   | Turkey                   | 3.42  | 62.91         | 0.75         |   | 97   | Niger                      | 2.56  | 23.08         | 0.24         |   |
| 34   | India                    | 3.42  | 62.74         | 0.74         |   | 98   | Paraguay                   | 2.56  | 23.05         | 0.23         |   |
| 35   | Portugal                 | 3.41  | 62.25         | 0.73         |   | 99   | Mauritius (2014)           | 2.51  | 20.90         | 0.22         |   |
| 36   | New Zealand              | 3.39  | 61.26         | 0.72         |   | 100  | TFYR of Macedonia          | 2.51  | 20.69         | 0.21         | ○ |
| 37   | Estonia                  | 3.36  | 60.13         | 0.71         |   | 101  | Burundi                    | 2.51  | 20.67         | 0.21         |   |
| 38   | Iceland                  | 3.35  | 59.30         | 0.71         |   | 102  | Mongolia                   | 2.51  | 20.49         | 0.20         |   |
| 39   | Panama                   | 3.34  | 58.94         | 0.70         |   | 103  | Mali                       | 2.50  | 20.36         | 0.19         |   |
| 40   | Slovakia                 | 3.34  | 58.90         | 0.69         |   | 104  | Tunisia                    | 2.50  | 20.06         | 0.18         | ○ |
| 41   | Kenya                    | 3.33  | 58.64         | 0.68         |   | 105  | Guatemala                  | 2.48  | 19.12         | 0.17         |   |
| 42   | Latvia                   | 3.33  | 58.45         | 0.67         |   | 106  | Honduras                   | 2.46  | 18.49         | 0.17         |   |
| 43   | Bahrain                  | 3.31  | 57.84         | 0.67         |   | 107  | Azerbaijan (2014)          | 2.45  | 17.83         | 0.16         |   |
| 44   | Thailand                 | 3.26  | 55.12         | 0.66         |   | 108  | Zambia                     | 2.43  | 16.97         | 0.15         |   |
| 45   | Chile                    | 3.25  | 54.81         | 0.65         |   | 109  | Benin                      | 2.43  | 16.89         | 0.14         |   |
| 46   | Greece                   | 3.24  | 54.40         | 0.64         |   | 110  | Albania                    | 2.41  | 16.17         | 0.13         |   |
| 47   | Oman                     | 3.23  | 54.16         | 0.63         |   | 111  | Jamaica                    | 2.40  | 15.60         | 0.13         | ○ |
| 48   | Egypt                    | 3.18  | 51.88         | 0.63         | ● | 112  | Belarus                    | 2.40  | 15.55         | 0.12         | ○ |
| 49   | Slovenia                 | 3.18  | 51.86         | 0.62         |   | 113  | Trinidad and Tobago        | 2.40  | 15.52         | 0.11         |   |
| 50   | Croatia                  | 3.16  | 50.76         | 0.61         |   | 114  | Montenegro                 | 2.38  | 14.67         | 0.10         | ○ |
| 51   | Saudi Arabia             | 3.16  | 50.56         | 0.60         |   | 115  | Nepal                      | 2.38  | 14.52         | 0.10         |   |
| 52   | Kuwait                   | 3.15  | 50.34         | 0.60         |   | 116  | Ethiopia                   | 2.38  | 14.52         | 0.09         |   |
| 53   | Mexico                   | 3.11  | 48.60         | 0.59         |   | 117  | Guinea                     | 2.36  | 13.69         | 0.08         |   |
| 54   | Brazil                   | 3.09  | 47.39         | 0.58         |   | 118  | Georgia                    | 2.35  | 13.42         | 0.07         | ○ |
| 55   | Malta                    | 3.07  | 46.53         | 0.57         |   | 119  | Senegal                    | 2.33  | 12.25         | 0.06         | ○ |
| 56   | Botswana                 | 3.05  | 45.43         | 0.56         |   | 120  | Bolivia, Plurinational St. | 2.25  | 8.72          | 0.06         | ○ |
| 57   | Uganda                   | 3.04  | 45.33         | 0.56         |   | 121  | Armenia                    | 2.21  | 6.60          | 0.05         | ○ |
| 58   | Cyprus                   | 3.00  | 43.28         | 0.55         |   | 122  | Yemen (2014)               | 2.18  | 5.60          | 0.04         |   |
| 59   | Romania                  | 2.99  | 43.01         | 0.54         |   | 123  | Kyrgyzstan                 | 2.16  | 4.31          | 0.03         | ○ |
| 60   | Tanzania, United Rep.    | 2.99  | 42.87         | 0.53         | ● | 124  | Madagascar                 | 2.15  | 4.25          | 0.02         | ○ |
| 61   | Rwanda                   | 2.99  | 42.69         | 0.52         |   | 125  | Cameroon                   | 2.15  | 4.10          | 0.02         | ○ |
| 62   | Indonesia                | 2.98  | 42.61         | 0.52         |   | 126  | Zimbabwe                   | 2.08  | 0.91          | 0.01         | ○ |
| 63   | Viet Nam                 | 2.98  | 42.25         | 0.51         |   | 127  | Tajikistan                 | 2.06  | 0.00          | 0.00         | ○ |
| 64   | Uruguay                  | 2.97  | 42.15         | 0.50         |   |      |                            |       |               |              |   |

SOURCE: World Bank and Turku School of Economics, *Logistics Performance Index 2016*; Arvis et al., 2016, *Connecting to Compete 2016: Trade Logistics in the Global Economy*

NOTE: ● Indicates a strength; ○ a weakness



## 3.2.3 Gross capital formation

### Gross capital formation (% of GDP) | 2016

| Rank | Country/Economy       | Value | Score (0–100) | Percent rank |   | Rank | Country/Economy            | Value | Score (0–100) | Percent rank |   |
|------|-----------------------|-------|---------------|--------------|---|------|----------------------------|-------|---------------|--------------|---|
| 1    | Algeria               | 47.81 | 100.00        | 1.00         | ● | 65   | Bulgaria                   | 21.96 | 42.00         | 0.48         |   |
| 2    | Panama                | 47.20 | 98.64         | 0.99         | ● | 66   | Cameroon                   | 21.88 | 41.83         | 0.47         | ● |
| 3    | China                 | 43.66 | 90.70         | 0.98         | ● | 67   | Tunisia                    | 21.71 | 41.45         | 0.46         |   |
| 4    | Niger                 | 42.52 | 88.13         | 0.98         | ● | 68   | Mauritius                  | 21.67 | 41.37         | 0.46         |   |
| 5    | Brunei Darussalam     | 40.94 | 84.58         | 0.97         | ● | 69   | Russian Federation         | 21.63 | 41.27         | 0.45         |   |
| 6    | Ethiopia              | 39.74 | 81.89         | 0.96         | ● | 70   | Latvia                     | 21.61 | 41.22         | 0.44         |   |
| 7    | Mozambique            | 38.55 | 79.22         | 0.95         | ● | 71   | Japan                      | 21.53 | 41.05         | 0.43         |   |
| 8    | Indonesia             | 34.65 | 70.49         | 0.94         | ● | 72   | Finland                    | 21.42 | 40.79         | 0.42         | ○ |
| 9    | Nepal                 | 33.96 | 68.92         | 0.93         | ● | 73   | Moldova, Rep.              | 21.07 | 40.01         | 0.41         |   |
| 10   | Georgia               | 33.43 | 67.75         | 0.93         | ● | 74   | Spain                      | 20.97 | 39.79         | 0.41         | ○ |
| 11   | Kyrgyzstan            | 33.43 | 67.73         | 0.92         | ● | 75   | Hungary                    | 20.95 | 39.75         | 0.40         |   |
| 12   | India                 | 31.67 | 63.78         | 0.91         | ● | 76   | Armenia                    | 20.62 | 39.00         | 0.39         |   |
| 13   | Saudi Arabia          | 31.66 | 63.77         | 0.90         | ● | 77   | Iceland                    | 20.55 | 38.83         | 0.38         | ○ |
| 14   | Zambia                | 31.50 | 63.40         | 0.89         | ● | 78   | Poland                     | 20.33 | 38.34         | 0.37         | ○ |
| 15   | Oman                  | 31.00 | 62.29         | 0.89         | ● | 79   | Côte d'Ivoire              | 20.17 | 37.99         | 0.37         |   |
| 16   | Tanzania, United Rep. | 30.74 | 61.70         | 0.88         | ● | 80   | Dominican Republic         | 20.06 | 37.75         | 0.36         |   |
| 17   | Botswana              | 30.44 | 61.04         | 0.87         | ● | 81   | Uruguay                    | 20.02 | 37.65         | 0.35         |   |
| 18   | Morocco               | 30.24 | 60.59         | 0.86         | ● | 82   | United States of America   | 19.76 | 37.08         | 0.34         | ○ |
| 19   | Azerbaijan            | 29.77 | 59.53         | 0.85         | ● | 83   | Bahrain                    | 19.68 | 36.89         | 0.33         |   |
| 20   | Rwanda                | 29.53 | 58.99         | 0.85         | ● | 84   | United Arab Emirates       | 19.67 | 36.87         | 0.33         | ○ |
| 21   | Namibia               | 29.23 | 58.32         | 0.84         | ● | 85   | South Africa               | 19.60 | 36.71         | 0.32         |   |
| 22   | Korea, Rep.           | 28.90 | 57.57         | 0.83         | ● | 86   | Denmark                    | 19.56 | 36.61         | 0.31         | ○ |
| 23   | Iran, Islamic Rep.    | 28.87 | 57.51         | 0.82         | ● | 87   | Netherlands                | 19.50 | 36.48         | 0.30         | ○ |
| 24   | Albania               | 28.83 | 57.41         | 0.81         | ● | 88   | Jordan                     | 19.48 | 36.44         | 0.29         |   |
| 25   | Bangladesh            | 28.45 | 56.57         | 0.80         | ● | 89   | Israel                     | 19.45 | 36.38         | 0.28         | ○ |
| 26   | Sri Lanka             | 28.34 | 56.31         | 0.80         | ● | 90   | Mali                       | 19.40 | 36.26         | 0.28         |   |
| 27   | Norway                | 28.31 | 56.25         | 0.79         | ● | 91   | Germany                    | 19.27 | 35.98         | 0.27         | ○ |
| 28   | Kazakhstan            | 28.09 | 55.75         | 0.78         | ● | 92   | Bolivia, Plurinational St. | 19.18 | 35.77         | 0.26         |   |
| 29   | Viet Nam              | 28.03 | 55.63         | 0.77         | ● | 93   | Costa Rica                 | 18.80 | 34.92         | 0.25         |   |
| 30   | Montenegro            | 27.08 | 53.50         | 0.76         | ● | 94   | Slovenia                   | 18.79 | 34.90         | 0.24         | ○ |
| 31   | Mongolia              | 27.02 | 53.36         | 0.76         | ● | 95   | Croatia                    | 18.74 | 34.79         | 0.24         | ○ |
| 32   | Belarus               | 26.86 | 53.01         | 0.75         | ● | 96   | Luxembourg                 | 18.58 | 34.43         | 0.23         | ○ |
| 33   | Senegal               | 26.58 | 52.38         | 0.74         | ● | 97   | Serbia                     | 18.25 | 33.69         | 0.22         |   |
| 34   | Benin                 | 26.25 | 51.63         | 0.73         | ● | 98   | Brazil                     | 17.96 | 33.04         | 0.21         | ○ |
| 35   | Malaysia              | 26.15 | 51.40         | 0.72         | ● | 99   | Tajikistan                 | 17.89 | 32.88         | 0.20         |   |
| 36   | Czech Republic        | 26.06 | 51.19         | 0.72         | ● | 100  | Lithuania                  | 17.66 | 32.36         | 0.20         | ○ |
| 37   | Togo                  | 26.02 | 51.12         | 0.71         | ● | 101  | Turkey                     | 17.40 | 31.79         | 0.19         | ○ |
| 38   | Honduras              | 25.98 | 51.03         | 0.70         | ● | 102  | United Kingdom             | 17.34 | 31.65         | 0.18         | ○ |
| 39   | Singapore             | 25.97 | 51.00         | 0.69         | ● | 103  | Bosnia and Herzegovina     | 17.12 | 31.16         | 0.17         |   |
| 40   | Uganda                | 25.63 | 50.25         | 0.68         | ● | 104  | Guinea                     | 16.90 | 30.66         | 0.16         |   |
| 41   | Sweden                | 25.63 | 50.24         | 0.67         | ● | 105  | Italy                      | 16.65 | 30.08         | 0.15         | ○ |
| 42   | Malta                 | 25.60 | 50.18         | 0.67         | ● | 106  | Argentina                  | 16.50 | 29.77         | 0.15         |   |
| 43   | Romania               | 25.01 | 48.84         | 0.66         | ● | 107  | Paraguay                   | 15.82 | 28.23         | 0.14         |   |
| 44   | Colombia              | 25.00 | 48.83         | 0.65         | ● | 108  | Ukraine                    | 15.81 | 28.22         | 0.13         | ○ |
| 45   | Australia             | 24.92 | 48.66         | 0.64         | ● | 109  | Jamaica                    | 15.43 | 27.35         | 0.12         | ○ |
| 46   | Ecuador               | 24.73 | 48.23         | 0.63         | ● | 110  | Madagascar                 | 15.33 | 27.13         | 0.11         |   |
| 47   | Peru                  | 24.63 | 48.00         | 0.63         | ● | 111  | Pakistan                   | 15.21 | 26.86         | 0.11         |   |
| 48   | Thailand              | 24.42 | 47.52         | 0.62         | ● | 112  | Portugal                   | 14.97 | 26.33         | 0.10         | ○ |
| 49   | Estonia               | 24.04 | 46.68         | 0.61         | ● | 113  | Egypt                      | 14.53 | 25.34         | 0.09         |   |
| 50   | Philippines           | 23.74 | 45.99         | 0.60         | ● | 114  | Burkina Faso               | 14.27 | 24.75         | 0.08         |   |
| 51   | Belgium               | 23.65 | 45.81         | 0.59         | ● | 115  | Zimbabwe                   | 14.23 | 24.67         | 0.07         |   |
| 52   | Kuwait                | 23.49 | 45.44         | 0.59         | ● | 116  | El Salvador                | 14.22 | 24.65         | 0.07         |   |
| 53   | New Zealand           | 23.29 | 44.99         | 0.58         | ● | 117  | Nigeria                    | 13.81 | 23.71         | 0.06         |   |
| 54   | Mexico                | 23.10 | 44.56         | 0.57         | ● | 118  | Trinidad and Tobago        | 13.42 | 22.85         | 0.05         | ○ |
| 55   | Switzerland           | 23.08 | 44.53         | 0.56         | ○ | 119  | Guatemala                  | 13.36 | 22.71         | 0.04         | ○ |
| 56   | Canada                | 23.07 | 44.50         | 0.55         | ○ | 120  | Malawi                     | 12.55 | 20.90         | 0.03         |   |
| 57   | Cambodia              | 22.90 | 44.12         | 0.54         | ● | 121  | Cyprus                     | 10.44 | 16.17         | 0.02         | ○ |
| 58   | Slovakia              | 22.78 | 43.85         | 0.54         | ● | 122  | Greece                     | 10.33 | 15.91         | 0.02         | ○ |
| 59   | Kenya                 | 22.52 | 43.27         | 0.53         | ● | 123  | Burundi                    | 4.19  | 2.15          | 0.01         | ○ |
| 60   | Ireland               | 22.45 | 43.12         | 0.52         | ○ | 124  | Yemen                      | 3.24  | 0.00          | 0.00         | ○ |
| 61   | Austria               | 22.45 | 43.11         | 0.51         | ○ | n/a  | Lebanon                    | n/a   | n/a           | n/a          |   |
| 62   | France                | 22.39 | 42.97         | 0.50         | ○ | n/a  | Qatar                      | n/a   | n/a           | n/a          |   |
| 63   | Chile                 | 22.34 | 42.85         | 0.50         | ○ | n/a  | TFYR of Macedonia          | n/a   | n/a           | n/a          |   |
| 64   | Hong Kong (China)     | 22.06 | 42.23         | 0.49         | ○ |      |                            |       |               |              |   |

SOURCE: International Monetary Fund, *World Economic Outlook Database*, October 2016

NOTE: ● indicates a strength; ○ a weakness

# 3.3.1 GDP per unit of energy use

GDP per unit of energy use (2010 PPP\$ per kg of oil equivalent) | 2014

| Rank | Country/Economy    | Value | Score (0–100) | Percent rank |   | Rank | Country/Economy            | Value | Score (0–100) | Percent rank |   |
|------|--------------------|-------|---------------|--------------|---|------|----------------------------|-------|---------------|--------------|---|
| 1    | Hong Kong (China)  | 26.32 | 100.00        | 1.00         | ● | 65   | India                      | 8.40  | 30.01         | 0.46         |   |
| 2    | Sri Lanka          | 20.00 | 75.32         | 0.99         | ● | 66   | Cameroon                   | 8.33  | 29.74         | 0.45         | ● |
| 3    | Panama             | 17.86 | 66.95         | 0.98         | ● | 67   | Australia                  | 8.20  | 29.21         | 0.44         | ○ |
| 4    | Colombia           | 17.54 | 65.73         | 0.96         | ● | 68   | United Arab Emirates       | 8.13  | 28.95         | 0.43         |   |
| 4    | Ireland            | 17.54 | 65.73         | 0.96         | ● | 69   | Jamaica                    | 8.06  | 28.69         | 0.42         |   |
| 4    | Switzerland        | 17.54 | 65.73         | 0.96         | ● | 69   | Senegal                    | 8.06  | 28.69         | 0.42         |   |
| 7    | Dominican Republic | 16.95 | 63.40         | 0.95         | ● | 71   | Malaysia                   | 8.00  | 28.44         | 0.41         |   |
| 8    | Mauritius          | 15.63 | 58.23         | 0.94         | ● | 72   | Bolivia, Plurinational St. | 7.87  | 27.95         | 0.40         |   |
| 9    | Malta              | 15.15 | 56.38         | 0.92         |   | 73   | Brunei Darussalam          | 7.81  | 27.71         | 0.39         |   |
| 9    | Singapore          | 15.15 | 56.38         | 0.92         |   | 74   | Armenia                    | 7.69  | 27.24         | 0.38         |   |
| 11   | Denmark            | 14.93 | 55.50         | 0.92         |   | 75   | New Zealand                | 7.63  | 27.01         | 0.37         | ○ |
| 12   | Peru               | 14.49 | 53.81         | 0.91         | ● | 76   | Kuwait                     | 7.58  | 26.78         | 0.36         |   |
| 13   | Uruguay            | 14.08 | 52.21         | 0.90         | ● | 76   | United States of America   | 7.58  | 26.78         | 0.36         | ○ |
| 14   | United Kingdom     | 13.89 | 51.45         | 0.89         |   | 78   | Czech Republic             | 7.46  | 26.34         | 0.35         | ○ |
| 15   | Costa Rica         | 13.51 | 49.98         | 0.88         | ● | 79   | Tajikistan                 | 7.46  | 26.34         | 0.34         |   |
| 16   | Philippines        | 13.51 | 49.98         | 0.87         | ● | 80   | Thailand                   | 7.41  | 26.12         | 0.33         |   |
| 17   | Luxembourg         | 13.33 | 49.28         | 0.86         |   | 81   | Cambodia                   | 7.35  | 25.91         | 0.32         |   |
| 18   | Bangladesh         | 13.16 | 48.59         | 0.85         | ● | 82   | Nigeria                    | 7.30  | 25.70         | 0.31         |   |
| 18   | Italy              | 13.16 | 48.59         | 0.85         |   | 83   | Georgia                    | 7.25  | 25.49         | 0.31         |   |
| 20   | Cyprus             | 12.99 | 47.92         | 0.84         |   | 84   | Viet Nam                   | 7.14  | 25.09         | 0.30         |   |
| 21   | Morocco            | 12.66 | 46.64         | 0.83         | ● | 85   | Saudi Arabia               | 7.04  | 24.70         | 0.29         |   |
| 22   | Albania            | 12.50 | 46.02         | 0.82         | ● | 86   | Honduras                   | 6.80  | 23.76         | 0.28         |   |
| 23   | Spain              | 12.50 | 46.02         | 0.81         |   | 87   | Bulgaria                   | 6.54  | 22.72         | 0.27         | ○ |
| 23   | Yemen              | 12.50 | 46.02         | 0.81         | ● | 88   | Qatar                      | 6.49  | 22.55         | 0.26         |   |
| 25   | Botswana           | 12.35 | 45.42         | 0.79         | ● | 89   | Finland                    | 6.33  | 21.91         | 0.25         | ○ |
| 25   | Portugal           | 12.35 | 45.42         | 0.79         |   | 90   | Oman                       | 6.29  | 21.75         | 0.25         |   |
| 27   | Namibia            | 12.35 | 45.42         | 0.78         | ● | 91   | Korea, Rep.                | 6.29  | 21.75         | 0.24         | ○ |
| 28   | Ecuador            | 11.90 | 43.69         | 0.77         | ● | 92   | Estonia                    | 6.13  | 21.15         | 0.23         | ○ |
| 29   | Egypt              | 11.76 | 43.15         | 0.75         | ● | 93   | Mongolia                   | 6.06  | 20.86         | 0.22         |   |
| 29   | El Salvador        | 11.76 | 43.15         | 0.75         | ● | 94   | Belarus                    | 5.81  | 19.90         | 0.20         |   |
| 31   | Romania            | 11.49 | 42.09         | 0.75         |   | 94   | Niger                      | 5.81  | 19.90         | 0.20         |   |
| 32   | Austria            | 11.24 | 41.08         | 0.71         |   | 96   | Zambia                     | 5.71  | 19.51         | 0.19         |   |
| 32   | Germany            | 11.24 | 41.08         | 0.71         |   | 97   | Canada                     | 5.56  | 18.89         | 0.19         | ○ |
| 32   | Greece             | 11.24 | 41.08         | 0.71         |   | 98   | China                      | 5.52  | 18.77         | 0.18         | ○ |
| 32   | Tunisia            | 11.24 | 41.08         | 0.71         | ● | 99   | Nepal                      | 5.35  | 18.07         | 0.17         |   |
| 36   | Indonesia          | 11.11 | 40.59         | 0.70         | ● | 100  | Iran, Islamic Rep.         | 5.32  | 17.96         | 0.16         |   |
| 37   | Israel             | 11.11 | 40.59         | 0.69         |   | 101  | Kenya                      | 5.24  | 17.64         | 0.15         |   |
| 37   | Turkey             | 11.11 | 40.59         | 0.69         |   | 102  | Kazakhstan                 | 5.10  | 17.12         | 0.14         |   |
| 39   | Azerbaijan         | 10.87 | 39.65         | 0.68         |   | 103  | Moldova, Rep.              | 5.03  | 16.81         | 0.14         | ○ |
| 40   | Netherlands        | 10.75 | 39.19         | 0.67         | ○ | 104  | Côte d'Ivoire              | 4.85  | 16.15         | 0.13         |   |
| 41   | Mexico             | 10.64 | 38.75         | 0.66         |   | 105  | Tanzania, United Rep.      | 4.81  | 15.97         | 0.12         |   |
| 42   | Paraguay           | 10.53 | 38.31         | 0.65         | ● | 106  | Kyrgyzstan                 | 4.78  | 15.88         | 0.11         |   |
| 43   | Chile              | 10.42 | 37.88         | 0.63         |   | 107  | Benin                      | 4.69  | 15.52         | 0.10         |   |
| 43   | Lithuania          | 10.42 | 37.88         | 0.63         |   | 108  | Bosnia and Herzegovina     | 4.52  | 14.86         | 0.08         | ○ |
| 43   | Norway             | 10.42 | 37.88         | 0.63         |   | 108  | Russian Federation         | 4.52  | 14.86         | 0.08         | ○ |
| 46   | Japan              | 10.20 | 37.05         | 0.62         |   | 110  | South Africa               | 4.48  | 14.70         | 0.08         | ○ |
| 47   | Brazil             | 10.10 | 36.65         | 0.61         |   | 111  | Bahrain                    | 4.10  | 13.19         | 0.07         | ○ |
| 48   | Algeria            | 10.00 | 36.25         | 0.59         | ● | 112  | Ukraine                    | 3.28  | 9.99          | 0.06         | ○ |
| 48   | TFYR of Macedonia  | 10.00 | 36.25         | 0.59         |   | 113  | Togo                       | 2.88  | 8.44          | 0.05         |   |
| 50   | Croatia            | 10.00 | 36.25         | 0.58         |   | 114  | Ethiopia                   | 2.81  | 8.16          | 0.04         |   |
| 51   | France             | 9.90  | 35.87         | 0.58         | ○ | 115  | Mozambique                 | 2.47  | 6.83          | 0.03         |   |
| 52   | Lebanon            | 9.90  | 35.87         | 0.57         |   | 116  | Iceland                    | 2.41  | 6.60          | 0.03         | ○ |
| 53   | Hungary            | 9.80  | 35.49         | 0.55         |   | 117  | Zimbabwe                   | 2.31  | 6.20          | 0.02         | ○ |
| 53   | Latvia             | 9.80  | 35.49         | 0.55         |   | 118  | Trinidad and Tobago        | 2.07  | 5.27          | 0.01         | ○ |
| 55   | Poland             | 9.71  | 35.11         | 0.54         |   | 119  | Serbia                     | 0.72  | 0.00          | 0.00         | ○ |
| 56   | Argentina          | 9.35  | 33.70         | 0.53         |   | n/a  | Burkina Faso               | n/a   | n/a           | n/a          |   |
| 57   | Pakistan           | 9.26  | 33.36         | 0.53         | ● | n/a  | Burundi                    | n/a   | n/a           | n/a          |   |
| 58   | Montenegro         | 9.17  | 33.03         | 0.52         |   | n/a  | Guinea                     | n/a   | n/a           | n/a          |   |
| 59   | Slovakia           | 9.09  | 32.70         | 0.51         |   | n/a  | Madagascar                 | n/a   | n/a           | n/a          |   |
| 60   | Jordan             | 9.09  | 32.70         | 0.50         |   | n/a  | Malawi                     | n/a   | n/a           | n/a          |   |
| 61   | Slovenia           | 8.85  | 31.76         | 0.49         |   | n/a  | Mali                       | n/a   | n/a           | n/a          |   |
| 62   | Sweden             | 8.62  | 30.86         | 0.48         | ○ | n/a  | Rwanda                     | n/a   | n/a           | n/a          |   |
| 63   | Belgium            | 8.47  | 30.29         | 0.47         | ○ | n/a  | Uganda                     | n/a   | n/a           | n/a          |   |
| 63   | Guatemala          | 8.47  | 30.29         | 0.47         |   |      |                            |       |               |              |   |

SOURCE: International Energy Agency (IEA) *World Energy Balances on-line data service, 2016 edition*

NOTE: ● indicates a strength; ○ a weakness

# 3.3.2 Environmental performance

## Environmental Performance Index | 2015

| Rank | Country/Economy          | Value | Score (0–100) | Percent rank |   | Rank | Country/Economy            | Value | Score (0–100) | Percent rank |   |
|------|--------------------------|-------|---------------|--------------|---|------|----------------------------|-------|---------------|--------------|---|
| 1    | Finland                  | 90.68 | 90.68         | 1.00         | ● | 65   | Kyrgyzstan                 | 73.13 | 73.13         | 0.48         |   |
| 2    | Iceland                  | 90.51 | 90.51         | 0.99         | ● | 66   | Tajikistan                 | 73.05 | 73.05         | 0.47         |   |
| 3    | Sweden                   | 90.43 | 90.43         | 0.98         | ● | 67   | Peru                       | 72.95 | 72.95         | 0.46         |   |
| 4    | Denmark                  | 89.21 | 89.21         | 0.98         | ● | 68   | Jordan                     | 72.24 | 72.24         | 0.45         |   |
| 5    | Slovenia                 | 88.98 | 88.98         | 0.97         | ● | 69   | Bolivia, Plurinational St. | 71.09 | 71.09         | 0.44         |   |
| 6    | Spain                    | 88.91 | 88.91         | 0.96         | ● | 70   | Mauritius                  | 70.85 | 70.85         | 0.43         |   |
| 7    | Portugal                 | 88.63 | 88.63         | 0.95         | ● | 71   | Namibia                    | 70.84 | 70.84         | 0.43         |   |
| 8    | Estonia                  | 88.59 | 88.59         | 0.94         | ● | 72   | Botswana                   | 70.72 | 70.72         | 0.42         |   |
| 9    | Malta                    | 88.48 | 88.48         | 0.93         |   | 73   | Korea, Rep.                | 70.61 | 70.61         | 0.41         |   |
| 10   | France                   | 88.20 | 88.20         | 0.93         | ● | 74   | South Africa               | 70.52 | 70.52         | 0.40         |   |
| 11   | New Zealand              | 88.00 | 88.00         | 0.92         |   | 75   | Paraguay                   | 70.36 | 70.36         | 0.39         |   |
| 12   | United Kingdom           | 87.38 | 87.38         | 0.91         |   | 76   | Algeria                    | 70.28 | 70.28         | 0.39         |   |
| 13   | Australia                | 87.22 | 87.22         | 0.90         |   | 77   | Bahrain                    | 70.07 | 70.07         | 0.38         |   |
| 14   | Singapore                | 87.04 | 87.04         | 0.89         |   | 78   | Qatar                      | 69.94 | 69.94         | 0.37         |   |
| 15   | Croatia                  | 86.98 | 86.98         | 0.89         | ● | 79   | Guatemala                  | 69.64 | 69.64         | 0.35         |   |
| 16   | Switzerland              | 86.93 | 86.93         | 0.88         |   | 79   | Honduras                   | 69.64 | 69.64         | 0.35         |   |
| 17   | Norway                   | 86.90 | 86.90         | 0.87         |   | 81   | Thailand                   | 69.54 | 69.54         | 0.34         |   |
| 18   | Austria                  | 86.64 | 86.64         | 0.86         |   | 82   | United Arab Emirates       | 69.35 | 69.35         | 0.34         |   |
| 19   | Ireland                  | 86.60 | 86.60         | 0.85         |   | 83   | Lebanon                    | 69.14 | 69.14         | 0.33         |   |
| 20   | Luxembourg               | 86.58 | 86.58         | 0.84         |   | 84   | Saudi Arabia               | 68.63 | 68.63         | 0.32         |   |
| 21   | Greece                   | 85.81 | 85.81         | 0.84         | ● | 85   | El Salvador                | 68.07 | 68.07         | 0.31         |   |
| 22   | Latvia                   | 85.71 | 85.71         | 0.83         |   | 86   | Brunei Darussalam          | 67.86 | 67.86         | 0.30         |   |
| 23   | Lithuania                | 85.49 | 85.49         | 0.82         |   | 87   | Turkey                     | 67.68 | 67.68         | 0.30         |   |
| 24   | Slovakia                 | 85.42 | 85.42         | 0.81         |   | 88   | Ecuador                    | 66.58 | 66.58         | 0.29         |   |
| 25   | Canada                   | 85.06 | 85.06         | 0.80         |   | 89   | Egypt                      | 66.45 | 66.45         | 0.28         |   |
| 26   | United States of America | 84.72 | 84.72         | 0.80         |   | 90   | Iran, Islamic Rep.         | 66.32 | 66.32         | 0.27         |   |
| 27   | Czech Republic           | 84.67 | 84.67         | 0.79         |   | 91   | Indonesia                  | 65.85 | 65.85         | 0.26         |   |
| 28   | Hungary                  | 84.60 | 84.60         | 0.78         |   | 92   | Sri Lanka                  | 65.55 | 65.55         | 0.25         |   |
| 29   | Italy                    | 84.48 | 84.48         | 0.77         |   | 93   | China                      | 65.10 | 65.10         | 0.25         |   |
| 30   | Germany                  | 84.26 | 84.26         | 0.76         |   | 94   | Georgia                    | 64.96 | 64.96         | 0.24         |   |
| 31   | Azerbaijan               | 83.78 | 83.78         | 0.75         | ● | 95   | Kuwait                     | 64.41 | 64.41         | 0.23         |   |
| 32   | Russian Federation       | 83.52 | 83.52         | 0.75         |   | 96   | Mongolia                   | 64.39 | 64.39         | 0.22         |   |
| 33   | Bulgaria                 | 83.40 | 83.40         | 0.74         |   | 97   | Senegal                    | 63.73 | 63.73         | 0.21         |   |
| 34   | Romania                  | 83.24 | 83.24         | 0.73         |   | 98   | Bosnia and Herzegovina     | 63.28 | 63.28         | 0.20         |   |
| 35   | Belarus                  | 82.30 | 82.30         | 0.72         |   | 99   | Kenya                      | 62.49 | 62.49         | 0.20         |   |
| 36   | Netherlands              | 82.03 | 82.03         | 0.71         |   | 100  | Oman                       | 60.13 | 60.13         | 0.19         |   |
| 37   | Armenia                  | 81.60 | 81.60         | 0.70         |   | 101  | Côte d'Ivoire              | 59.89 | 59.89         | 0.18         |   |
| 38   | Poland                   | 81.26 | 81.26         | 0.70         |   | 102  | Viet Nam                   | 58.50 | 58.50         | 0.17         |   |
| 39   | Japan                    | 80.59 | 80.59         | 0.69         |   | 103  | Tanzania, United Rep.      | 58.34 | 58.34         | 0.16         |   |
| 40   | Cyprus                   | 80.24 | 80.24         | 0.68         |   | 104  | Nigeria                    | 58.27 | 58.27         | 0.16         |   |
| 41   | Belgium                  | 80.15 | 80.15         | 0.67         |   | 105  | Uganda                     | 57.56 | 57.56         | 0.15         |   |
| 42   | Costa Rica               | 80.03 | 80.03         | 0.66         |   | 106  | Cameroon                   | 57.13 | 57.13         | 0.14         |   |
| 43   | Argentina                | 79.84 | 79.84         | 0.66         |   | 107  | Guinea                     | 55.40 | 55.40         | 0.13         |   |
| 44   | Ukraine                  | 79.69 | 79.69         | 0.65         |   | 108  | India                      | 53.58 | 53.58         | 0.12         | ○ |
| 45   | Brazil                   | 78.90 | 78.90         | 0.64         |   | 109  | Pakistan                   | 51.42 | 51.42         | 0.11         |   |
| 46   | Montenegro               | 78.89 | 78.89         | 0.63         |   | 110  | Cambodia                   | 51.24 | 51.24         | 0.11         |   |
| 47   | Serbia                   | 78.67 | 78.67         | 0.62         |   | 111  | Rwanda                     | 50.34 | 50.34         | 0.10         |   |
| 48   | Israel                   | 78.14 | 78.14         | 0.61         |   | 112  | Nepal                      | 50.21 | 50.21         | 0.09         |   |
| 49   | TFYR of Macedonia        | 78.02 | 78.02         | 0.61         |   | 113  | Malawi                     | 49.69 | 49.69         | 0.08         |   |
| 50   | Panama                   | 78.00 | 78.00         | 0.60         |   | 114  | Togo                       | 46.10 | 46.10         | 0.07         |   |
| 51   | Chile                    | 77.67 | 77.67         | 0.59         |   | 115  | Ethiopia                   | 45.83 | 45.83         | 0.07         |   |
| 52   | Tunisia                  | 77.28 | 77.28         | 0.58         |   | 116  | Burkina Faso               | 43.71 | 43.71         | 0.06         | ○ |
| 53   | Jamaica                  | 77.02 | 77.02         | 0.57         |   | 117  | Benin                      | 43.66 | 43.66         | 0.05         |   |
| 54   | Moldova, Rep.            | 76.69 | 76.69         | 0.57         |   | 118  | Burundi                    | 43.37 | 43.37         | 0.04         |   |
| 55   | Colombia                 | 75.93 | 75.93         | 0.56         |   | 119  | Mozambique                 | 41.82 | 41.82         | 0.03         | ○ |
| 56   | Dominican Republic       | 75.32 | 75.32         | 0.55         |   | 120  | Bangladesh                 | 41.77 | 41.77         | 0.02         | ○ |
| 57   | Albania                  | 74.38 | 74.38         | 0.54         |   | 121  | Mali                       | 41.48 | 41.48         | 0.02         | ○ |
| 58   | Trinidad and Tobago      | 74.34 | 74.34         | 0.53         |   | 122  | Niger                      | 37.48 | 37.48         | 0.01         | ○ |
| 59   | Malaysia                 | 74.23 | 74.23         | 0.52         |   | 123  | Madagascar                 | 37.10 | 37.10         | 0.00         | ○ |
| 60   | Morocco                  | 74.18 | 74.18         | 0.52         |   | n/a  | Hong Kong (China)          | n/a   | n/a           | n/a          |   |
| 61   | Uruguay                  | 73.98 | 73.98         | 0.51         |   | n/a  | Yemen                      | n/a   | n/a           | n/a          |   |
| 62   | Philippines              | 73.70 | 73.70         | 0.50         |   | n/a  | Zambia                     | n/a   | n/a           | n/a          |   |
| 63   | Mexico                   | 73.59 | 73.59         | 0.49         |   | n/a  | Zimbabwe                   | n/a   | n/a           | n/a          |   |
| 64   | Kazakhstan               | 73.29 | 73.29         | 0.48         |   |      |                            |       |               |              |   |

SOURCE: Yale University and Columbia University *Environmental Performance Index 2016*  
 NOTE: ● Indicates a strength; ○ a weakness

### 3.3.3 ISO 14001 environmental certificates

ISO 14001 Environmental management systems—Requirements with guidance for use: Number of certificates issued (per billion PPP\$ GDP) | 2015

| Rank | Country/Economy        | Value | Score (0–100) | Percent rank |   | Rank | Country/Economy            | Value | Score (0–100) | Percent rank |   |
|------|------------------------|-------|---------------|--------------|---|------|----------------------------|-------|---------------|--------------|---|
| 1    | Estonia                | 14.75 | 100.00        | 0.99         | ● | 65   | Brazil                     | 0.97  | 6.52          | 0.49         |   |
| 1    | Romania                | 25.51 | 100.00        | 0.99         | ● | 66   | Brunei Darussalam          | 0.90  | 6.05          | 0.48         |   |
| 3    | Slovakia               | 14.11 | 95.68         | 0.98         | ● | 67   | Mauritius                  | 0.89  | 5.97          | 0.47         |   |
| 4    | Serbia                 | 11.46 | 77.70         | 0.98         | ● | 68   | Sri Lanka                  | 0.86  | 5.77          | 0.46         |   |
| 5    | Czech Republic         | 11.34 | 76.83         | 0.97         | ● | 69   | India                      | 0.85  | 5.67          | 0.46         |   |
| 6    | Bulgaria               | 10.82 | 73.34         | 0.96         | ● | 70   | Egypt                      | 0.81  | 5.41          | 0.45         |   |
| 7    | Italy                  | 10.27 | 69.63         | 0.95         | ● | 71   | Jordan                     | 0.80  | 5.32          | 0.44         |   |
| 8    | Croatia                | 9.68  | 65.62         | 0.94         | ● | 72   | Indonesia                  | 0.79  | 5.25          | 0.43         |   |
| 9    | Cyprus                 | 8.79  | 59.54         | 0.94         | ● | 73   | Canada                     | 0.77  | 5.15          | 0.42         | ○ |
| 10   | Lithuania              | 8.74  | 59.18         | 0.93         | ● | 74   | Bolivia, Plurinational St. | 0.74  | 4.92          | 0.42         |   |
| 11   | Spain                  | 8.22  | 55.72         | 0.92         | ● | 75   | Philippines                | 0.73  | 4.89          | 0.41         |   |
| 12   | Latvia                 | 7.92  | 53.68         | 0.91         | ● | 76   | Namibia                    | 0.70  | 4.69          | 0.40         |   |
| 13   | Sweden                 | 7.77  | 52.63         | 0.90         |   | 77   | Oman                       | 0.67  | 4.48          | 0.39         |   |
| 14   | Hungary                | 7.49  | 50.74         | 0.90         | ● | 78   | Mexico                     | 0.62  | 4.13          | 0.38         |   |
| 15   | Switzerland            | 6.70  | 45.40         | 0.89         |   | 79   | Morocco                    | 0.62  | 4.12          | 0.38         |   |
| 16   | United Kingdom         | 6.60  | 44.67         | 0.88         |   | 80   | Iran, Islamic Rep.         | 0.55  | 3.63          | 0.37         |   |
| 17   | Finland                | 6.52  | 44.14         | 0.87         |   | 81   | Trinidad and Tobago        | 0.52  | 3.45          | 0.36         |   |
| 18   | China                  | 5.80  | 39.29         | 0.86         |   | 82   | Jamaica                    | 0.49  | 3.21          | 0.35         |   |
| 19   | Slovenia               | 5.60  | 37.89         | 0.86         |   | 83   | Pakistan                   | 0.48  | 3.16          | 0.34         |   |
| 20   | Japan                  | 5.38  | 36.44         | 0.85         |   | 84   | Senegal                    | 0.46  | 3.05          | 0.34         |   |
| 21   | Portugal               | 4.38  | 29.64         | 0.84         |   | 85   | Ukraine                    | 0.46  | 3.01          | 0.33         |   |
| 22   | TFYR of Macedonia      | 4.26  | 28.83         | 0.83         | ● | 86   | Lebanon                    | 0.42  | 2.77          | 0.32         |   |
| 23   | Colombia               | 4.21  | 28.51         | 0.82         | ● | 87   | Mozambique                 | 0.42  | 2.76          | 0.31         |   |
| 24   | Denmark                | 3.90  | 26.37         | 0.82         |   | 88   | Zambia                     | 0.40  | 2.63          | 0.30         |   |
| 25   | Greece                 | 3.89  | 26.32         | 0.81         | ● | 89   | Azerbaijan                 | 0.38  | 2.51          | 0.30         |   |
| 26   | Australia              | 3.86  | 26.09         | 0.80         |   | 90   | Kenya                      | 0.35  | 2.30          | 0.29         |   |
| 27   | Iceland                | 3.69  | 24.94         | 0.79         |   | 91   | United States of America   | 0.34  | 2.20          | 0.28         | ○ |
| 28   | Bosnia and Herzegovina | 3.66  | 24.72         | 0.78         | ● | 92   | Cambodia                   | 0.33  | 2.16          | 0.27         |   |
| 29   | Norway                 | 3.54  | 23.94         | 0.78         |   | 93   | Kuwait                     | 0.32  | 2.12          | 0.26         |   |
| 30   | Singapore              | 3.45  | 23.32         | 0.77         |   | 94   | Russian Federation         | 0.31  | 2.02          | 0.26         | ○ |
| 31   | Albania                | 3.25  | 21.94         | 0.76         | ● | 95   | Georgia                    | 0.31  | 2.01          | 0.25         |   |
| 32   | Uruguay                | 3.10  | 20.95         | 0.75         | ● | 96   | Uganda                     | 0.30  | 1.95          | 0.24         |   |
| 33   | Austria                | 2.99  | 20.18         | 0.74         |   | 97   | Nepal                      | 0.30  | 1.95          | 0.23         |   |
| 34   | Israel                 | 2.95  | 19.94         | 0.74         |   | 98   | Panama                     | 0.30  | 1.94          | 0.22         |   |
| 35   | Malaysia               | 2.94  | 19.85         | 0.73         |   | 99   | Kazakhstan                 | 0.30  | 1.93          | 0.22         |   |
| 36   | United Arab Emirates   | 2.94  | 19.84         | 0.72         |   | 100  | Côte d'Ivoire              | 0.29  | 1.88          | 0.21         |   |
| 37   | Korea, Rep.            | 2.93  | 19.82         | 0.71         |   | 101  | El Salvador                | 0.27  | 1.71          | 0.20         |   |
| 38   | Netherlands            | 2.93  | 19.78         | 0.70         |   | 102  | Cameroon                   | 0.26  | 1.69          | 0.19         |   |
| 39   | Chile                  | 2.87  | 19.38         | 0.70         |   | 103  | Botswana                   | 0.26  | 1.66          | 0.18         |   |
| 40   | Poland                 | 2.78  | 18.77         | 0.69         |   | 104  | Paraguay                   | 0.25  | 1.58          | 0.18         |   |
| 41   | Thailand               | 2.75  | 18.56         | 0.68         |   | 105  | Tanzania, United Rep.      | 0.22  | 1.43          | 0.17         |   |
| 42   | Malta                  | 2.65  | 17.89         | 0.67         |   | 106  | Saudi Arabia               | 0.21  | 1.33          | 0.16         | ○ |
| 43   | France                 | 2.57  | 17.34         | 0.66         |   | 107  | Madagascar                 | 0.20  | 1.25          | 0.15         |   |
| 44   | Belarus                | 2.56  | 17.25         | 0.66         |   | 108  | Dominican Republic         | 0.19  | 1.18          | 0.14         |   |
| 45   | Ireland                | 2.48  | 16.75         | 0.65         |   | 109  | Togo                       | 0.18  | 1.16          | 0.14         |   |
| 46   | Belgium                | 2.32  | 15.68         | 0.64         |   | 110  | Algeria                    | 0.18  | 1.11          | 0.13         |   |
| 47   | Viet Nam               | 2.16  | 14.60         | 0.63         |   | 111  | Guatemala                  | 0.17  | 1.10          | 0.12         |   |
| 48   | Germany                | 2.13  | 14.37         | 0.62         |   | 112  | Bangladesh                 | 0.17  | 1.10          | 0.11         |   |
| 49   | Luxembourg             | 1.91  | 12.88         | 0.62         |   | 113  | Mongolia                   | 0.17  | 1.04          | 0.10         |   |
| 50   | Tunisia                | 1.81  | 12.18         | 0.61         |   | 114  | Niger                      | 0.16  | 0.99          | 0.10         |   |
| 51   | Turkey                 | 1.80  | 12.11         | 0.60         |   | 115  | Armenia                    | 0.12  | 0.72          | 0.09         | ○ |
| 52   | Montenegro             | 1.71  | 11.49         | 0.59         |   | 116  | Malawi                     | 0.10  | 0.58          | 0.08         |   |
| 53   | Hong Kong (China)      | 1.70  | 11.43         | 0.58         |   | 117  | Tajikistan                 | 0.08  | 0.48          | 0.07         |   |
| 54   | South Africa           | 1.64  | 11.06         | 0.58         |   | 118  | Guinea                     | 0.07  | 0.36          | 0.06         |   |
| 55   | Argentina              | 1.61  | 10.83         | 0.57         |   | 119  | Burkina Faso               | 0.06  | 0.35          | 0.06         | ○ |
| 56   | New Zealand            | 1.54  | 10.38         | 0.56         |   | 120  | Mali                       | 0.06  | 0.30          | 0.05         |   |
| 57   | Costa Rica             | 1.48  | 9.95          | 0.55         |   | 121  | Nigeria                    | 0.05  | 0.28          | 0.04         |   |
| 58   | Bahrain                | 1.45  | 9.75          | 0.54         |   | 122  | Kyrgyzstan (2014)          | 0.05  | 0.27          | 0.03         | ○ |
| 59   | Honduras               | 1.17  | 7.83          | 0.54         |   | 123  | Rwanda                     | 0.05  | 0.25          | 0.02         | ○ |
| 60   | Ecuador                | 1.16  | 7.80          | 0.53         |   | 124  | Benin                      | 0.04  | 0.21          | 0.02         | ○ |
| 61   | Peru                   | 1.04  | 6.98          | 0.52         |   | 125  | Yemen                      | 0.01  | 0.01          | 0.01         |   |
| 62   | Moldova, Rep.          | 1.00  | 6.72          | 0.51         |   | 126  | Ethiopia                   | 0.01  | 0.00          | 0.00         | ○ |
| 63   | Zimbabwe               | 1.00  | 6.69          | 0.50         |   | n/a  | Burundi                    | n/a   | n/a           | n/a          |   |
| 64   | Qatar                  | 0.98  | 6.54          | 0.50         |   |      |                            |       |               |              |   |

SOURCE: International Organization for Standardization, *The ISO Survey 2015*; International Monetary Fund, *World Economic Outlook Database*, October 2016 (PPP\$ GDP)

NOTE: ● indicates a strength; ○ a weakness

# 4.1.1

## Ease of getting credit Ease of getting credit (distance to frontier) | 2016

| Rank | Country/Economy          | Value  | Score (0–100) | Percent rank |   | Rank | Country/Economy            | Value | Score (0–100) | Percent rank |   |
|------|--------------------------|--------|---------------|--------------|---|------|----------------------------|-------|---------------|--------------|---|
| 1    | New Zealand              | 100.00 | 100.00        | 1.00         | ● | 55   | Switzerland                | 60.00 | 60.00         | 0.48         | ○ |
| 2    | Colombia                 | 95.00  | 95.00         | 0.98         | ● | 55   | Uruguay                    | 60.00 | 60.00         | 0.48         |   |
| 2    | Rwanda                   | 95.00  | 95.00         | 0.98         | ● | 67   | Botswana                   | 55.00 | 55.00         | 0.44         |   |
| 2    | United States of America | 95.00  | 95.00         | 0.98         | ● | 67   | Croatia                    | 55.00 | 55.00         | 0.44         |   |
| 5    | Australia                | 90.00  | 90.00         | 0.96         | ● | 67   | Kazakhstan                 | 55.00 | 55.00         | 0.44         |   |
| 5    | Mexico                   | 90.00  | 90.00         | 0.96         | ● | 67   | Norway                     | 55.00 | 55.00         | 0.44         | ○ |
| 7    | Cambodia                 | 85.00  | 85.00         | 0.90         | ● | 67   | Sweden                     | 55.00 | 55.00         | 0.44         | ○ |
| 7    | Canada                   | 85.00  | 85.00         | 0.90         |   | 72   | Argentina                  | 50.00 | 50.00         | 0.35         |   |
| 7    | Costa Rica               | 85.00  | 85.00         | 0.90         | ● | 72   | Chile                      | 50.00 | 50.00         | 0.35         |   |
| 7    | Georgia                  | 85.00  | 85.00         | 0.90         | ● | 72   | Egypt                      | 50.00 | 50.00         | 0.35         |   |
| 7    | Honduras                 | 85.00  | 85.00         | 0.90         | ● | 72   | France                     | 50.00 | 50.00         | 0.35         | ○ |
| 7    | Latvia                   | 85.00  | 85.00         | 0.90         | ● | 72   | Greece                     | 50.00 | 50.00         | 0.35         |   |
| 7    | Montenegro               | 85.00  | 85.00         | 0.90         | ● | 72   | Japan                      | 50.00 | 50.00         | 0.35         | ○ |
| 7    | Romania                  | 85.00  | 85.00         | 0.90         | ● | 72   | Netherlands                | 50.00 | 50.00         | 0.35         | ○ |
| 15   | Guatemala                | 80.00  | 80.00         | 0.87         | ● | 72   | Pakistan                   | 50.00 | 50.00         | 0.35         |   |
| 15   | Jamaica                  | 80.00  | 80.00         | 0.87         | ● | 72   | Saudi Arabia               | 50.00 | 50.00         | 0.35         |   |
| 15   | Peru                     | 80.00  | 80.00         | 0.87         | ● | 72   | Thailand                   | 50.00 | 50.00         | 0.35         |   |
| 15   | TFYR of Macedonia        | 80.00  | 80.00         | 0.87         | ● | 72   | Turkey                     | 50.00 | 50.00         | 0.35         |   |
| 19   | Armenia                  | 75.00  | 75.00         | 0.79         | ● | 72   | Zimbabwe                   | 50.00 | 50.00         | 0.35         |   |
| 19   | Hong Kong (China)        | 75.00  | 75.00         | 0.79         |   | 84   | Bahrain                    | 45.00 | 45.00         | 0.24         |   |
| 19   | Hungary                  | 75.00  | 75.00         | 0.79         |   | 84   | Belarus                    | 45.00 | 45.00         | 0.24         |   |
| 19   | Malaysia                 | 75.00  | 75.00         | 0.79         |   | 84   | Belgium                    | 45.00 | 45.00         | 0.24         | ○ |
| 19   | Panama                   | 75.00  | 75.00         | 0.79         | ● | 84   | Brazil                     | 45.00 | 45.00         | 0.24         |   |
| 19   | Poland                   | 75.00  | 75.00         | 0.79         |   | 84   | Dominican Republic         | 45.00 | 45.00         | 0.24         |   |
| 19   | Singapore                | 75.00  | 75.00         | 0.79         |   | 84   | Ecuador                    | 45.00 | 45.00         | 0.24         |   |
| 19   | Ukraine                  | 75.00  | 75.00         | 0.79         |   | 84   | Iran, Islamic Rep.         | 45.00 | 45.00         | 0.24         |   |
| 19   | United Kingdom           | 75.00  | 75.00         | 0.79         |   | 84   | Italy                      | 45.00 | 45.00         | 0.24         | ○ |
| 19   | Zambia                   | 75.00  | 75.00         | 0.79         | ● | 84   | Malawi                     | 45.00 | 45.00         | 0.24         |   |
| 29   | Bulgaria                 | 70.00  | 70.00         | 0.70         |   | 84   | Morocco                    | 45.00 | 45.00         | 0.24         |   |
| 29   | Czech Republic           | 70.00  | 70.00         | 0.70         |   | 84   | Paraguay                   | 45.00 | 45.00         | 0.24         |   |
| 29   | Denmark                  | 70.00  | 70.00         | 0.70         |   | 84   | Portugal                   | 45.00 | 45.00         | 0.24         | ○ |
| 29   | Estonia                  | 70.00  | 70.00         | 0.70         |   | 84   | Tunisia                    | 45.00 | 45.00         | 0.24         |   |
| 29   | Germany                  | 70.00  | 70.00         | 0.70         |   | 84   | United Arab Emirates       | 45.00 | 45.00         | 0.24         | ○ |
| 29   | Ireland                  | 70.00  | 70.00         | 0.70         |   | 98   | Azerbaijan                 | 40.00 | 40.00         | 0.19         |   |
| 29   | Kenya                    | 70.00  | 70.00         | 0.70         |   | 98   | Kuwait                     | 40.00 | 40.00         | 0.19         |   |
| 29   | Kyrgyzstan               | 70.00  | 70.00         | 0.70         | ● | 98   | Lebanon                    | 40.00 | 40.00         | 0.19         |   |
| 29   | Lithuania                | 70.00  | 70.00         | 0.70         |   | 98   | Philippines                | 40.00 | 40.00         | 0.19         |   |
| 29   | Moldova, Rep.            | 70.00  | 70.00         | 0.70         |   | 98   | Sri Lanka                  | 40.00 | 40.00         | 0.19         |   |
| 29   | Viet Nam                 | 70.00  | 70.00         | 0.70         |   | 98   | Tajikistan                 | 40.00 | 40.00         | 0.19         |   |
| 40   | Albania                  | 65.00  | 65.00         | 0.58         |   | 104  | Bolivia, Plurinational St. | 35.00 | 35.00         | 0.16         |   |
| 40   | Bosnia and Herzegovina   | 65.00  | 65.00         | 0.58         |   | 104  | Cameroon                   | 35.00 | 35.00         | 0.16         |   |
| 40   | El Salvador              | 65.00  | 65.00         | 0.58         |   | 104  | Oman                       | 35.00 | 35.00         | 0.16         |   |
| 40   | Finland                  | 65.00  | 65.00         | 0.58         |   | 104  | Slovenia                   | 35.00 | 35.00         | 0.16         | ○ |
| 40   | India                    | 65.00  | 65.00         | 0.58         |   | 108  | Benin                      | 30.00 | 30.00         | 0.07         |   |
| 40   | Israel                   | 65.00  | 65.00         | 0.58         |   | 108  | Burkina Faso               | 30.00 | 30.00         | 0.07         |   |
| 40   | Korea, Rep.              | 65.00  | 65.00         | 0.58         |   | 108  | Côte d'Ivoire              | 30.00 | 30.00         | 0.07         | ○ |
| 40   | Mauritius                | 65.00  | 65.00         | 0.58         |   | 108  | Guinea                     | 30.00 | 30.00         | 0.07         |   |
| 40   | Nigeria                  | 65.00  | 65.00         | 0.58         | ● | 108  | Mali                       | 30.00 | 30.00         | 0.07         |   |
| 40   | Russian Federation       | 65.00  | 65.00         | 0.58         |   | 108  | Malta                      | 30.00 | 30.00         | 0.07         | ○ |
| 40   | Serbia                   | 65.00  | 65.00         | 0.58         |   | 108  | Nepal                      | 30.00 | 30.00         | 0.07         |   |
| 40   | Slovakia                 | 65.00  | 65.00         | 0.58         |   | 108  | Niger                      | 30.00 | 30.00         | 0.07         |   |
| 40   | Tanzania, United Rep.    | 65.00  | 65.00         | 0.58         | ● | 108  | Qatar                      | 30.00 | 30.00         | 0.07         | ○ |
| 40   | Trinidad and Tobago      | 65.00  | 65.00         | 0.58         | ● | 108  | Senegal                    | 30.00 | 30.00         | 0.07         |   |
| 40   | Uganda                   | 65.00  | 65.00         | 0.58         |   | 108  | Togo                       | 30.00 | 30.00         | 0.07         |   |
| 55   | Austria                  | 60.00  | 60.00         | 0.48         | ○ | 119  | Bangladesh                 | 25.00 | 25.00         | 0.06         |   |
| 55   | Brunei Darussalam        | 60.00  | 60.00         | 0.48         |   | 119  | Mozambique                 | 25.00 | 25.00         | 0.06         |   |
| 55   | China                    | 60.00  | 60.00         | 0.48         |   | 121  | Ethiopia                   | 15.00 | 15.00         | 0.03         |   |
| 55   | Cyprus                   | 60.00  | 60.00         | 0.48         |   | 121  | Luxembourg                 | 15.00 | 15.00         | 0.03         | ○ |
| 55   | Iceland                  | 60.00  | 60.00         | 0.48         |   | 121  | Madagascar                 | 15.00 | 15.00         | 0.03         | ○ |
| 55   | Indonesia                | 60.00  | 60.00         | 0.48         |   | 124  | Algeria                    | 10.00 | 10.00         | 0.02         | ○ |
| 55   | Mongolia                 | 60.00  | 60.00         | 0.48         |   | 124  | Burundi                    | 10.00 | 10.00         | 0.02         | ○ |
| 55   | Namibia                  | 60.00  | 60.00         | 0.48         |   | 126  | Jordan                     | 0.00  | 0.00          | 0.00         | ○ |
| 55   | South Africa             | 60.00  | 60.00         | 0.48         |   | 126  | Yemen                      | 0.00  | 0.00          | 0.00         | ○ |
| 55   | Spain                    | 60.00  | 60.00         | 0.48         | ○ |      |                            |       |               |              |   |

SOURCE: World Bank, *Ease of Doing Business Index 2017: Equal Opportunity for All*  
NOTE: ● indicates a strength; ○ a weakness

# 4.1.2 Domestic credit to private sector

## Domestic credit to private sector (% of GDP) | 2015

| Rank | Country/Economy            | Value  | Score (0–100) | Percent rank |   | Rank | Country/Economy       | Value | Score (0–100) | Percent rank |   |
|------|----------------------------|--------|---------------|--------------|---|------|-----------------------|-------|---------------|--------------|---|
| 1    | Cyprus                     | 247.64 | 100.00        | 1.00         | ● | 65   | Poland                | 53.65 | 20.74         | 0.49         |   |
| 2    | Hong Kong (China)          | 208.03 | 83.82         | 0.99         | ● | 66   | Slovakia              | 53.46 | 20.66         | 0.48         |   |
| 3    | United States of America   | 188.83 | 75.97         | 0.98         | ● | 67   | India                 | 52.62 | 20.32         | 0.47         |   |
| 4    | Japan                      | 182.88 | 73.54         | 0.98         | ● | 68   | TFYR of Macedonia     | 50.88 | 19.61         | 0.46         |   |
| 5    | Denmark                    | 174.09 | 69.95         | 0.97         | ● | 69   | Montenegro            | 50.63 | 19.51         | 0.46         |   |
| 6    | Switzerland                | 172.58 | 69.33         | 0.96         |   | 70   | Czech Republic        | 50.31 | 19.38         | 0.45         | ○ |
| 7    | China                      | 153.34 | 61.47         | 0.95         |   | 71   | Slovenia              | 50.20 | 19.33         | 0.44         |   |
| 8    | Thailand                   | 151.31 | 60.64         | 0.94         | ● | 72   | Georgia               | 49.76 | 19.15         | 0.43         |   |
| 9    | South Africa               | 149.18 | 59.77         | 0.94         | ● | 73   | Latvia                | 48.75 | 18.74         | 0.42         |   |
| 10   | New Zealand (2010)         | 142.33 | 56.97         | 0.93         |   | 74   | Colombia              | 47.13 | 18.08         | 0.42         |   |
| 11   | Korea, Rep.                | 140.57 | 56.26         | 0.92         |   | 75   | Armenia               | 45.74 | 17.51         | 0.41         |   |
| 12   | Norway                     | 138.42 | 55.38         | 0.91         |   | 76   | El Salvador           | 44.86 | 17.15         | 0.40         |   |
| 13   | Australia                  | 137.64 | 55.06         | 0.90         |   | 77   | Bangladesh            | 43.93 | 16.77         | 0.39         |   |
| 14   | United Kingdom             | 134.07 | 53.60         | 0.90         |   | 78   | Serbia                | 43.37 | 16.54         | 0.38         |   |
| 15   | Singapore                  | 129.75 | 51.83         | 0.89         |   | 79   | Philippines           | 41.81 | 15.91         | 0.38         |   |
| 16   | Sweden                     | 128.95 | 51.51         | 0.88         |   | 80   | Lithuania             | 41.81 | 15.90         | 0.37         |   |
| 17   | Malaysia                   | 125.21 | 49.98         | 0.87         | ● | 81   | Brunei Darussalam     | 41.44 | 15.75         | 0.36         |   |
| 18   | Canada (2008)              | 124.41 | 49.65         | 0.86         |   | 82   | Sri Lanka             | 40.73 | 15.46         | 0.35         |   |
| 19   | Portugal                   | 120.06 | 47.88         | 0.86         |   | 83   | Indonesia             | 39.07 | 14.79         | 0.34         |   |
| 20   | Spain                      | 118.86 | 47.39         | 0.85         |   | 84   | Azerbaijan            | 38.45 | 14.53         | 0.34         |   |
| 21   | Greece                     | 113.22 | 45.08         | 0.84         | ● | 85   | Kazakhstan            | 37.73 | 14.24         | 0.33         |   |
| 22   | Viet Nam                   | 111.93 | 44.55         | 0.83         | ● | 86   | Peru                  | 37.42 | 14.11         | 0.32         |   |
| 23   | Netherlands                | 111.50 | 44.38         | 0.82         |   | 87   | Trinidad and Tobago   | 37.11 | 13.98         | 0.31         |   |
| 24   | Chile                      | 110.96 | 44.16         | 0.82         | ● | 88   | Togo                  | 37.08 | 13.97         | 0.30         |   |
| 25   | Lebanon                    | 106.64 | 42.39         | 0.81         | ● | 89   | Hungary               | 36.12 | 13.58         | 0.30         |   |
| 26   | Mauritius                  | 102.81 | 40.83         | 0.80         | ● | 90   | Albania               | 35.46 | 13.31         | 0.29         |   |
| 27   | Kuwait                     | 98.60  | 39.11         | 0.79         | ● | 91   | Mozambique            | 35.09 | 13.16         | 0.28         |   |
| 28   | Malta                      | 98.02  | 38.87         | 0.78         |   | 92   | Kenya                 | 34.89 | 13.08         | 0.27         |   |
| 29   | France                     | 95.85  | 37.98         | 0.78         |   | 93   | Moldova, Rep.         | 34.76 | 13.02         | 0.26         |   |
| 30   | Finland                    | 95.45  | 37.82         | 0.77         |   | 94   | Guatemala             | 34.37 | 12.87         | 0.26         |   |
| 31   | Luxembourg                 | 95.36  | 37.78         | 0.76         |   | 95   | Botswana              | 33.85 | 12.65         | 0.25         |   |
| 32   | Iceland                    | 92.06  | 36.44         | 0.75         |   | 96   | Senegal               | 33.30 | 12.43         | 0.24         |   |
| 33   | Panama                     | 88.52  | 34.99         | 0.74         |   | 97   | Mexico                | 32.70 | 12.18         | 0.23         |   |
| 34   | Italy                      | 88.05  | 34.80         | 0.74         |   | 98   | Uruguay               | 30.02 | 11.09         | 0.22         |   |
| 35   | Austria                    | 86.98  | 34.36         | 0.73         |   | 99   | Jamaica               | 29.89 | 11.04         | 0.22         |   |
| 36   | Turkey                     | 80.04  | 31.52         | 0.72         |   | 100  | Romania               | 29.89 | 11.04         | 0.21         | ○ |
| 37   | Tunisia                    | 79.60  | 31.34         | 0.71         | ● | 101  | Burkina Faso          | 27.23 | 9.95          | 0.20         |   |
| 38   | Germany                    | 77.95  | 30.67         | 0.70         |   | 102  | Dominican Republic    | 27.13 | 9.91          | 0.19         |   |
| 39   | United Arab Emirates       | 76.48  | 30.07         | 0.70         |   | 103  | Ecuador               | 26.92 | 9.82          | 0.18         |   |
| 40   | Bahrain                    | 73.72  | 28.94         | 0.69         |   | 104  | Egypt                 | 26.47 | 9.64          | 0.18         |   |
| 41   | Estonia                    | 70.26  | 27.53         | 0.68         |   | 105  | Mali                  | 24.39 | 8.79          | 0.17         |   |
| 42   | Jordan                     | 70.25  | 27.53         | 0.67         | ● | 106  | Côte d'Ivoire         | 23.09 | 8.26          | 0.16         |   |
| 43   | Qatar                      | 69.59  | 27.26         | 0.66         |   | 107  | Kyrgyzstan            | 22.96 | 8.20          | 0.15         |   |
| 44   | Brazil                     | 67.86  | 26.55         | 0.66         |   | 108  | Tajikistan            | 22.72 | 8.11          | 0.14         |   |
| 45   | Israel                     | 66.61  | 26.04         | 0.65         |   | 109  | Rwanda                | 21.61 | 7.65          | 0.14         |   |
| 46   | Oman                       | 65.57  | 25.61         | 0.64         |   | 110  | Algeria               | 21.60 | 7.65          | 0.13         |   |
| 47   | Croatia                    | 65.47  | 25.57         | 0.63         |   | 111  | Benin                 | 21.49 | 7.60          | 0.12         |   |
| 48   | Nepal                      | 65.04  | 25.40         | 0.62         | ● | 112  | Zambia                | 19.76 | 6.90          | 0.11         |   |
| 49   | Morocco                    | 64.31  | 25.10         | 0.62         |   | 113  | Ethiopia (2008)       | 17.71 | 6.06          | 0.10         |   |
| 50   | Cambodia                   | 63.10  | 24.60         | 0.61         | ● | 114  | Cameroon              | 16.39 | 5.52          | 0.10         |   |
| 51   | Belgium                    | 61.55  | 23.97         | 0.60         |   | 115  | Pakistan              | 15.38 | 5.11          | 0.09         | ○ |
| 52   | Bolivia, Plurinational St. | 58.07  | 22.55         | 0.59         | ● | 116  | Tanzania, United Rep. | 15.17 | 5.02          | 0.08         |   |
| 53   | Paraguay                   | 57.94  | 22.49         | 0.58         | ● | 117  | Argentina             | 14.70 | 4.83          | 0.07         | ○ |
| 54   | Ukraine                    | 56.97  | 22.10         | 0.58         |   | 118  | Uganda                | 14.58 | 4.78          | 0.06         | ○ |
| 55   | Costa Rica                 | 56.79  | 22.03         | 0.57         |   | 119  | Guinea                | 14.38 | 4.70          | 0.06         |   |
| 56   | Saudi Arabia               | 56.63  | 21.96         | 0.56         |   | 120  | Burundi               | 14.26 | 4.65          | 0.05         |   |
| 57   | Russian Federation         | 56.36  | 21.85         | 0.55         |   | 121  | Nigeria               | 14.22 | 4.63          | 0.04         |   |
| 58   | Bulgaria                   | 55.41  | 21.46         | 0.54         |   | 122  | Niger                 | 14.17 | 4.61          | 0.03         |   |
| 59   | Honduras                   | 55.37  | 21.45         | 0.54         |   | 123  | Madagascar            | 13.33 | 4.27          | 0.02         | ○ |
| 60   | Mongolia                   | 54.83  | 21.23         | 0.53         |   | 124  | Malawi                | 12.20 | 3.81          | 0.02         | ○ |
| 61   | Iran, Islamic Rep. (2014)  | 54.41  | 21.05         | 0.52         |   | 125  | Yemen (2013)          | 5.64  | 1.13          | 0.01         |   |
| 62   | Ireland                    | 54.35  | 21.03         | 0.51         | ○ | 126  | Belarus               | 2.88  | 0.00          | 0.00         | ○ |
| 63   | Namibia                    | 53.79  | 20.80         | 0.50         |   | n/a  | Zimbabwe              | n/a   | n/a           | n/a          |   |
| 64   | Bosnia and Herzegovina     | 53.71  | 20.77         | 0.50         |   |      |                       |       |               |              |   |

SOURCE: International Monetary Fund, International Financial Statistics and data files; and World Bank and OECD GDP estimates; extracted from the World Bank's *World Development Indicators* database

NOTE: ● Indicates a strength; ○ a weakness



# 4.1.3

## Microfinance institutions' gross loan portfolio

Microfinance institutions: Gross loan portfolio (% of GDP) | 2015

| Rank | Country/Economy            | Value | Score (0–100) | Percent rank |   | Rank | Country/Economy            | Value | Score (0–100) | Percent rank |     |
|------|----------------------------|-------|---------------|--------------|---|------|----------------------------|-------|---------------|--------------|-----|
| 1    | Bolivia, Plurinational St. | 19.59 | 100.00        | 0.96         | ● | 65   | Namibia (2012)             | 0.03  | 0.52          | 0.20         |     |
| 1    | Cambodia                   | 29.59 | 100.00        | 0.96         | ● | 66   | Ethiopia                   | 0.03  | 0.49          | 0.19         |     |
| 1    | Mongolia                   | 18.36 | 100.00        | 0.96         | ● | 67   | Costa Rica                 | 0.02  | 0.26          | 0.18         | ○   |
| 1    | Tajikistan                 | 5.64  | 100.00        | 0.96         | ● | 68   | Indonesia                  | 0.01  | 0.25          | 0.16         |     |
| 5    | Paraguay                   | 5.34  | 94.70         | 0.95         | ● | 69   | Zimbabwe                   | 0.01  | 0.23          | 0.15         |     |
| 6    | Peru                       | 4.84  | 85.88         | 0.94         | ● | 70   | Croatia (2007)             | 0.01  | 0.19          | 0.14         | ○   |
| 7    | Armenia                    | 4.78  | 84.76         | 0.93         | ● | 71   | Uruguay                    | 0.01  | 0.17          | 0.13         | ○   |
| 8    | Ecuador                    | 4.72  | 83.73         | 0.91         | ● | 72   | Romania                    | 0.01  | 0.16          | 0.11         | ○   |
| 9    | Kenya                      | 4.28  | 75.84         | 0.90         | ● | 73   | China                      | 0.01  | 0.15          | 0.10         | ○   |
| 10   | Azerbaijan                 | 4.27  | 75.71         | 0.89         | ● | 74   | South Africa               | 0.01  | 0.11          | 0.09         | ○   |
| 11   | Kyrgyzstan                 | 4.16  | 73.80         | 0.88         | ● | 75   | Bulgaria                   | 0.01  | 0.10          | 0.08         | ○   |
| 12   | Viet Nam                   | 3.52  | 62.40         | 0.86         | ● | 76   | Turkey                     | 0.00  | 0.04          | 0.06         | ○   |
| 13   | Burundi                    | 3.42  | 60.71         | 0.85         | ● | 77   | Trinidad and Tobago (2013) | 0.00  | 0.03          | 0.05         |     |
| 14   | Togo                       | 2.65  | 47.04         | 0.84         | ● | 78   | Argentina                  | 0.00  | 0.02          | 0.04         | ○   |
| 15   | Georgia                    | 2.29  | 40.63         | 0.83         | ● | 79   | Hungary (2007)             | 0.00  | 0.01          | 0.03         | ○   |
| 16   | Bangladesh                 | 1.94  | 34.39         | 0.81         | ● | 80   | Ukraine                    | 0.00  | 0.01          | 0.01         | ○   |
| 17   | Colombia                   | 1.75  | 30.99         | 0.80         | ● | 81   | Thailand (2011)            | 0.00  | 0.00          | 0.00         | ○   |
| 18   | Nepal                      | 1.73  | 30.76         | 0.79         | ● | n/a  | Algeria                    | n/a   | n/a           | n/a          |     |
| 19   | Burkina Faso               | 1.53  | 27.16         | 0.78         | ● | n/a  | Australia                  | n/a   | n/a           | n/a          |     |
| 20   | Senegal                    | 1.53  | 27.09         | 0.76         | ● | n/a  | Austria                    | n/a   | n/a           | n/a          |     |
| 21   | Benin                      | 1.50  | 26.58         | 0.75         | ● | n/a  | Bahrain                    | n/a   | n/a           | n/a          |     |
| 22   | El Salvador                | 1.28  | 22.78         | 0.74         | ● | n/a  | Belgium                    | n/a   | n/a           | n/a          |     |
| 23   | Bosnia and Herzegovina     | 1.25  | 22.09         | 0.73         | ● | n/a  | Botswana                   | n/a   | n/a           | n/a          |     |
| 24   | Madagascar                 | 1.24  | 21.99         | 0.71         | ● | n/a  | Brunei Darussalam          | n/a   | n/a           | n/a          |     |
| 25   | Cameroon                   | 1.11  | 19.61         | 0.70         | ● | n/a  | Canada                     | n/a   | n/a           | n/a          |     |
| 26   | Montenegro                 | 1.01  | 17.98         | 0.69         | ● | n/a  | Cyprus                     | n/a   | n/a           | n/a          |     |
| 27   | Niger                      | 0.77  | 13.68         | 0.68         | ● | n/a  | Czech Republic             | n/a   | n/a           | n/a          |     |
| 28   | Chile                      | 0.75  | 13.27         | 0.66         | ● | n/a  | Denmark                    | n/a   | n/a           | n/a          |     |
| 29   | Dominican Republic         | 0.73  | 12.90         | 0.65         | ● | n/a  | Estonia                    | n/a   | n/a           | n/a          |     |
| 30   | Belarus                    | 0.71  | 12.55         | 0.64         | ● | n/a  | Finland                    | n/a   | n/a           | n/a          |     |
| 31   | Rwanda                     | 0.70  | 12.35         | 0.63         | ● | n/a  | France                     | n/a   | n/a           | n/a          |     |
| 32   | Honduras                   | 0.57  | 10.17         | 0.61         | ● | n/a  | Germany                    | n/a   | n/a           | n/a          |     |
| 33   | Morocco                    | 0.56  | 9.98          | 0.60         | ● | n/a  | Greece                     | n/a   | n/a           | n/a          |     |
| 34   | India                      | 0.56  | 9.88          | 0.59         | ● | n/a  | Hong Kong (China)          | n/a   | n/a           | n/a          |     |
| 35   | Albania                    | 0.46  | 8.17          | 0.58         | ● | n/a  | Iceland                    | n/a   | n/a           | n/a          |     |
| 36   | Jordan                     | 0.45  | 7.94          | 0.56         | ● | n/a  | Iran, Islamic Rep.         | n/a   | n/a           | n/a          |     |
| 37   | Côte d'Ivoire              | 0.36  | 6.33          | 0.55         | ● | n/a  | Ireland                    | n/a   | n/a           | n/a          |     |
| 38   | Moldova, Rep.              | 0.35  | 6.28          | 0.54         | ● | n/a  | Israel                     | n/a   | n/a           | n/a          |     |
| 39   | Philippines                | 0.34  | 6.04          | 0.53         | ● | n/a  | Italy                      | n/a   | n/a           | n/a          |     |
| 40   | TFYR of Macedonia          | 0.34  | 5.99          | 0.51         | ● | n/a  | Japan                      | 5.99  | n/a           | n/a          | n/a |
| 41   | Tunisia                    | 0.34  | 5.95          | 0.50         | ● | n/a  | Korea, Rep.                | n/a   | n/a           | n/a          |     |
| 42   | Malawi                     | 0.30  | 5.32          | 0.49         | ● | n/a  | Kuwait                     | n/a   | n/a           | n/a          |     |
| 43   | Panama                     | 0.30  | 5.23          | 0.48         | ● | n/a  | Latvia                     | n/a   | n/a           | n/a          |     |
| 44   | Mali                       | 0.27  | 4.85          | 0.46         | ● | n/a  | Lithuania                  | n/a   | n/a           | n/a          |     |
| 45   | Serbia                     | 0.26  | 4.53          | 0.45         | ● | n/a  | Luxembourg                 | n/a   | n/a           | n/a          |     |
| 46   | Guinea (2012)              | 0.25  | 4.42          | 0.44         | ● | n/a  | Malta                      | n/a   | n/a           | n/a          |     |
| 47   | Mexico                     | 0.24  | 4.18          | 0.43         | ● | n/a  | Mauritius                  | n/a   | n/a           | n/a          |     |
| 48   | Tanzania, United Rep.      | 0.24  | 4.17          | 0.41         | ● | n/a  | Netherlands                | n/a   | n/a           | n/a          |     |
| 49   | Uganda                     | 0.23  | 4.04          | 0.40         | ● | n/a  | New Zealand                | n/a   | n/a           | n/a          |     |
| 50   | Pakistan                   | 0.22  | 3.85          | 0.39         | ● | n/a  | Norway                     | n/a   | n/a           | n/a          |     |
| 51   | Mozambique                 | 0.20  | 3.54          | 0.38         | ● | n/a  | Oman                       | n/a   | n/a           | n/a          |     |
| 52   | Guatemala                  | 0.19  | 3.30          | 0.36         | ● | n/a  | Portugal                   | n/a   | n/a           | n/a          |     |
| 53   | Jamaica                    | 0.14  | 2.49          | 0.35         | ● | n/a  | Qatar                      | n/a   | n/a           | n/a          |     |
| 54   | Malaysia (2011)            | 0.13  | 2.27          | 0.34         | ● | n/a  | Saudi Arabia               | n/a   | n/a           | n/a          |     |
| 55   | Poland                     | 0.12  | 2.04          | 0.33         | ○ | n/a  | Singapore                  | n/a   | n/a           | n/a          |     |
| 56   | Nigeria                    | 0.11  | 1.90          | 0.31         | ○ | n/a  | Slovakia                   | n/a   | n/a           | n/a          |     |
| 57   | Lebanon                    | 0.10  | 1.76          | 0.30         | ○ | n/a  | Slovenia                   | n/a   | n/a           | n/a          |     |
| 58   | Zambia                     | 0.10  | 1.71          | 0.29         | ○ | n/a  | Spain                      | n/a   | n/a           | n/a          |     |
| 59   | Kazakhstan                 | 0.08  | 1.40          | 0.28         | ○ | n/a  | Sweden                     | n/a   | n/a           | n/a          |     |
| 60   | Russian Federation         | 0.08  | 1.37          | 0.26         | ○ | n/a  | Switzerland                | n/a   | n/a           | n/a          |     |
| 61   | Egypt                      | 0.05  | 0.84          | 0.25         | ○ | n/a  | United Arab Emirates       | n/a   | n/a           | n/a          |     |
| 62   | Brazil                     | 0.05  | 0.79          | 0.24         | ○ | n/a  | United Kingdom             | n/a   | n/a           | n/a          |     |
| 63   | Sri Lanka                  | 0.04  | 0.69          | 0.23         | ○ | n/a  | United States of America   | n/a   | n/a           | n/a          |     |
| 64   | Yemen                      | 0.04  | 0.69          | 0.21         | ○ |      |                            |       |               |              |     |

SOURCE: Microfinance Information Exchange, *Mix Market database*; International Monetary Fund, *World Economic Outlook Database*, October 2016

NOTE: ● indicates a strength; ○ a weakness

# 4.2.1 Ease of protecting minority investors

## Ease of protecting minority investors (distance to frontier) | 2016

| Rank | Country/Economy          | Value | Score (0–100) | Percent rank |   | Rank | Country/Economy            | Value | Score (0–100) | Percent rank |   |
|------|--------------------------|-------|---------------|--------------|---|------|----------------------------|-------|---------------|--------------|---|
| 1    | New Zealand              | 83.33 | 83.33         | 0.99         | ● | 62   | Nepal                      | 58.33 | 58.33         | 0.48         | ● |
| 1    | Singapore                | 83.33 | 83.33         | 0.99         | ● | 62   | Saudi Arabia               | 58.33 | 58.33         | 0.48         | ● |
| 3    | Hong Kong (China)        | 80.00 | 80.00         | 0.97         | ● | 67   | Bangladesh                 | 56.67 | 56.67         | 0.42         | ○ |
| 3    | Kazakhstan               | 80.00 | 80.00         | 0.97         | ● | 67   | Finland                    | 56.67 | 56.67         | 0.42         | ○ |
| 3    | Malaysia                 | 80.00 | 80.00         | 0.97         | ● | 67   | Indonesia                  | 56.67 | 56.67         | 0.42         | ○ |
| 6    | United Kingdom           | 78.33 | 78.33         | 0.96         | ● | 67   | Netherlands                | 56.67 | 56.67         | 0.42         | ○ |
| 7    | Canada                   | 76.67 | 76.67         | 0.94         | ● | 67   | Panama                     | 56.67 | 56.67         | 0.42         | ○ |
| 7    | Georgia                  | 76.67 | 76.67         | 0.94         | ● | 67   | Portugal                   | 56.67 | 56.67         | 0.42         | ○ |
| 9    | Israel                   | 75.00 | 75.00         | 0.91         | ● | 67   | Serbia                     | 56.67 | 56.67         | 0.42         | ○ |
| 9    | Norway                   | 75.00 | 75.00         | 0.91         | ● | 67   | Ukraine                    | 56.67 | 56.67         | 0.42         | ○ |
| 9    | Slovenia                 | 75.00 | 75.00         | 0.91         | ● | 75   | Bosnia and Herzegovina     | 55.00 | 55.00         | 0.38         | ○ |
| 9    | United Arab Emirates     | 75.00 | 75.00         | 0.91         | ● | 75   | Botswana                   | 55.00 | 55.00         | 0.38         | ○ |
| 13   | Bulgaria                 | 73.33 | 73.33         | 0.87         | ● | 75   | Hungary                    | 55.00 | 55.00         | 0.38         | ○ |
| 13   | Colombia                 | 73.33 | 73.33         | 0.87         | ● | 75   | Kuwait                     | 55.00 | 55.00         | 0.38         | ○ |
| 13   | India                    | 73.33 | 73.33         | 0.87         | ● | 75   | Namibia                    | 55.00 | 55.00         | 0.38         | ○ |
| 13   | Ireland                  | 73.33 | 73.33         | 0.87         | ● | 80   | Dominican Republic         | 53.33 | 53.33         | 0.33         | ○ |
| 13   | Korea, Rep.              | 73.33 | 73.33         | 0.87         | ● | 80   | Kenya                      | 53.33 | 53.33         | 0.33         | ○ |
| 13   | TFYR of Macedonia        | 73.33 | 73.33         | 0.87         | ● | 80   | Morocco                    | 53.33 | 53.33         | 0.33         | ○ |
| 19   | Albania                  | 71.67 | 71.67         | 0.84         | ● | 80   | Slovakia                   | 53.33 | 53.33         | 0.33         | ○ |
| 19   | Denmark                  | 71.67 | 71.67         | 0.84         | ● | 80   | Viet Nam                   | 53.33 | 53.33         | 0.33         | ○ |
| 19   | Sweden                   | 71.67 | 71.67         | 0.84         | ● | 80   | Zambia                     | 53.33 | 53.33         | 0.33         | ○ |
| 22   | Iceland                  | 70.00 | 70.00         | 0.82         | ● | 86   | Brunei Darussalam          | 51.67 | 51.67         | 0.31         | ○ |
| 22   | South Africa             | 70.00 | 70.00         | 0.82         | ● | 86   | Rwanda                     | 51.67 | 51.67         | 0.31         | ○ |
| 22   | Turkey                   | 70.00 | 70.00         | 0.82         | ● | 86   | Zimbabwe                   | 51.67 | 51.67         | 0.31         | ○ |
| 25   | Mongolia                 | 68.33 | 68.33         | 0.81         | ● | 89   | Bahrain                    | 50.00 | 50.00         | 0.29         | ○ |
| 26   | Croatia                  | 66.67 | 66.67         | 0.77         | ● | 89   | Switzerland                | 50.00 | 50.00         | 0.29         | ○ |
| 26   | Cyprus                   | 66.67 | 66.67         | 0.77         | ● | 89   | Uganda                     | 50.00 | 50.00         | 0.29         | ○ |
| 26   | Pakistan                 | 66.67 | 66.67         | 0.77         | ● | 92   | Cambodia                   | 48.33 | 48.33         | 0.26         | ○ |
| 26   | Tajikistan               | 66.67 | 66.67         | 0.77         | ● | 92   | Egypt                      | 48.33 | 48.33         | 0.26         | ○ |
| 26   | Thailand                 | 66.67 | 66.67         | 0.77         | ● | 92   | Madagascar                 | 48.33 | 48.33         | 0.26         | ○ |
| 31   | Austria                  | 65.00 | 65.00         | 0.70         | ● | 95   | Ecuador                    | 46.67 | 46.67         | 0.24         | ○ |
| 31   | Azerbaijan               | 65.00 | 65.00         | 0.70         | ● | 95   | Oman                       | 46.67 | 46.67         | 0.24         | ○ |
| 31   | Brazil                   | 65.00 | 65.00         | 0.70         | ● | 95   | Tunisia                    | 46.67 | 46.67         | 0.24         | ○ |
| 31   | Chile                    | 65.00 | 65.00         | 0.70         | ● | 98   | China                      | 45.00 | 45.00         | 0.21         | ○ |
| 31   | France                   | 65.00 | 65.00         | 0.70         | ● | 98   | Luxembourg                 | 45.00 | 45.00         | 0.21         | ○ |
| 31   | Malta                    | 65.00 | 65.00         | 0.70         | ● | 98   | Uruguay                    | 45.00 | 45.00         | 0.21         | ○ |
| 31   | Mauritius                | 65.00 | 65.00         | 0.70         | ● | 101  | Honduras                   | 43.33 | 43.33         | 0.18         | ○ |
| 31   | Nigeria                  | 65.00 | 65.00         | 0.70         | ● | 101  | Malawi                     | 43.33 | 43.33         | 0.18         | ○ |
| 31   | Spain                    | 65.00 | 65.00         | 0.70         | ● | 101  | Mozambique                 | 43.33 | 43.33         | 0.18         | ○ |
| 40   | United States of America | 64.67 | 64.67         | 0.69         | ● | 101  | Yemen                      | 43.33 | 43.33         | 0.18         | ○ |
| 41   | Belarus                  | 63.33 | 63.33         | 0.62         | ● | 105  | Bolivia, Plurinational St. | 41.67 | 41.67         | 0.13         | ○ |
| 41   | Greece                   | 63.33 | 63.33         | 0.62         | ● | 105  | Burundi                    | 41.67 | 41.67         | 0.13         | ○ |
| 41   | Italy                    | 63.33 | 63.33         | 0.62         | ● | 105  | Cameroon                   | 41.67 | 41.67         | 0.13         | ○ |
| 41   | Kyrgyzstan               | 63.33 | 63.33         | 0.62         | ● | 105  | Paraguay                   | 41.67 | 41.67         | 0.13         | ○ |
| 41   | Latvia                   | 63.33 | 63.33         | 0.62         | ● | 105  | Philippines                | 41.67 | 41.67         | 0.13         | ○ |
| 41   | Moldova, Rep.            | 63.33 | 63.33         | 0.62         | ● | 105  | Senegal                    | 41.67 | 41.67         | 0.13         | ○ |
| 41   | Montenegro               | 63.33 | 63.33         | 0.62         | ● | 111  | Benin                      | 40.00 | 40.00         | 0.06         | ○ |
| 41   | Poland                   | 63.33 | 63.33         | 0.62         | ● | 111  | Burkina Faso               | 40.00 | 40.00         | 0.06         | ○ |
| 41   | Sri Lanka                | 63.33 | 63.33         | 0.62         | ● | 111  | Côte d'Ivoire              | 40.00 | 40.00         | 0.06         | ○ |
| 50   | Argentina                | 61.67 | 61.67         | 0.60         | ● | 111  | Guinea                     | 40.00 | 40.00         | 0.06         | ○ |
| 50   | Lithuania                | 61.67 | 61.67         | 0.60         | ● | 111  | Lebanon                    | 40.00 | 40.00         | 0.06         | ○ |
| 52   | Armenia                  | 60.00 | 60.00         | 0.52         | ○ | 111  | Mali                       | 40.00 | 40.00         | 0.06         | ○ |
| 52   | Czech Republic           | 60.00 | 60.00         | 0.52         | ○ | 111  | Niger                      | 40.00 | 40.00         | 0.06         | ○ |
| 52   | Estonia                  | 60.00 | 60.00         | 0.52         | ○ | 111  | Tanzania, United Rep.      | 40.00 | 40.00         | 0.06         | ○ |
| 52   | Germany                  | 60.00 | 60.00         | 0.52         | ○ | 111  | Togo                       | 40.00 | 40.00         | 0.06         | ○ |
| 52   | Japan                    | 60.00 | 60.00         | 0.52         | ○ | 120  | El Salvador                | 38.33 | 38.33         | 0.06         | ○ |
| 52   | Mexico                   | 60.00 | 60.00         | 0.52         | ○ | 121  | Costa Rica                 | 35.00 | 35.00         | 0.03         | ○ |
| 52   | Peru                     | 60.00 | 60.00         | 0.52         | ○ | 121  | Iran, Islamic Rep.         | 35.00 | 35.00         | 0.03         | ○ |
| 52   | Romania                  | 60.00 | 60.00         | 0.52         | ○ | 121  | Jordan                     | 35.00 | 35.00         | 0.03         | ○ |
| 52   | Russian Federation       | 60.00 | 60.00         | 0.52         | ○ | 124  | Algeria                    | 33.33 | 33.33         | 0.02         | ○ |
| 52   | Trinidad and Tobago      | 60.00 | 60.00         | 0.52         | ○ | 124  | Guatemala                  | 33.33 | 33.33         | 0.02         | ○ |
| 62   | Australia                | 58.33 | 58.33         | 0.48         | ○ | 126  | Ethiopia                   | 31.67 | 31.67         | 0.01         | ○ |
| 62   | Belgium                  | 58.33 | 58.33         | 0.48         | ○ | 127  | Qatar                      | 26.67 | 26.67         | 0.00         | ○ |
| 62   | Jamaica                  | 58.33 | 58.33         | 0.48         | ○ |      |                            |       |               |              |   |

SOURCE: World Bank, *Ease of Doing Business Index 2017: Equal Opportunity for All*

NOTE: ● indicates a strength; ○ a weakness

# 4.2.2 Market capitalization

## Market capitalization of listed companies (% of GDP) | 2015

| Rank | Country/Economy           | Value    | Score (0–100) | Percent rank |   | Rank | Country/Economy                   | Value | Score (0–100) | Percent rank |   |
|------|---------------------------|----------|---------------|--------------|---|------|-----------------------------------|-------|---------------|--------------|---|
| 1    | Hong Kong (China)         | 1,029.92 | 100.00        | 0.99         | ● | 65   | Bolivia, Plurinational St. (2012) | 16.41 | 7.01          | 0.25         |   |
| 1    | Singapore                 | 218.61   | 93.44         | 0.96         |   | 66   | Ukraine (2011)                    | 15.72 | 6.72          | 0.24         |   |
| 3    | South Africa              | 233.95   | 100.00        | 0.99         | ● | 67   | Pakistan (2011)                   | 15.25 | 6.51          | 0.22         |   |
| 4    | Switzerland               | 226.50   | 96.81         | 0.98         | ● | 68   | Hungary                           | 14.53 | 6.21          | 0.21         | ○ |
| 5    | United States of America  | 138.98   | 59.40         | 0.95         |   | 69   | Bulgaria (2011)                   | 14.37 | 6.14          | 0.20         | ○ |
| 6    | Malaysia                  | 129.26   | 55.25         | 0.94         | ● | 70   | Slovenia                          | 14.11 | 6.03          | 0.19         | ○ |
| 7    | Japan                     | 111.68   | 47.73         | 0.93         |   | 71   | Cyprus                            | 13.76 | 5.88          | 0.18         | ○ |
| 8    | Canada                    | 102.76   | 43.92         | 0.92         |   | 72   | Zambia (2011)                     | 13.57 | 5.80          | 0.16         |   |
| 9    | Netherlands               | 97.09    | 41.50         | 0.91         |   | 73   | Malawi (2012)                     | 12.60 | 5.38          | 0.15         |   |
| 10   | Montenegro (2012)         | 92.65    | 39.60         | 0.89         | ● | 74   | Bosnia and Herzegovina (2011)     | 12.15 | 5.19          | 0.14         |   |
| 11   | Belgium                   | 91.09    | 38.93         | 0.88         |   | 75   | Mongolia (2012)                   | 10.52 | 4.49          | 0.13         |   |
| 12   | Korea, Rep.               | 89.36    | 38.19         | 0.87         |   | 76   | Nigeria                           | 10.39 | 4.44          | 0.12         |   |
| 13   | Australia                 | 88.65    | 37.89         | 0.86         |   | 77   | Argentina                         | 9.63  | 4.11          | 0.11         | ○ |
| 14   | Thailand                  | 88.27    | 37.73         | 0.85         | ● | 78   | Serbia (2011)                     | 8.73  | 3.73          | 0.09         | ○ |
| 15   | Qatar                     | 86.59    | 37.01         | 0.84         |   | 79   | Romania (2011)                    | 7.57  | 3.23          | 0.08         | ○ |
| 16   | France                    | 86.34    | 36.90         | 0.82         |   | 80   | Georgia (2012)                    | 5.95  | 2.54          | 0.07         | ○ |
| 17   | Philippines               | 81.66    | 34.90         | 0.81         | ● | 81   | TFYR of Macedonia (2012)          | 5.74  | 2.45          | 0.06         | ○ |
| 18   | Luxembourg                | 81.55    | 34.86         | 0.80         |   | 82   | Slovakia (2013)                   | 4.88  | 2.08          | 0.05         | ○ |
| 19   | Israel                    | 81.46    | 34.82         | 0.79         |   | 83   | Costa Rica (2011)                 | 3.55  | 1.51          | 0.04         | ○ |
| 20   | Chile                     | 79.05    | 33.79         | 0.78         |   | 84   | Kyrgyzstan (2012)                 | 2.50  | 1.06          | 0.02         | ○ |
| 21   | China                     | 74.38    | 31.79         | 0.76         |   | 85   | Armenia (2012)                    | 1.24  | 0.53          | 0.01         | ○ |
| 22   | India                     | 72.36    | 30.93         | 0.75         |   | 86   | Namibia (2011)                    | 0.01  | 0.00          | 0.00         | ○ |
| 23   | Jordan                    | 67.84    | 29.00         | 0.74         | ● | n/a  | Albania                           | n/a   | n/a           | n/a          |   |
| 24   | Spain                     | 65.65    | 28.06         | 0.73         |   | n/a  | Algeria                           | n/a   | n/a           | n/a          |   |
| 25   | Saudi Arabia              | 65.18    | 27.86         | 0.72         |   | n/a  | Azerbaijan                        | n/a   | n/a           | n/a          |   |
| 26   | United Kingdom (2008)     | 64.97    | 27.77         | 0.71         |   | n/a  | Belarus                           | n/a   | n/a           | n/a          |   |
| 27   | Mauritius                 | 61.96    | 26.48         | 0.69         |   | n/a  | Benin                             | n/a   | n/a           | n/a          |   |
| 28   | Bahrain                   | 61.85    | 26.43         | 0.68         |   | n/a  | Botswana                          | n/a   | n/a           | n/a          |   |
| 29   | Oman                      | 58.89    | 25.17         | 0.67         |   | n/a  | Brunei Darussalam                 | n/a   | n/a           | n/a          |   |
| 30   | United Arab Emirates      | 52.90    | 22.61         | 0.66         |   | n/a  | Burkina Faso                      | n/a   | n/a           | n/a          |   |
| 31   | Germany                   | 51.01    | 21.80         | 0.65         |   | n/a  | Burundi                           | n/a   | n/a           | n/a          |   |
| 32   | Norway                    | 50.16    | 21.44         | 0.64         |   | n/a  | Cambodia                          | n/a   | n/a           | n/a          |   |
| 33   | Morocco                   | 45.66    | 19.51         | 0.62         |   | n/a  | Cameroon                          | n/a   | n/a           | n/a          |   |
| 34   | Malta                     | 45.20    | 19.32         | 0.61         |   | n/a  | Denmark                           | n/a   | n/a           | n/a          |   |
| 35   | Ireland                   | 45.12    | 19.28         | 0.60         | ○ | n/a  | Dominican Republic                | n/a   | n/a           | n/a          |   |
| 36   | El Salvador (2012)        | 45.11    | 19.28         | 0.59         |   | n/a  | Ecuador                           | n/a   | n/a           | n/a          |   |
| 37   | New Zealand               | 42.79    | 18.29         | 0.58         |   | n/a  | Estonia                           | n/a   | n/a           | n/a          |   |
| 38   | Indonesia                 | 40.99    | 17.52         | 0.56         |   | n/a  | Ethiopia                          | n/a   | n/a           | n/a          |   |
| 39   | Côte d'Ivoire             | 39.34    | 16.81         | 0.55         | ● | n/a  | Finland                           | n/a   | n/a           | n/a          |   |
| 40   | Bangladesh (2011)         | 37.08    | 15.85         | 0.54         | ● | n/a  | Guatemala                         | n/a   | n/a           | n/a          |   |
| 41   | Croatia (2011)            | 36.24    | 15.49         | 0.53         |   | n/a  | Guinea                            | n/a   | n/a           | n/a          |   |
| 42   | Mexico                    | 35.17    | 15.03         | 0.52         |   | n/a  | Honduras                          | n/a   | n/a           | n/a          |   |
| 43   | Jamaica (2011)            | 34.69    | 14.82         | 0.51         |   | n/a  | Iceland                           | n/a   | n/a           | n/a          |   |
| 44   | Panama (2011)             | 31.08    | 13.28         | 0.49         |   | n/a  | Kuwait                            | n/a   | n/a           | n/a          |   |
| 45   | Uganda (2012)             | 31.03    | 13.26         | 0.48         |   | n/a  | Latvia                            | n/a   | n/a           | n/a          |   |
| 46   | Portugal                  | 30.08    | 12.85         | 0.47         |   | n/a  | Lithuania                         | n/a   | n/a           | n/a          |   |
| 47   | Peru                      | 29.91    | 12.78         | 0.46         |   | n/a  | Madagascar                        | n/a   | n/a           | n/a          |   |
| 48   | Russian Federation        | 29.54    | 12.62         | 0.45         |   | n/a  | Mali                              | n/a   | n/a           | n/a          |   |
| 49   | Colombia                  | 29.43    | 12.58         | 0.44         |   | n/a  | Moldova, Rep.                     | n/a   | n/a           | n/a          |   |
| 50   | Poland                    | 28.88    | 12.34         | 0.42         |   | n/a  | Mozambique                        | n/a   | n/a           | n/a          |   |
| 51   | Brazil                    | 27.64    | 11.81         | 0.41         |   | n/a  | Nepal                             | n/a   | n/a           | n/a          |   |
| 52   | Iran, Islamic Rep. (2014) | 27.42    | 11.72         | 0.40         |   | n/a  | Niger                             | n/a   | n/a           | n/a          |   |
| 53   | Italy (2014)              | 27.32    | 11.67         | 0.39         | ○ | n/a  | Paraguay                          | n/a   | n/a           | n/a          |   |
| 54   | Viet Nam                  | 26.80    | 11.45         | 0.38         |   | n/a  | Rwanda                            | n/a   | n/a           | n/a          |   |
| 55   | Turkey                    | 26.31    | 11.24         | 0.36         |   | n/a  | Senegal                           | n/a   | n/a           | n/a          |   |
| 56   | Austria                   | 25.49    | 10.89         | 0.35         | ○ | n/a  | Sweden                            | n/a   | n/a           | n/a          |   |
| 57   | Sri Lanka                 | 25.27    | 10.80         | 0.34         |   | n/a  | Tajikistan                        | n/a   | n/a           | n/a          |   |
| 58   | Kenya (2011)              | 24.32    | 10.39         | 0.33         |   | n/a  | Tanzania, United Rep.             | n/a   | n/a           | n/a          |   |
| 59   | Lebanon (2011)            | 22.57    | 9.65          | 0.32         |   | n/a  | Togo                              | n/a   | n/a           | n/a          |   |
| 60   | Greece                    | 21.60    | 9.23          | 0.31         |   | n/a  | Trinidad and Tobago               | n/a   | n/a           | n/a          |   |
| 61   | Tunisia (2011)            | 21.09    | 9.01          | 0.29         |   | n/a  | Uruguay                           | n/a   | n/a           | n/a          |   |
| 62   | Kazakhstan                | 18.92    | 8.08          | 0.28         |   | n/a  | Yemen                             | n/a   | n/a           | n/a          |   |
| 63   | Czech Republic (2008)     | 17.39    | 7.43          | 0.27         | ○ | n/a  | Zimbabwe                          | n/a   | n/a           | n/a          |   |
| 64   | Egypt                     | 16.69    | 7.13          | 0.26         |   |      |                                   |       |               |              |   |

SOURCE: World Federation of Exchanges database; extracted from the World Bank's *World Development Indicators* database

NOTE: ● Indicates a strength; ○ a weakness

## 4.2.3 Venture capital deals

Venture capital per investment location: Number of deals (per billion PPP\$ GDP) | 2016

| Rank | Country/Economy          | Value | Score (0–100) | Percent rank |   | Rank | Country/Economy            | Value | Score (0–100) | Percent rank |   |
|------|--------------------------|-------|---------------|--------------|---|------|----------------------------|-------|---------------|--------------|---|
| 1    | Canada                   | 0.55  | 100.00        | 0.97         | ● | 65   | Jordan                     | 0.01  | 3.48          | 0.30         |   |
| 1    | France                   | 0.31  | 100.00        | 0.97         | ● | 66   | Ethiopia                   | 0.01  | 3.43          | 0.29         |   |
| 1    | Israel                   | 0.43  | 100.00        | 0.97         | ● | 67   | Romania                    | 0.01  | 3.40          | 0.27         |   |
| 1    | United States of America | 0.39  | 100.00        | 0.97         | ● | 68   | Croatia                    | 0.01  | 3.17          | 0.26         | ○ |
| 5    | Finland                  | 0.28  | 89.93         | 0.96         |   | 69   | Colombia                   | 0.01  | 3.02          | 0.25         |   |
| 6    | Denmark                  | 0.22  | 70.83         | 0.95         |   | 70   | Mexico                     | 0.01  | 2.82          | 0.24         |   |
| 7    | United Kingdom           | 0.21  | 67.39         | 0.93         |   | 71   | Chile                      | 0.01  | 2.71          | 0.23         | ○ |
| 8    | Sweden                   | 0.19  | 61.88         | 0.92         |   | 72   | Egypt                      | 0.01  | 2.67          | 0.22         |   |
| 9    | Iceland                  | 0.19  | 59.04         | 0.91         |   | 73   | Turkey                     | 0.01  | 2.65          | 0.21         |   |
| 10   | Switzerland              | 0.18  | 57.20         | 0.90         |   | 74   | Philippines                | 0.01  | 2.57          | 0.20         |   |
| 11   | Netherlands              | 0.18  | 56.50         | 0.89         |   | 75   | Ukraine                    | 0.01  | 2.52          | 0.19         |   |
| 12   | Estonia                  | 0.16  | 49.23         | 0.88         |   | 76   | Bulgaria                   | 0.01  | 2.01          | 0.18         | ○ |
| 13   | Luxembourg               | 0.15  | 48.64         | 0.87         |   | 77   | Thailand                   | 0.01  | 1.98          | 0.16         | ○ |
| 14   | Singapore                | 0.13  | 39.74         | 0.86         |   | 78   | Argentina                  | 0.01  | 1.96          | 0.15         |   |
| 15   | Malta                    | 0.12  | 38.87         | 0.85         |   | 79   | Tanzania, United Rep.      | 0.01  | 1.90          | 0.14         |   |
| 16   | Germany                  | 0.12  | 37.93         | 0.84         |   | 80   | Indonesia                  | 0.01  | 1.89          | 0.13         |   |
| 17   | Ireland                  | 0.11  | 36.17         | 0.82         |   | 81   | Algeria                    | 0.01  | 1.87          | 0.12         |   |
| 18   | Lithuania (2015)         | 0.11  | 34.72         | 0.81         |   | 82   | Belarus                    | 0.01  | 1.71          | 0.11         | ○ |
| 19   | Belgium                  | 0.10  | 31.13         | 0.80         |   | 83   | Slovakia                   | 0.01  | 1.67          | 0.10         | ○ |
| 20   | New Zealand              | 0.09  | 27.14         | 0.79         |   | 84   | Saudi Arabia               | 0.01  | 1.62          | 0.09         | ○ |
| 21   | Portugal                 | 0.08  | 26.62         | 0.78         |   | 85   | Ecuador (2015)             | 0.01  | 1.54          | 0.08         |   |
| 22   | Australia                | 0.08  | 26.34         | 0.77         |   | 86   | Nigeria                    | 0.00  | 1.25          | 0.07         |   |
| 23   | Lebanon                  | 0.08  | 26.00         | 0.76         | ● | 87   | Kuwait (2015)              | 0.00  | 0.89          | 0.05         | ○ |
| 24   | Guinea (2015)            | 0.07  | 20.66         | 0.75         | ● | 88   | Kazakhstan (2015)          | 0.00  | 0.52          | 0.04         | ○ |
| 25   | Austria                  | 0.06  | 19.72         | 0.74         |   | 89   | Pakistan (2015)            | 0.00  | 0.47          | 0.03         | ○ |
| 26   | China                    | 0.06  | 18.37         | 0.73         |   | 90   | Russian Federation         | 0.00  | 0.29          | 0.02         | ○ |
| 27   | Spain                    | 0.06  | 17.52         | 0.71         |   | 91   | Bangladesh                 | 0.00  | 0.29          | 0.01         | ○ |
| 28   | United Arab Emirates     | 0.05  | 16.51         | 0.70         |   | 92   | Iran, Islamic Rep.         | 0.00  | 0.00          | 0.00         | ○ |
| 29   | Kenya                    | 0.05  | 16.49         | 0.69         |   | n/a  | Albania                    | n/a   | n/a           | n/a          |   |
| 30   | Italy                    | 0.05  | 15.58         | 0.68         |   | n/a  | Armenia                    | n/a   | n/a           | n/a          |   |
| 31   | Rwanda (2015)            | 0.05  | 15.48         | 0.67         | ● | n/a  | Azerbaijan                 | n/a   | n/a           | n/a          |   |
| 32   | Tunisia                  | 0.05  | 14.41         | 0.66         |   | n/a  | Benin                      | n/a   | n/a           | n/a          |   |
| 33   | Norway                   | 0.04  | 13.77         | 0.65         |   | n/a  | Bolivia, Plurinational St. | n/a   | n/a           | n/a          |   |
| 34   | Hong Kong (China)        | 0.04  | 12.47         | 0.64         |   | n/a  | Bosnia and Herzegovina     | n/a   | n/a           | n/a          |   |
| 35   | Mauritius                | 0.04  | 12.12         | 0.63         |   | n/a  | Botswana                   | n/a   | n/a           | n/a          |   |
| 36   | Zimbabwe                 | 0.04  | 11.04         | 0.62         | ● | n/a  | Brunei Darussalam          | n/a   | n/a           | n/a          |   |
| 37   | Mali (2015)              | 0.03  | 10.72         | 0.60         | ● | n/a  | Burundi                    | n/a   | n/a           | n/a          |   |
| 38   | Cyprus                   | 0.03  | 10.68         | 0.59         |   | n/a  | Cameroon                   | n/a   | n/a           | n/a          |   |
| 39   | Burkina Faso (2015)      | 0.03  | 10.01         | 0.58         | ● | n/a  | Dominican Republic         | n/a   | n/a           | n/a          |   |
| 40   | India                    | 0.03  | 9.88          | 0.57         |   | n/a  | El Salvador                | n/a   | n/a           | n/a          |   |
| 41   | Slovenia                 | 0.03  | 9.43          | 0.56         |   | n/a  | Guatemala                  | n/a   | n/a           | n/a          |   |
| 42   | Czech Republic           | 0.03  | 8.87          | 0.55         |   | n/a  | Honduras                   | n/a   | n/a           | n/a          |   |
| 43   | Senegal (2015)           | 0.03  | 8.57          | 0.54         |   | n/a  | Jamaica                    | n/a   | n/a           | n/a          |   |
| 44   | Georgia                  | 0.03  | 8.31          | 0.53         |   | n/a  | Kyrgyzstan                 | n/a   | n/a           | n/a          |   |
| 45   | Hungary                  | 0.03  | 8.12          | 0.52         |   | n/a  | Madagascar                 | n/a   | n/a           | n/a          |   |
| 46   | Panama (2015)            | 0.02  | 7.54          | 0.51         |   | n/a  | Malawi                     | n/a   | n/a           | n/a          |   |
| 47   | Poland                   | 0.02  | 7.36          | 0.49         |   | n/a  | Moldova, Rep.              | n/a   | n/a           | n/a          |   |
| 48   | Brazil                   | 0.02  | 7.21          | 0.48         |   | n/a  | Mongolia                   | n/a   | n/a           | n/a          |   |
| 49   | Japan                    | 0.02  | 7.15          | 0.47         |   | n/a  | Montenegro                 | n/a   | n/a           | n/a          |   |
| 50   | Morocco                  | 0.02  | 6.55          | 0.46         |   | n/a  | Mozambique                 | n/a   | n/a           | n/a          |   |
| 51   | South Africa             | 0.02  | 6.28          | 0.45         |   | n/a  | Namibia                    | n/a   | n/a           | n/a          |   |
| 52   | Latvia                   | 0.02  | 6.05          | 0.44         |   | n/a  | Nepal                      | n/a   | n/a           | n/a          |   |
| 53   | Korea, Rep.              | 0.02  | 5.73          | 0.43         |   | n/a  | Niger                      | n/a   | n/a           | n/a          |   |
| 54   | Cambodia (2015)          | 0.02  | 5.67          | 0.42         |   | n/a  | Oman                       | n/a   | n/a           | n/a          |   |
| 55   | Malaysia                 | 0.02  | 5.32          | 0.41         |   | n/a  | Paraguay                   | n/a   | n/a           | n/a          |   |
| 56   | Zambia                   | 0.02  | 4.67          | 0.40         |   | n/a  | Qatar                      | n/a   | n/a           | n/a          |   |
| 57   | Bahrain                  | 0.02  | 4.59          | 0.38         |   | n/a  | Serbia                     | n/a   | n/a           | n/a          |   |
| 58   | Greece (2015)            | 0.01  | 4.31          | 0.37         |   | n/a  | Sri Lanka                  | n/a   | n/a           | n/a          |   |
| 59   | Uruguay                  | 0.01  | 4.10          | 0.36         |   | n/a  | Tajikistan                 | n/a   | n/a           | n/a          |   |
| 60   | Viet Nam                 | 0.01  | 4.07          | 0.35         |   | n/a  | TFYR of Macedonia          | n/a   | n/a           | n/a          |   |
| 61   | Côte d'Ivoire (2015)     | 0.01  | 3.85          | 0.34         |   | n/a  | Togo                       | n/a   | n/a           | n/a          |   |
| 62   | Costa Rica               | 0.01  | 3.81          | 0.33         |   | n/a  | Trinidad and Tobago        | n/a   | n/a           | n/a          |   |
| 63   | Uganda (2015)            | 0.01  | 3.78          | 0.32         |   | n/a  | Yemen                      | n/a   | n/a           | n/a          |   |
| 64   | Peru                     | 0.01  | 3.67          | 0.31         |   |      |                            |       |               |              |   |

SOURCE: Thomson Reuters, *Thomson One Banker Private Equity*, *SDC Platinum* database; International Monetary Fund, *World Economic Outlook Database*, October 2016 (PPP\$ GDP)

NOTE: ● indicates a strength; ○ a weakness

# 4.3.1

## Applied tariff rate, weighted mean

Tariff rate, applied, weighted mean, all products (%) | 2015

| Rank | Country/Economy          | Value | Score (0–100) | Percent rank |   | Rank | Country/Economy            | Value | Score (0–100) | Percent rank |   |
|------|--------------------------|-------|---------------|--------------|---|------|----------------------------|-------|---------------|--------------|---|
| 1    | Hong Kong (China)        | .00   | 100.00        | 0.98         | ● | 64   | Morocco                    | 2.79  | 83.80         | 0.49         |   |
| 1    | Singapore                | .00   | 100.00        | 0.98         | ● | 66   | Russian Federation         | 2.80  | 83.74         | 0.48         |   |
| 1    | Switzerland              | .00   | 100.00        | 0.98         | ● | 67   | United Arab Emirates       | 2.83  | 83.57         | 0.47         |   |
| 4    | Georgia                  | .30   | 98.26         | 0.98         | ● | 68   | Kuwait                     | 2.96  | 82.81         | 0.46         |   |
| 5    | Brunei Darussalam (2014) | .46   | 97.33         | 0.97         | ● | 69   | Viet Nam                   | 3.14  | 81.77         | 0.46         |   |
| 6    | Botswana                 | .54   | 96.86         | 0.96         | ● | 70   | Turkey                     | 3.20  | 81.42         | 0.45         |   |
| 7    | Mauritius                | .63   | 96.34         | 0.95         | ● | 71   | Bahrain                    | 3.29  | 80.89         | 0.44         |   |
| 8    | Chile                    | .64   | 96.28         | 0.94         | ● | 72   | Moldova, Rep.              | 3.35  | 80.55         | 0.42         |   |
| 9    | Iceland                  | .77   | 95.53         | 0.94         |   | 72   | Zambia (2013)              | 3.35  | 80.55         | 0.42         |   |
| 10   | Namibia                  | .87   | 94.95         | 0.93         | ● | 74   | Qatar                      | 3.36  | 80.49         | 0.42         |   |
| 11   | Canada                   | .96   | 94.43         | 0.92         |   | 75   | Saudi Arabia (2014)        | 3.40  | 80.26         | 0.41         |   |
| 12   | Mexico (2014)            | 1.02  | 94.08         | 0.91         | ● | 76   | China                      | 3.41  | 80.20         | 0.40         |   |
| 13   | Norway                   | 1.04  | 93.96         | 0.90         |   | 77   | Thailand                   | 3.47  | 79.85         | 0.39         |   |
| 14   | Bosnia and Herzegovina   | 1.09  | 93.67         | 0.90         | ● | 78   | Tunisia                    | 3.94  | 77.12         | 0.38         |   |
| 15   | Albania                  | 1.11  | 93.55         | 0.89         | ● | 79   | Jordan                     | 3.98  | 76.89         | 0.38         |   |
| 16   | TFYR of Macedonia        | 1.12  | 93.50         | 0.88         | ● | 80   | Mozambique (2014)          | 4.17  | 75.78         | 0.37         |   |
| 17   | Malaysia (2014)          | 1.28  | 92.57         | 0.87         | ● | 81   | Colombia (2014)            | 4.21  | 75.55         | 0.36         |   |
| 18   | Croatia (2013)           | 1.30  | 92.45         | 0.86         | ● | 82   | South Africa               | 4.22  | 75.49         | 0.35         |   |
| 19   | New Zealand              | 1.32  | 92.33         | 0.86         |   | 83   | Malawi                     | 4.24  | 75.38         | 0.34         |   |
| 20   | Japan                    | 1.36  | 92.10         | 0.85         |   | 84   | Paraguay                   | 4.43  | 74.27         | 0.34         |   |
| 21   | Guatemala                | 1.39  | 91.93         | 0.84         | ● | 85   | Mongolia                   | 4.57  | 73.46         | 0.33         |   |
| 22   | Peru (2014)              | 1.43  | 91.70         | 0.83         | ● | 86   | Kazakhstan                 | 4.72  | 72.59         | 0.32         |   |
| 23   | Austria                  | 1.57  | 90.88         | 0.62         |   | 87   | Bolivia, Plurinational St. | 4.75  | 72.42         | 0.31         |   |
| 23   | Belgium                  | 1.57  | 90.88         | 0.62         |   | 88   | Korea, Rep.                | 4.78  | 72.24         | 0.30         | ○ |
| 23   | Bulgaria                 | 1.57  | 90.88         | 0.62         |   | 89   | Uruguay                    | 4.79  | 72.18         | 0.30         |   |
| 23   | Cyprus                   | 1.57  | 90.88         | 0.62         |   | 90   | Cambodia (2014)            | 4.85  | 71.84         | 0.29         |   |
| 23   | Czech Republic           | 1.57  | 90.88         | 0.62         |   | 91   | Yemen                      | 5.14  | 70.15         | 0.28         | ● |
| 23   | Denmark                  | 1.57  | 90.88         | 0.62         |   | 92   | Azerbaijan                 | 5.19  | 69.86         | 0.27         |   |
| 23   | Estonia                  | 1.57  | 90.88         | 0.62         |   | 93   | Sri Lanka (2014)           | 5.25  | 69.51         | 0.26         |   |
| 23   | Finland                  | 1.57  | 90.88         | 0.62         |   | 94   | Burundi                    | 5.39  | 68.70         | 0.26         |   |
| 23   | France                   | 1.57  | 90.88         | 0.62         |   | 95   | Zimbabwe                   | 5.43  | 68.47         | 0.25         |   |
| 23   | Germany                  | 1.57  | 90.88         | 0.62         |   | 96   | Ecuador                    | 5.60  | 67.48         | 0.24         |   |
| 23   | Greece                   | 1.57  | 90.88         | 0.62         |   | 97   | Uganda                     | 5.93  | 65.56         | 0.23         |   |
| 23   | Hungary                  | 1.57  | 90.88         | 0.62         |   | 98   | Madagascar (2014)          | 5.99  | 65.21         | 0.22         |   |
| 23   | Ireland                  | 1.57  | 90.88         | 0.62         |   | 99   | Panama (2013)              | 6.08  | 64.69         | 0.22         |   |
| 23   | Italy                    | 1.57  | 90.88         | 0.62         |   | 100  | Dominican Republic         | 6.30  | 63.41         | 0.20         |   |
| 23   | Latvia                   | 1.57  | 90.88         | 0.62         |   | 100  | India (2013)               | 6.30  | 63.41         | 0.20         |   |
| 23   | Lithuania                | 1.57  | 90.88         | 0.62         |   | 102  | Tanzania, United Rep.      | 6.54  | 62.02         | 0.19         |   |
| 23   | Luxembourg               | 1.57  | 90.88         | 0.62         |   | 103  | Egypt                      | 7.04  | 59.12         | 0.18         |   |
| 23   | Malta                    | 1.57  | 90.88         | 0.62         |   | 104  | Rwanda                     | 7.15  | 58.48         | 0.18         |   |
| 23   | Netherlands              | 1.57  | 90.88         | 0.62         | ○ | 105  | Tajikistan                 | 7.18  | 58.30         | 0.17         |   |
| 23   | Poland                   | 1.57  | 90.88         | 0.62         |   | 106  | Argentina                  | 7.35  | 57.32         | 0.16         |   |
| 23   | Portugal                 | 1.57  | 90.88         | 0.62         |   | 107  | Kenya                      | 7.60  | 55.87         | 0.15         |   |
| 23   | Romania                  | 1.57  | 90.88         | 0.62         |   | 108  | Algeria                    | 8.27  | 51.97         | 0.13         |   |
| 23   | Slovakia                 | 1.57  | 90.88         | 0.62         |   | 108  | Brazil                     | 8.27  | 51.97         | 0.13         | ○ |
| 23   | Slovenia                 | 1.57  | 90.88         | 0.62         |   | 108  | Trinidad and Tobago (2013) | 8.27  | 51.97         | 0.13         |   |
| 23   | Spain                    | 1.57  | 90.88         | 0.62         |   | 111  | Pakistan                   | 9.53  | 44.66         | 0.12         |   |
| 23   | Sweden                   | 1.57  | 90.88         | 0.62         | ○ | 112  | Burkina Faso               | 9.59  | 44.31         | 0.10         |   |
| 23   | United Kingdom           | 1.57  | 90.88         | 0.62         | ○ | 112  | Jamaica (2013)             | 9.59  | 44.31         | 0.10         | ○ |
| 50   | United States of America | 1.64  | 90.48         | 0.61         |   | 114  | Nigeria                    | 9.75  | 43.38         | 0.10         |   |
| 51   | El Salvador              | 1.79  | 89.61         | 0.60         |   | 115  | Côte d'Ivoire              | 10.63 | 38.27         | 0.09         |   |
| 52   | Belarus                  | 1.80  | 89.55         | 0.59         |   | 116  | Mali                       | 10.64 | 38.21         | 0.08         |   |
| 53   | Australia                | 1.89  | 89.02         | 0.58         |   | 117  | Togo                       | 11.41 | 33.74         | 0.07         |   |
| 54   | Oman                     | 1.90  | 88.97         | 0.58         |   | 118  | Senegal                    | 11.64 | 32.40         | 0.06         | ○ |
| 55   | Ukraine                  | 1.93  | 88.79         | 0.57         |   | 119  | Nepal                      | 11.72 | 31.94         | 0.06         | ○ |
| 56   | Philippines (2013)       | 2.15  | 87.51         | 0.56         |   | 120  | Niger                      | 11.77 | 31.65         | 0.05         |   |
| 57   | Israel                   | 2.23  | 87.05         | 0.55         |   | 121  | Bangladesh                 | 11.89 | 30.95         | 0.04         | ○ |
| 58   | Indonesia (2013)         | 2.27  | 86.82         | 0.54         |   | 122  | Guinea (2012)              | 11.91 | 30.84         | 0.03         |   |
| 59   | Armenia                  | 2.52  | 85.37         | 0.54         |   | 123  | Ethiopia                   | 12.14 | 29.50         | 0.02         |   |
| 60   | Montenegro (2012)        | 2.63  | 84.73         | 0.53         |   | 124  | Iran, Islamic Rep. (2011)  | 15.23 | 11.56         | 0.02         | ○ |
| 61   | Costa Rica (2014)        | 2.66  | 84.55         | 0.52         |   | 125  | Cameroon (2014)            | 15.78 | 8.36          | 0.01         | ○ |
| 62   | Kyrgyzstan               | 2.74  | 84.09         | 0.51         |   | 126  | Benin                      | 17.22 | 0.00          | 0.00         | ○ |
| 63   | Lebanon                  | 2.77  | 83.91         | 0.50         |   | n/a  | Serbia                     | n/a   | n/a           | n/a          |   |
| 64   | Honduras                 | 2.79  | 83.80         | 0.49         |   |      |                            |       |               |              |   |

SOURCE: World Bank, based on data from United Nations Conference on Trade and Development's Trade Analysis and Information System (TRAINS) database and the World Trade Organization's (WTO) Integrated Data Base (IDB) and Consolidated Tariff Schedules (CTS) database; extracted from World Bank *World Development Indicators* database

NOTE: ● indicates a strength; ○ a weakness

## 4.3.2 Intensity of local competition

Average answer to the question: In your country, how intense is competition in the local markets? [1 = not intense at all; 7 = extremely intense] | 2016

| Rank | Country/Economy          | Value | Score (0–100) | Percent rank |   | Rank | Country/Economy            | Value | Score (0–100) | Percent rank |   |
|------|--------------------------|-------|---------------|--------------|---|------|----------------------------|-------|---------------|--------------|---|
| 1    | Japan                    | 6.23  | 87.11         | 1.00         | ● | 65   | Sri Lanka                  | 5.18  | 69.67         | 0.48         |   |
| 2    | Hong Kong (China)        | 6.16  | 86.02         | 0.99         | ● | 66   | Peru                       | 5.18  | 69.63         | 0.47         |   |
| 3    | United Kingdom           | 5.99  | 83.23         | 0.98         | ● | 67   | Norway                     | 5.14  | 68.94         | 0.46         | ○ |
| 4    | Malta                    | 5.99  | 83.22         | 0.98         | ● | 68   | Morocco                    | 5.12  | 68.75         | 0.45         |   |
| 5    | United States of America | 5.98  | 82.95         | 0.97         |   | 69   | Bangladesh                 | 5.11  | 68.48         | 0.44         |   |
| 6    | Australia                | 5.92  | 81.94         | 0.96         | ● | 70   | Greece                     | 5.06  | 67.62         | 0.43         |   |
| 7    | Korea, Rep.              | 5.92  | 81.92         | 0.95         |   | 71   | Paraguay                   | 5.04  | 67.31         | 0.43         |   |
| 8    | United Arab Emirates     | 5.90  | 81.75         | 0.94         | ● | 72   | Nigeria                    | 5.03  | 67.23         | 0.42         | ● |
| 9    | Germany                  | 5.90  | 81.74         | 0.93         |   | 73   | Ecuador                    | 5.02  | 66.93         | 0.41         |   |
| 10   | Netherlands              | 5.90  | 81.64         | 0.93         |   | 74   | Rwanda                     | 4.98  | 66.39         | 0.40         |   |
| 11   | Turkey                   | 5.88  | 81.29         | 0.92         | ● | 75   | Georgia                    | 4.97  | 66.09         | 0.39         |   |
| 12   | Belgium                  | 5.85  | 80.83         | 0.91         | ● | 76   | Honduras                   | 4.95  | 65.86         | 0.39         |   |
| 13   | France                   | 5.76  | 79.36         | 0.90         |   | 77   | Viet Nam                   | 4.95  | 65.86         | 0.38         |   |
| 14   | Czech Republic           | 5.76  | 79.35         | 0.89         | ● | 78   | Russian Federation         | 4.95  | 65.83         | 0.37         |   |
| 15   | Estonia                  | 5.75  | 79.17         | 0.89         |   | 79   | Bolivia, Plurinational St. | 4.94  | 65.64         | 0.36         |   |
| 16   | Qatar                    | 5.74  | 79.04         | 0.88         | ● | 80   | Nepal                      | 4.91  | 65.23         | 0.35         |   |
| 17   | Spain                    | 5.64  | 77.27         | 0.87         |   | 81   | Tunisia                    | 4.85  | 64.19         | 0.34         |   |
| 18   | Kenya                    | 5.63  | 77.24         | 0.86         | ● | 82   | Iceland                    | 4.84  | 63.96         | 0.34         | ○ |
| 19   | Singapore                | 5.62  | 76.94         | 0.85         |   | 83   | Cameroon                   | 4.83  | 63.84         | 0.33         |   |
| 20   | Dominican Republic       | 5.60  | 76.60         | 0.84         | ● | 84   | Benin                      | 4.82  | 63.72         | 0.32         |   |
| 21   | Sweden                   | 5.59  | 76.49         | 0.84         |   | 85   | Zimbabwe                   | 4.82  | 63.64         | 0.31         |   |
| 22   | Austria                  | 5.59  | 76.49         | 0.83         |   | 86   | Armenia                    | 4.81  | 63.50         | 0.30         |   |
| 23   | Colombia                 | 5.58  | 76.26         | 0.82         | ● | 87   | Croatia                    | 4.80  | 63.27         | 0.30         | ○ |
| 24   | Slovakia                 | 5.52  | 75.39         | 0.81         |   | 88   | Romania                    | 4.79  | 63.14         | 0.29         |   |
| 25   | Guatemala                | 5.52  | 75.33         | 0.80         | ● | 89   | Finland                    | 4.78  | 63.04         | 0.28         | ○ |
| 26   | Lithuania                | 5.51  | 75.25         | 0.80         |   | 90   | Côte d'Ivoire              | 4.77  | 62.92         | 0.27         |   |
| 27   | Jamaica                  | 5.49  | 74.76         | 0.79         | ● | 91   | India                      | 4.75  | 62.49         | 0.26         |   |
| 28   | New Zealand              | 5.48  | 74.62         | 0.78         |   | 92   | Tajikistan                 | 4.73  | 62.16         | 0.25         |   |
| 29   | South Africa             | 5.46  | 74.29         | 0.77         |   | 93   | Cambodia                   | 4.73  | 62.12         | 0.25         |   |
| 30   | Denmark                  | 5.45  | 74.24         | 0.76         |   | 94   | Tanzania, United Rep.      | 4.72  | 62.01         | 0.24         |   |
| 31   | Canada                   | 5.45  | 74.10         | 0.75         |   | 95   | Namibia                    | 4.67  | 61.13         | 0.23         |   |
| 32   | Lebanon                  | 5.44  | 73.92         | 0.75         | ● | 96   | Uruguay                    | 4.64  | 60.61         | 0.22         |   |
| 33   | Panama                   | 5.42  | 73.74         | 0.74         |   | 97   | Kazakhstan                 | 4.63  | 60.53         | 0.21         |   |
| 34   | Latvia                   | 5.42  | 73.68         | 0.73         |   | 98   | Bulgaria                   | 4.62  | 60.28         | 0.20         | ○ |
| 35   | China                    | 5.41  | 73.54         | 0.72         |   | 99   | Ukraine                    | 4.61  | 60.16         | 0.20         |   |
| 36   | Saudi Arabia             | 5.40  | 73.36         | 0.71         |   | 100  | Mongolia                   | 4.60  | 60.06         | 0.19         |   |
| 37   | Jordan                   | 5.40  | 73.27         | 0.70         | ● | 101  | Madagascar                 | 4.60  | 60.05         | 0.18         |   |
| 38   | Switzerland              | 5.39  | 73.19         | 0.70         |   | 102  | Brunei Darussalam          | 4.60  | 60.05         | 0.17         |   |
| 39   | Malaysia                 | 5.38  | 73.08         | 0.69         |   | 103  | Oman                       | 4.60  | 59.99         | 0.16         |   |
| 40   | TFYR of Macedonia        | 5.38  | 72.98         | 0.68         |   | 104  | Malawi                     | 4.58  | 59.72         | 0.16         |   |
| 41   | Luxembourg               | 5.32  | 71.93         | 0.67         |   | 105  | Moldova, Rep.              | 4.55  | 59.13         | 0.15         | ○ |
| 42   | Cyprus                   | 5.31  | 71.90         | 0.66         |   | 106  | Azerbaijan                 | 4.52  | 58.65         | 0.14         | ○ |
| 43   | Thailand                 | 5.31  | 71.89         | 0.66         |   | 107  | Albania                    | 4.50  | 58.31         | 0.13         | ○ |
| 44   | Uganda                   | 5.31  | 71.83         | 0.65         | ● | 108  | Mozambique                 | 4.48  | 57.96         | 0.12         |   |
| 45   | Italy                    | 5.31  | 71.82         | 0.64         |   | 109  | Pakistan                   | 4.47  | 57.81         | 0.11         |   |
| 46   | Poland                   | 5.31  | 71.81         | 0.63         |   | 110  | Bosnia and Herzegovina     | 4.46  | 57.61         | 0.11         | ○ |
| 47   | Mauritius                | 5.30  | 71.68         | 0.62         |   | 111  | Mali                       | 4.43  | 57.16         | 0.10         |   |
| 48   | Costa Rica               | 5.30  | 71.59         | 0.61         |   | 112  | Argentina                  | 4.42  | 57.07         | 0.09         | ○ |
| 49   | Botswana                 | 5.27  | 71.25         | 0.61         |   | 113  | Burundi                    | 4.36  | 56.08         | 0.08         |   |
| 50   | Indonesia                | 5.27  | 71.24         | 0.60         |   | 114  | Montenegro                 | 4.28  | 54.59         | 0.07         | ○ |
| 51   | Brazil                   | 5.26  | 71.01         | 0.59         |   | 115  | Yemen                      | 4.27  | 54.58         | 0.07         |   |
| 52   | El Salvador              | 5.26  | 70.99         | 0.58         |   | 116  | Iran, Islamic Rep.         | 4.24  | 53.97         | 0.06         | ○ |
| 53   | Senegal                  | 5.24  | 70.59         | 0.57         | ● | 117  | Egypt                      | 4.24  | 53.95         | 0.05         | ○ |
| 54   | Slovenia                 | 5.23  | 70.54         | 0.57         |   | 118  | Serbia                     | 4.23  | 53.91         | 0.04         | ○ |
| 55   | Portugal                 | 5.23  | 70.52         | 0.56         |   | 119  | Guinea (2015)              | 4.20  | 53.28         | 0.03         |   |
| 56   | Mexico                   | 5.22  | 70.30         | 0.55         |   | 120  | Hungary                    | 4.16  | 52.74         | 0.02         | ○ |
| 57   | Trinidad and Tobago      | 5.22  | 70.28         | 0.54         |   | 121  | Kyrgyzstan                 | 4.15  | 52.51         | 0.02         | ○ |
| 58   | Kuwait                   | 5.21  | 70.23         | 0.53         |   | 122  | Ethiopia                   | 3.88  | 48.08         | 0.01         | ○ |
| 59   | Philippines              | 5.21  | 70.21         | 0.52         |   | 123  | Algeria                    | 3.78  | 46.35         | 0.00         | ○ |
| 60   | Bahrain                  | 5.21  | 70.14         | 0.52         |   | n/a  | Belarus                    | n/a   | n/a           | n/a          |   |
| 61   | Chile                    | 5.20  | 70.05         | 0.51         |   | n/a  | Burkina Faso               | n/a   | n/a           | n/a          |   |
| 62   | Zambia                   | 5.20  | 69.94         | 0.50         | ● | n/a  | Niger                      | n/a   | n/a           | n/a          |   |
| 63   | Ireland                  | 5.19  | 69.88         | 0.49         | ○ | n/a  | Togo                       | n/a   | n/a           | n/a          |   |
| 64   | Israel                   | 5.19  | 69.82         | 0.48         |   |      |                            |       |               |              |   |

SOURCE: World Economic Forum, *Executive Opinion Survey 2016–2017*

NOTE: ● indicates a strength; ○ a weakness



# 4.3.3 Domestic market scale

## Domestic market scale as measured by GDP, billion PPP\$ | 2016

| Rank | Country/Economy          | Value     | Score (0–100) | Percent rank |   | Rank | Country/Economy            | Value  | Score (0–100) | Percent rank |   |
|------|--------------------------|-----------|---------------|--------------|---|------|----------------------------|--------|---------------|--------------|---|
| 1    | China                    | 21,269.02 | 100.00        | 1.00         | ● | 65   | Belarus                    | 165.36 | 50.84         | 0.49         |   |
| 2    | United States of America | 18,561.93 | 98.63         | 0.99         | ● | 66   | Dominican Republic         | 160.86 | 50.55         | 0.48         |   |
| 3    | India                    | 8,720.51  | 91.05         | 0.98         | ● | 67   | Kenya                      | 152.74 | 50.00         | 0.48         |   |
| 4    | Japan                    | 4,931.88  | 85.32         | 0.98         | ● | 68   | Tanzania, United Rep.      | 150.63 | 49.86         | 0.47         | ● |
| 5    | Germany                  | 3,979.08  | 83.16         | 0.97         | ● | 69   | Bulgaria                   | 143.10 | 49.32         | 0.46         |   |
| 6    | Russian Federation       | 3,745.08  | 82.56         | 0.96         | ● | 70   | Guatemala                  | 132.34 | 48.49         | 0.45         |   |
| 7    | Brazil                   | 3,134.89  | 80.77         | 0.95         | ● | 71   | Tunisia                    | 130.83 | 48.37         | 0.44         |   |
| 8    | Indonesia                | 3,027.83  | 80.42         | 0.94         | ● | 72   | Serbia                     | 101.46 | 45.66         | 0.44         |   |
| 9    | United Kingdom           | 2,787.74  | 79.59         | 0.94         |   | 73   | Croatia                    | 94.24  | 44.86         | 0.43         |   |
| 10   | France                   | 2,736.72  | 79.40         | 0.93         | ● | 74   | Panama                     | 93.12  | 44.73         | 0.42         |   |
| 11   | Mexico                   | 2,306.67  | 77.68         | 0.92         | ● | 75   | Côte d'Ivoire              | 87.12  | 44.01         | 0.41         |   |
| 12   | Italy                    | 2,220.58  | 77.30         | 0.91         | ● | 76   | Jordan                     | 86.19  | 43.89         | 0.40         |   |
| 13   | Korea, Rep.              | 1,928.62  | 75.88         | 0.90         |   | 77   | Lithuania                  | 85.79  | 43.84         | 0.40         |   |
| 14   | Saudi Arabia             | 1,731.23  | 74.79         | 0.90         | ● | 78   | Lebanon                    | 85.16  | 43.76         | 0.39         |   |
| 15   | Spain                    | 1,689.71  | 74.55         | 0.89         |   | 79   | Uganda                     | 84.93  | 43.73         | 0.38         |   |
| 16   | Canada                   | 1,674.31  | 74.45         | 0.88         |   | 80   | Costa Rica                 | 79.26  | 42.97         | 0.37         |   |
| 17   | Turkey                   | 1,669.89  | 74.43         | 0.87         | ● | 81   | Bolivia, Plurinational St. | 78.35  | 42.84         | 0.37         |   |
| 18   | Iran, Islamic Rep.       | 1,459.20  | 73.07         | 0.87         | ● | 82   | Cameroon                   | 77.24  | 42.69         | 0.36         |   |
| 19   | Australia                | 1,188.76  | 71.00         | 0.86         |   | 83   | Uruguay                    | 73.93  | 42.20         | 0.35         |   |
| 20   | Thailand                 | 1,161.33  | 70.76         | 0.85         | ● | 84   | Yemen                      | 73.45  | 42.13         | 0.34         | ● |
| 21   | Egypt                    | 1,105.04  | 70.26         | 0.84         | ● | 85   | Nepal                      | 71.52  | 41.84         | 0.33         |   |
| 22   | Nigeria                  | 1,088.94  | 70.11         | 0.83         | ● | 86   | Bahrain                    | 66.37  | 41.00         | 0.33         |   |
| 23   | Poland                   | 1,052.25  | 69.77         | 0.83         | ● | 87   | Slovenia                   | 66.13  | 40.96         | 0.32         | ○ |
| 24   | Pakistan                 | 988.22    | 69.13         | 0.82         | ● | 88   | Zambia                     | 65.17  | 40.80         | 0.31         |   |
| 25   | Argentina                | 879.45    | 67.96         | 0.81         | ● | 89   | Paraguay                   | 64.12  | 40.61         | 0.30         |   |
| 26   | Netherlands              | 865.91    | 67.80         | 0.80         |   | 90   | Cambodia                   | 58.94  | 39.66         | 0.29         |   |
| 27   | Malaysia                 | 863.77    | 67.77         | 0.79         |   | 91   | Luxembourg                 | 58.74  | 39.63         | 0.29         | ○ |
| 28   | Philippines              | 801.90    | 67.02         | 0.79         | ● | 92   | El Salvador                | 54.79  | 38.83         | 0.28         |   |
| 29   | South Africa             | 736.33    | 66.16         | 0.78         | ● | 93   | Latvia                     | 50.87  | 37.97         | 0.27         | ○ |
| 30   | Colombia                 | 690.39    | 65.50         | 0.77         |   | 94   | Trinidad and Tobago        | 43.57  | 36.15         | 0.26         |   |
| 31   | United Arab Emirates     | 667.21    | 65.16         | 0.76         |   | 95   | Honduras                   | 43.19  | 36.05         | 0.25         |   |
| 32   | Bangladesh               | 628.37    | 64.55         | 0.75         | ● | 96   | Bosnia and Herzegovina     | 42.53  | 35.86         | 0.25         |   |
| 33   | Algeria                  | 609.39    | 64.24         | 0.75         | ● | 97   | Senegal                    | 39.72  | 35.04         | 0.24         |   |
| 34   | Viet Nam                 | 594.89    | 63.99         | 0.74         |   | 98   | Estonia                    | 38.70  | 34.72         | 0.23         | ○ |
| 35   | Belgium                  | 508.60    | 62.40         | 0.73         |   | 99   | Mali                       | 38.09  | 34.53         | 0.22         |   |
| 36   | Sweden                   | 498.13    | 62.19         | 0.72         |   | 100  | Madagascar                 | 37.49  | 34.33         | 0.21         |   |
| 37   | Switzerland              | 494.30    | 62.11         | 0.71         |   | 101  | Georgia                    | 37.38  | 34.30         | 0.21         |   |
| 38   | Singapore                | 486.91    | 61.96         | 0.71         |   | 102  | Mongolia                   | 36.65  | 34.05         | 0.20         |   |
| 39   | Kazakhstan               | 460.69    | 61.39         | 0.70         |   | 103  | Botswana                   | 36.51  | 34.00         | 0.19         |   |
| 40   | Romania                  | 441.03    | 60.95         | 0.69         |   | 104  | Mozambique                 | 35.31  | 33.59         | 0.18         |   |
| 41   | Chile                    | 436.14    | 60.84         | 0.68         |   | 105  | Albania                    | 34.21  | 33.20         | 0.17         |   |
| 42   | Hong Kong (China)        | 427.39    | 60.63         | 0.67         |   | 106  | Brunei Darussalam          | 33.73  | 33.02         | 0.17         |   |
| 43   | Austria                  | 415.94    | 60.35         | 0.67         |   | 107  | Burkina Faso               | 32.99  | 32.73         | 0.16         |   |
| 44   | Peru                     | 409.85    | 60.20         | 0.66         | ● | 108  | TFYR of Macedonia          | 30.13  | 31.57         | 0.15         | ○ |
| 45   | Norway                   | 364.69    | 59.01         | 0.65         |   | 109  | Cyprus                     | 29.26  | 31.19         | 0.14         | ○ |
| 46   | Czech Republic           | 350.86    | 58.61         | 0.64         |   | 110  | Zimbabwe                   | 28.33  | 30.76         | 0.13         |   |
| 47   | Ukraine                  | 349.77    | 58.58         | 0.63         |   | 111  | Namibia                    | 27.04  | 30.14         | 0.13         |   |
| 48   | Qatar                    | 334.49    | 58.12         | 0.63         |   | 112  | Armenia                    | 26.56  | 29.90         | 0.12         | ○ |
| 49   | Ireland                  | 324.30    | 57.81         | 0.62         |   | 113  | Mauritius                  | 25.85  | 29.53         | 0.11         | ○ |
| 50   | Kuwait                   | 301.06    | 57.04         | 0.61         |   | 114  | Tajikistan                 | 25.81  | 29.51         | 0.10         |   |
| 51   | Portugal                 | 297.09    | 56.91         | 0.60         |   | 115  | Jamaica                    | 25.39  | 29.28         | 0.10         | ○ |
| 52   | Israel                   | 297.05    | 56.91         | 0.60         |   | 116  | Benin                      | 24.31  | 28.68         | 0.09         |   |
| 53   | Greece                   | 290.49    | 56.68         | 0.59         |   | 117  | Rwanda                     | 21.97  | 27.23         | 0.08         |   |
| 54   | Morocco                  | 282.78    | 56.40         | 0.58         |   | 118  | Malawi                     | 21.23  | 26.72         | 0.07         |   |
| 55   | Hungary                  | 267.62    | 55.83         | 0.57         |   | 119  | Kyrgyzstan                 | 21.01  | 26.57         | 0.06         |   |
| 56   | Denmark                  | 264.84    | 55.73         | 0.56         | ○ | 120  | Niger                      | 20.27  | 26.03         | 0.06         |   |
| 57   | Sri Lanka                | 237.79    | 54.61         | 0.56         |   | 121  | Moldova, Rep.              | 18.54  | 24.64         | 0.05         | ○ |
| 58   | Finland                  | 229.95    | 54.27         | 0.55         | ○ | 122  | Malta                      | 16.32  | 22.52         | 0.04         | ○ |
| 59   | Ecuador                  | 182.42    | 51.86         | 0.54         |   | 123  | Iceland                    | 16.15  | 22.33         | 0.03         | ○ |
| 60   | New Zealand              | 174.85    | 51.42         | 0.53         |   | 124  | Guinea                     | 16.08  | 22.26         | 0.02         |   |
| 61   | Ethiopia                 | 174.74    | 51.41         | 0.52         | ● | 125  | Togo                       | 11.61  | 15.57         | 0.02         | ○ |
| 62   | Oman                     | 173.07    | 51.31         | 0.52         |   | 126  | Montenegro                 | 10.61  | 13.19         | 0.01         | ○ |
| 63   | Slovakia                 | 169.07    | 51.07         | 0.51         |   | 127  | Burundi                    | 7.89   | 0.00          | 0.00         | ○ |
| 64   | Azerbaijan               | 167.91    | 51.00         | 0.50         |   |      |                            |        |               |              |   |

SOURCE: World Bank; International Monetary Fund, *World Economic Outlook Database* October 2016 (PPP\$ GDP)

NOTE: ● Indicates a strength; ○ a weakness

# 5.1.1 Employment in knowledge-intensive services

## Employment in knowledge-intensive services (% of workforce) | 2015

| Rank | Country/Economy                 | Value | Score (0–100) | Percent rank |   | Rank | Country/Economy                   | Value | Score (0–100) | Percent rank |     |
|------|---------------------------------|-------|---------------|--------------|---|------|-----------------------------------|-------|---------------|--------------|-----|
| 1    | Luxembourg                      | 56.81 | 100.00        | 1.00         | ● | 65   | Georgia (2007)                    | 22.30 | 38.45         | 0.40         |     |
| 2    | Singapore                       | 54.33 | 95.58         | 0.99         | ● | 66   | Costa Rica                        | 21.63 | 37.26         | 0.39         |     |
| 3    | Switzerland                     | 52.98 | 93.17         | 0.98         | ● | 67   | Brazil (2014)                     | 21.63 | 37.24         | 0.38         |     |
| 4    | Norway                          | 51.68 | 90.86         | 0.97         | ● | 68   | Korea, Rep.                       | 21.42 | 36.88         | 0.37         | ○   |
| 5    | Sweden                          | 50.38 | 88.54         | 0.96         |   | 69   | Uruguay (2014)                    | 20.97 | 36.07         | 0.36         |     |
| 6    | Israel                          | 48.30 | 84.82         | 0.95         |   | 70   | Tunisia (2012)                    | 20.97 | 36.07         | 0.36         |     |
| 7    | Iceland                         | 47.83 | 83.98         | 0.94         |   | 71   | Bahrain (2008)                    | 20.88 | 35.91         | 0.35         |     |
| 8    | United Kingdom                  | 47.63 | 83.62         | 0.93         |   | 72   | Turkey                            | 20.49 | 35.21         | 0.34         |     |
| 9    | Netherlands                     | 46.57 | 81.73         | 0.93         |   | 73   | Jamaica (2008)                    | 20.12 | 34.56         | 0.33         |     |
| 10   | Finland                         | 45.96 | 80.64         | 0.92         |   | 74   | Bangladesh (2011)                 | 20.01 | 34.36         | 0.32         |     |
| 11   | Belgium                         | 45.58 | 79.98         | 0.91         |   | 75   | Pakistan (2008)                   | 19.48 | 33.41         | 0.31         |     |
| 12   | Denmark                         | 45.13 | 79.17         | 0.90         |   | 76   | Paraguay                          | 19.00 | 32.55         | 0.30         |     |
| 13   | Australia (2014)                | 44.90 | 78.76         | 0.89         |   | 77   | Mexico                            | 18.85 | 32.29         | 0.29         |     |
| 14   | France                          | 44.56 | 78.15         | 0.88         |   | 78   | Kyrgyzstan                        | 18.28 | 31.28         | 0.28         |     |
| 15   | Russian Federation              | 44.35 | 77.77         | 0.87         | ● | 79   | Dominican Republic                | 17.94 | 30.67         | 0.27         |     |
| 16   | Germany                         | 44.19 | 77.49         | 0.86         |   | 80   | Botswana (2010)                   | 17.79 | 30.40         | 0.26         |     |
| 17   | Estonia                         | 43.99 | 77.14         | 0.85         |   | 81   | Iran, Islamic Rep.                | 17.65 | 30.16         | 0.25         |     |
| 18   | Canada (2014)                   | 43.73 | 76.66         | 0.84         |   | 82   | Sri Lanka (2014)                  | 16.87 | 28.76         | 0.24         |     |
| 19   | New Zealand (2008)              | 42.92 | 75.22         | 0.83         |   | 83   | Colombia (2010)                   | 16.81 | 28.66         | 0.23         | ○   |
| 20   | Lithuania                       | 41.80 | 73.22         | 0.82         |   | 84   | Qatar                             | 16.08 | 27.34         | 0.22         |     |
| 21   | Slovenia                        | 41.66 | 72.97         | 0.81         |   | 85   | Albania (2009)                    | 16.02 | 27.24         | 0.21         |     |
| 22   | Latvia                          | 41.18 | 72.13         | 0.80         |   | 86   | Bolivia, Plurinational St. (2009) | 15.25 | 25.86         | 0.21         |     |
| 23   | Austria                         | 40.62 | 71.13         | 0.79         |   | 87   | Yemen (2010)                      | 15.03 | 25.48         | 0.20         |     |
| 24   | Ireland                         | 40.58 | 71.05         | 0.79         |   | 88   | Ecuador                           | 14.66 | 24.82         | 0.19         |     |
| 25   | Brunei Darussalam (2014)        | 40.53 | 70.96         | 0.78         | ● | 89   | Namibia (2013)                    | 14.64 | 24.78         | 0.18         |     |
| 26   | Malta                           | 39.78 | 69.63         | 0.77         |   | 90   | Peru                              | 14.61 | 24.72         | 0.17         | ○   |
| 27   | Hong Kong (China)               | 38.64 | 67.59         | 0.76         |   | 91   | Thailand (2014)                   | 13.80 | 23.28         | 0.16         | ○   |
| 28   | United States of America (2013) | 38.01 | 66.47         | 0.75         |   | 92   | El Salvador (2013)                | 12.13 | 20.30         | 0.15         |     |
| 29   | Poland                          | 37.63 | 65.78         | 0.74         |   | 93   | Honduras                          | 12.01 | 20.08         | 0.14         |     |
| 30   | Ukraine                         | 37.59 | 65.72         | 0.73         |   | 94   | Viet Nam                          | 10.76 | 17.86         | 0.13         | ○   |
| 31   | Czech Republic                  | 37.58 | 65.71         | 0.72         |   | 95   | Algeria (2014)                    | 10.00 | 16.50         | 0.12         |     |
| 32   | Montenegro                      | 37.39 | 65.36         | 0.71         |   | 96   | Indonesia                         | 9.82  | 16.18         | 0.11         | ○   |
| 33   | United Arab Emirates (2008)     | 36.08 | 63.02         | 0.70         |   | 97   | Guatemala                         | 9.56  | 15.73         | 0.10         |     |
| 34   | Belarus (2009)                  | 35.90 | 62.70         | 0.69         |   | 98   | Zambia (2010)                     | 7.28  | 11.66         | 0.09         |     |
| 35   | Italy                           | 35.70 | 62.34         | 0.68         |   | 99   | Morocco (2008)                    | 6.78  | 10.76         | 0.08         | ○   |
| 36   | Croatia                         | 35.62 | 62.20         | 0.67         |   | 100  | Zimbabwe (2014)                   | 6.13  | 9.60          | 0.07         |     |
| 37   | Portugal                        | 35.55 | 62.07         | 0.66         |   | 101  | Nepal (2008)                      | 4.28  | 6.30          | 0.07         |     |
| 38   | Cyprus                          | 35.20 | 61.45         | 0.65         |   | 102  | Cambodia (2010)                   | 4.12  | 6.01          | 0.06         | ○   |
| 39   | Hungary                         | 34.87 | 60.86         | 0.64         |   | 103  | Uganda (2013)                     | 4.09  | 5.97          | 0.05         | ○   |
| 40   | Egypt                           | 33.93 | 59.19         | 0.64         | ● | 104  | Ethiopia (2013)                   | 3.77  | 5.39          | 0.04         |     |
| 41   | Kazakhstan                      | 33.34 | 58.13         | 0.63         |   | 105  | Rwanda (2012)                     | 3.76  | 5.37          | 0.03         | ○   |
| 42   | Spain                           | 32.87 | 57.30         | 0.62         |   | 106  | Madagascar                        | 3.66  | 5.20          | 0.02         | ○   |
| 43   | Bulgaria                        | 32.26 | 56.20         | 0.61         |   | 107  | Tanzania, United Rep. (2014)      | 3.37  | 4.69          | 0.01         | ○   |
| 44   | Slovakia                        | 31.93 | 55.62         | 0.60         |   | 108  | Guinea (2010)                     | 0.75  | 0.00          | 0.00         | ○   |
| 45   | Lebanon (2007)                  | 31.84 | 55.47         | 0.59         |   | n/a  | Benin                             | n/a   | n/a           | n/a          | n/a |
| 46   | Armenia                         | 31.13 | 54.19         | 0.58         |   | n/a  | Burkina Faso                      | n/a   | n/a           | n/a          | n/a |
| 47   | Greece                          | 29.85 | 51.92         | 0.57         |   | n/a  | Burundi                           | n/a   | n/a           | n/a          | n/a |
| 48   | Serbia                          | 28.87 | 50.16         | 0.56         |   | n/a  | Cameroon                          | n/a   | n/a           | n/a          | n/a |
| 49   | Trinidad and Tobago             | 28.41 | 49.34         | 0.55         |   | n/a  | China                             | n/a   | n/a           | n/a          | n/a |
| 50   | Moldova, Rep.                   | 28.07 | 48.74         | 0.54         |   | n/a  | Côte d'Ivoire                     | n/a   | n/a           | n/a          | n/a |
| 51   | TFYR of Macedonia               | 27.34 | 47.43         | 0.53         |   | n/a  | India                             | n/a   | n/a           | n/a          | n/a |
| 52   | Saudi Arabia                    | 27.30 | 47.36         | 0.52         |   | n/a  | Jordan                            | n/a   | n/a           | n/a          | n/a |
| 53   | Malaysia                        | 25.50 | 44.16         | 0.51         |   | n/a  | Kenya                             | n/a   | n/a           | n/a          | n/a |
| 54   | Chile                           | 25.01 | 43.28         | 0.50         |   | n/a  | Kuwait                            | n/a   | n/a           | n/a          | n/a |
| 55   | Japan                           | 24.78 | 42.87         | 0.50         |   | n/a  | Malawi                            | n/a   | n/a           | n/a          | n/a |
| 56   | Mauritius                       | 24.72 | 42.76         | 0.49         |   | n/a  | Mali                              | n/a   | n/a           | n/a          | n/a |
| 57   | Mongolia                        | 24.67 | 42.68         | 0.48         |   | n/a  | Mozambique                        | n/a   | n/a           | n/a          | n/a |
| 58   | Philippines                     | 24.03 | 41.54         | 0.47         |   | n/a  | Niger                             | n/a   | n/a           | n/a          | n/a |
| 59   | Panama (2014)                   | 24.01 | 41.50         | 0.46         |   | n/a  | Nigeria                           | n/a   | n/a           | n/a          | n/a |
| 60   | Bosnia and Herzegovina          | 23.97 | 41.42         | 0.45         |   | n/a  | Oman                              | n/a   | n/a           | n/a          | n/a |
| 61   | Argentina (2014)                | 23.91 | 41.32         | 0.44         |   | n/a  | Senegal                           | n/a   | n/a           | n/a          | n/a |
| 62   | Azerbaijan                      | 23.42 | 40.44         | 0.43         |   | n/a  | Tajikistan                        | n/a   | n/a           | n/a          | n/a |
| 63   | Romania                         | 22.74 | 39.23         | 0.42         |   | n/a  | Togo                              | n/a   | n/a           | n/a          | n/a |
| 64   | South Africa                    | 22.46 | 38.74         | 0.41         |   |      |                                   |       |               |              |     |

SOURCE: International Labour Organization ILOSTAT Database of Labour Statistics

NOTE: ● Indicates a strength; ○ a weakness

# 5.1.2

## Firms offering formal training Firms offering formal training (% of firms) | 2013

| Rank | Country/Economy                   | Value | Score (0–100) | Percent rank |   | Rank | Country/Economy          | Value | Score (0–100) | Percent rank |   |
|------|-----------------------------------|-------|---------------|--------------|---|------|--------------------------|-------|---------------|--------------|---|
| 1    | China (2012)                      | 79.20 | 100.00        | 1.00         | ● | 65   | Burkina Faso (2009)      | 24.80 | 28.23         | 0.30         |   |
| 2    | Sweden (2014)                     | 70.30 | 88.26         | 0.99         | ● | 66   | Albania                  | 23.80 | 26.91         | 0.29         |   |
| 3    | Ecuador (2010)                    | 65.90 | 82.45         | 0.98         | ● | 67   | Montenegro               | 23.70 | 26.78         | 0.27         |   |
| 4    | Colombia (2010)                   | 65.10 | 81.40         | 0.97         | ● | 68   | Ukraine                  | 22.60 | 25.33         | 0.26         |   |
| 5    | Argentina (2010)                  | 63.60 | 79.42         | 0.96         | ● | 69   | Cambodia (2016)          | 22.20 | 24.80         | 0.24         |   |
| 6    | Kyrgyzstan                        | 62.70 | 78.23         | 0.95         | ● | 69   | Viet Nam (2015)          | 22.20 | 24.80         | 0.24         |   |
| 7    | Mongolia                          | 60.90 | 75.86         | 0.93         | ● | 71   | Mozambique (2007)        | 22.10 | 24.67         | 0.23         |   |
| 8    | Peru (2010)                       | 60.10 | 74.80         | 0.92         | ● | 72   | Bangladesh               | 21.90 | 24.41         | 0.22         |   |
| 9    | Philippines (2015)                | 59.80 | 74.41         | 0.91         | ● | 73   | Guinea (2006)            | 21.10 | 23.35         | 0.21         |   |
| 10   | Chile (2010)                      | 57.50 | 71.37         | 0.90         | ● | 74   | Ethiopia (2015)          | 20.80 | 22.96         | 0.20         |   |
| 11   | Bolivia, Plurinational St. (2010) | 57.10 | 70.84         | 0.89         | ● | 75   | Azerbaijan               | 20.20 | 22.16         | 0.19         |   |
| 12   | Dominican Republic (2010)         | 57.00 | 70.71         | 0.88         | ● | 76   | Benin (2016)             | 20.00 | 21.90         | 0.18         |   |
| 13   | Rwanda (2011)                     | 55.40 | 68.60         | 0.87         | ● | 77   | Côte d'Ivoire (2009)     | 19.10 | 20.71         | 0.16         |   |
| 14   | Czech Republic                    | 55.10 | 68.21         | 0.86         | ● | 78   | Israel                   | 18.60 | 20.05         | 0.15         | ○ |
| 15   | Paraguay (2010)                   | 54.90 | 67.94         | 0.85         | ● | 79   | Malaysia (2015)          | 18.50 | 19.92         | 0.14         | ○ |
| 16   | Costa Rica (2010)                 | 54.70 | 67.68         | 0.84         | ● | 80   | Sri Lanka (2011)         | 18.40 | 19.79         | 0.13         | ○ |
| 17   | El Salvador (2016)                | 53.80 | 66.49         | 0.82         | ● | 81   | Thailand (2016)          | 18.00 | 19.26         | 0.12         | ○ |
| 18   | Bosnia and Herzegovina            | 52.40 | 64.64         | 0.81         | ● | 82   | Senegal (2014)           | 17.40 | 18.47         | 0.11         |   |
| 19   | Botswana (2010)                   | 51.90 | 63.98         | 0.79         | ● | 83   | Algeria (2007)           | 17.30 | 18.34         | 0.10         |   |
| 19   | Guatemala (2010)                  | 51.90 | 63.98         | 0.79         | ● | 84   | Armenia                  | 16.20 | 16.89         | 0.09         | ○ |
| 21   | Belarus                           | 51.10 | 62.93         | 0.78         | ● | 85   | Hungary                  | 15.80 | 16.36         | 0.08         | ○ |
| 22   | Mexico (2010)                     | 50.80 | 62.53         | 0.77         |   | 86   | Yemen                    | 14.30 | 14.38         | 0.07         |   |
| 23   | Croatia                           | 49.30 | 60.55         | 0.76         |   | 87   | Madagascar               | 12.70 | 12.27         | 0.05         |   |
| 24   | Uruguay (2010)                    | 48.60 | 59.63         | 0.75         | ● | 88   | Panama (2010)            | 11.00 | 10.03         | 0.04         | ○ |
| 25   | TFYR of Macedonia                 | 46.90 | 57.39         | 0.74         |   | 89   | Georgia                  | 10.50 | 9.37          | 0.03         | ○ |
| 26   | Russian Federation (2012)         | 46.20 | 56.46         | 0.73         |   | 90   | Indonesia (2015)         | 7.70  | 5.67          | 0.02         | ○ |
| 27   | Slovakia                          | 43.50 | 52.90         | 0.71         |   | 91   | Egypt                    | 5.20  | 2.37          | 0.01         | ○ |
| 28   | Bulgaria                          | 42.70 | 51.85         | 0.70         |   | 92   | Jordan                   | 3.40  | 0.00          | 0.00         | ○ |
| 29   | Brazil (2009)                     | 42.20 | 51.19         | 0.69         |   | n/a  | Australia                | n/a   | n/a           | n/a          |   |
| 30   | Lithuania                         | 42.00 | 50.92         | 0.68         |   | n/a  | Austria                  | n/a   | n/a           | n/a          |   |
| 31   | Slovenia                          | 41.50 | 50.26         | 0.67         |   | n/a  | Bahrain                  | n/a   | n/a           | n/a          |   |
| 32   | Romania                           | 40.70 | 49.21         | 0.66         |   | n/a  | Belgium                  | n/a   | n/a           | n/a          |   |
| 33   | Kenya                             | 40.60 | 49.08         | 0.65         |   | n/a  | Brunei Darussalam        | n/a   | n/a           | n/a          |   |
| 34   | Serbia                            | 37.80 | 45.38         | 0.64         |   | n/a  | Canada                   | n/a   | n/a           | n/a          |   |
| 35   | South Africa (2007)               | 36.80 | 44.06         | 0.63         |   | n/a  | Cyprus                   | n/a   | n/a           | n/a          |   |
| 36   | India (2014)                      | 35.90 | 42.88         | 0.62         |   | n/a  | Denmark                  | n/a   | n/a           | n/a          |   |
| 37   | Honduras (2010)                   | 35.80 | 42.74         | 0.60         | ● | n/a  | Finland                  | n/a   | n/a           | n/a          |   |
| 38   | Estonia                           | 35.20 | 41.95         | 0.59         |   | n/a  | France                   | n/a   | n/a           | n/a          |   |
| 39   | Uganda                            | 34.70 | 41.29         | 0.58         | ● | n/a  | Germany                  | n/a   | n/a           | n/a          |   |
| 40   | Poland                            | 34.60 | 41.16         | 0.57         |   | n/a  | Greece                   | n/a   | n/a           | n/a          |   |
| 41   | Tajikistan                        | 33.10 | 39.18         | 0.56         | ● | n/a  | Hong Kong (China)        | n/a   | n/a           | n/a          |   |
| 42   | Malawi (2014)                     | 32.90 | 38.92         | 0.55         | ● | n/a  | Iceland                  | n/a   | n/a           | n/a          |   |
| 43   | Moldova, Rep.                     | 32.40 | 38.26         | 0.54         |   | n/a  | Iran, Islamic Rep.       | n/a   | n/a           | n/a          |   |
| 44   | Mali (2010)                       | 32.10 | 37.86         | 0.52         | ● | n/a  | Ireland                  | n/a   | n/a           | n/a          |   |
| 44   | Niger (2009)                      | 32.10 | 37.86         | 0.52         |   | n/a  | Italy                    | n/a   | n/a           | n/a          |   |
| 46   | Burundi (2014)                    | 32.00 | 37.73         | 0.49         |   | n/a  | Japan                    | n/a   | n/a           | n/a          |   |
| 46   | Pakistan                          | 32.00 | 37.73         | 0.49         |   | n/a  | Korea, Rep.              | n/a   | n/a           | n/a          |   |
| 48   | Nepal                             | 31.90 | 37.60         | 0.48         | ● | n/a  | Kuwait                   | n/a   | n/a           | n/a          |   |
| 49   | Zimbabwe (2011)                   | 31.20 | 36.68         | 0.47         |   | n/a  | Luxembourg               | n/a   | n/a           | n/a          |   |
| 50   | Togo (2009)                       | 31.00 | 36.41         | 0.46         | ● | n/a  | Malta                    | n/a   | n/a           | n/a          |   |
| 51   | Nigeria (2014)                    | 30.70 | 36.02         | 0.44         | ● | n/a  | Netherlands              | n/a   | n/a           | n/a          |   |
| 51   | Tanzania, United Rep.             | 30.70 | 36.02         | 0.44         |   | n/a  | New Zealand              | n/a   | n/a           | n/a          |   |
| 53   | Tunisia                           | 28.90 | 33.64         | 0.43         |   | n/a  | Norway                   | n/a   | n/a           | n/a          |   |
| 54   | Turkey                            | 28.40 | 32.98         | 0.42         |   | n/a  | Oman                     | n/a   | n/a           | n/a          |   |
| 55   | Kazakhstan                        | 28.30 | 32.85         | 0.41         |   | n/a  | Portugal                 | n/a   | n/a           | n/a          |   |
| 56   | Zambia                            | 28.20 | 32.72         | 0.40         |   | n/a  | Qatar                    | n/a   | n/a           | n/a          |   |
| 57   | Trinidad and Tobago (2010)        | 28.00 | 32.45         | 0.38         |   | n/a  | Saudi Arabia             | n/a   | n/a           | n/a          |   |
| 58   | Lebanon                           | 26.60 | 30.61         | 0.37         |   | n/a  | Singapore                | n/a   | n/a           | n/a          |   |
| 59   | Morocco                           | 26.30 | 30.21         | 0.36         |   | n/a  | Spain                    | n/a   | n/a           | n/a          |   |
| 60   | Jamaica (2010)                    | 25.90 | 29.68         | 0.35         |   | n/a  | Switzerland              | n/a   | n/a           | n/a          |   |
| 61   | Mauritius (2009)                  | 25.60 | 29.29         | 0.34         |   | n/a  | United Arab Emirates     | n/a   | n/a           | n/a          |   |
| 62   | Cameroon (2009)                   | 25.50 | 29.16         | 0.33         |   | n/a  | United Kingdom           | n/a   | n/a           | n/a          |   |
| 63   | Namibia (2014)                    | 25.40 | 29.02         | 0.32         |   | n/a  | United States of America | n/a   | n/a           | n/a          |   |
| 64   | Latvia                            | 25.20 | 28.76         | 0.31         | ○ |      |                          |       |               |              |   |

SOURCE: World Bank, Enterprise Surveys

NOTE: ● indicates a strength; ○ a weakness

## 5.1.3 GERD performed by business enterprise

GERD: Performed by business enterprise (% of GDP) | 2015

| Rank | Country/Economy          | Value | Score (0–100) | Percent rank |   | Rank | Country/Economy            | Value | Score (0–100) | Percent rank |   |
|------|--------------------------|-------|---------------|--------------|---|------|----------------------------|-------|---------------|--------------|---|
| 1    | Israel                   | 3.67  | 100.00        | 1.00         | ● | 65   | Cyprus                     | 0.08  | 2.08          | 0.28         | ○ |
| 2    | Korea, Rep.              | 3.28  | 89.37         | 0.99         | ● | 66   | Bosnia and Herzegovina     | 0.07  | 1.99          | 0.27         |   |
| 3    | Japan                    | 2.74  | 74.69         | 0.98         | ● | 67   | Iran, Islamic Rep. (2008)  | 0.07  | 1.94          | 0.26         |   |
| 4    | Sweden                   | 2.28  | 62.16         | 0.97         |   | 68   | Kenya (2010)               | 0.07  | 1.85          | 0.25         |   |
| 5    | Austria                  | 2.19  | 59.74         | 0.96         | ● | 69   | Philippines (2013)         | 0.05  | 1.34          | 0.24         |   |
| 6    | Switzerland (2012)       | 2.05  | 55.97         | 0.94         |   | 70   | Kazakhstan (2013)          | 0.05  | 1.33          | 0.22         |   |
| 7    | United States of America | 2.00  | 54.59         | 0.93         |   | 71   | Sri Lanka (2013)           | 0.05  | 1.23          | 0.21         |   |
| 8    | Finland                  | 1.95  | 53.20         | 0.92         |   | 72   | Egypt                      | 0.04  | 1.22          | 0.20         |   |
| 9    | Germany                  | 1.95  | 53.17         | 0.91         |   | 73   | Oman                       | 0.04  | 1.17          | 0.19         |   |
| 10   | Denmark                  | 1.93  | 52.62         | 0.90         |   | 74   | Namibia (2014)             | 0.04  | 1.05          | 0.18         |   |
| 11   | Belgium                  | 1.77  | 48.22         | 0.89         |   | 75   | TFYR of Macedonia (2011)   | 0.03  | 0.94          | 0.17         | ○ |
| 12   | Slovenia                 | 1.69  | 45.98         | 0.88         |   | 76   | Indonesia (2013)           | 0.02  | 0.59          | 0.16         |   |
| 13   | China                    | 1.61  | 43.80         | 0.87         |   | 77   | Azerbaijan (2014)          | 0.02  | 0.57          | 0.15         |   |
| 14   | France                   | 1.45  | 39.50         | 0.85         |   | 78   | Bahrain (2014)             | 0.02  | 0.55          | 0.13         |   |
| 15   | Iceland                  | 1.43  | 39.02         | 0.84         |   | 79   | Kyrgyzstan                 | 0.02  | 0.46          | 0.12         |   |
| 16   | Singapore (2014)         | 1.34  | 36.60         | 0.83         |   | 80   | Uruguay (2014)             | 0.02  | 0.42          | 0.11         | ○ |
| 17   | Australia (2013)         | 1.24  | 33.68         | 0.82         |   | 81   | Mongolia                   | 0.01  | 0.31          | 0.10         | ○ |
| 18   | United Kingdom           | 1.12  | 30.58         | 0.81         |   | 82   | Ethiopia (2013)            | 0.01  | 0.19          | 0.09         |   |
| 19   | Netherlands              | 1.12  | 30.40         | 0.80         |   | 83   | Mali (2007)                | 0.01  | 0.17          | 0.08         |   |
| 20   | Ireland (2014)           | 1.11  | 30.36         | 0.79         |   | 84   | Zambia (2008)              | 0.01  | 0.15          | 0.07         |   |
| 21   | Czech Republic           | 1.08  | 29.32         | 0.78         |   | 85   | Senegal (2010)             | 0.00  | 0.05          | 0.06         | ○ |
| 22   | Norway                   | 1.04  | 28.46         | 0.76         |   | 86   | Mozambique                 | 0.00  | 0.04          | 0.04         |   |
| 23   | Hungary                  | 1.02  | 27.79         | 0.75         |   | 87   | Trinidad and Tobago (2009) | 0.00  | 0.03          | 0.03         | ○ |
| 24   | Canada (2014)            | 0.80  | 21.92         | 0.74         |   | 88   | Panama (2013)              | 0.00  | 0.03          | 0.02         | ○ |
| 25   | Italy                    | 0.74  | 20.15         | 0.73         |   | 89   | Paraguay (2011)            | 0.00  | 0.01          | 0.01         | ○ |
| 26   | Bulgaria                 | 0.72  | 19.57         | 0.72         |   | 90   | Guatemala (2012)           | 0.00  | 0.00          | 0.00         | ○ |
| 27   | Estonia                  | 0.68  | 18.56         | 0.71         |   | n/a  | Albania                    | n/a   | n/a           | n/a          |   |
| 28   | Russian Federation       | 0.67  | 18.25         | 0.70         |   | n/a  | Algeria                    | n/a   | n/a           | n/a          |   |
| 29   | Luxembourg               | 0.66  | 17.90         | 0.69         |   | n/a  | Armenia                    | n/a   | n/a           | n/a          |   |
| 30   | Spain                    | 0.64  | 17.43         | 0.67         |   | n/a  | Bangladesh                 | n/a   | n/a           | n/a          |   |
| 31   | Portugal                 | 0.60  | 16.38         | 0.66         |   | n/a  | Benin                      | n/a   | n/a           | n/a          |   |
| 32   | Malaysia (2014)          | 0.58  | 15.70         | 0.65         |   | n/a  | Bolivia, Plurinational St. | n/a   | n/a           | n/a          |   |
| 33   | New Zealand (2013)       | 0.54  | 14.59         | 0.64         |   | n/a  | Brazil                     | n/a   | n/a           | n/a          |   |
| 34   | Turkey (2014)            | 0.50  | 13.65         | 0.63         |   | n/a  | Brunei Darussalam          | n/a   | n/a           | n/a          |   |
| 35   | Poland                   | 0.47  | 12.80         | 0.62         |   | n/a  | Burkina Faso               | n/a   | n/a           | n/a          |   |
| 36   | Thailand                 | 0.44  | 11.96         | 0.61         |   | n/a  | Burundi                    | n/a   | n/a           | n/a          |   |
| 37   | Croatia                  | 0.44  | 11.91         | 0.60         |   | n/a  | Cambodia                   | n/a   | n/a           | n/a          |   |
| 38   | Malta (2014)             | 0.42  | 11.48         | 0.58         |   | n/a  | Cameroon                   | n/a   | n/a           | n/a          |   |
| 39   | United Arab Emirates     | 0.41  | 11.16         | 0.57         |   | n/a  | Côte d'Ivoire              | n/a   | n/a           | n/a          |   |
| 40   | Ukraine                  | 0.38  | 10.42         | 0.56         |   | n/a  | Dominican Republic         | n/a   | n/a           | n/a          |   |
| 41   | Belarus                  | 0.34  | 9.24          | 0.55         |   | n/a  | El Salvador                | n/a   | n/a           | n/a          |   |
| 42   | South Africa (2013)      | 0.33  | 9.08          | 0.54         |   | n/a  | Georgia                    | n/a   | n/a           | n/a          |   |
| 43   | Slovakia                 | 0.33  | 9.04          | 0.53         |   | n/a  | Guinea                     | n/a   | n/a           | n/a          |   |
| 44   | Hong Kong (China) (2014) | 0.33  | 8.97          | 0.52         |   | n/a  | Honduras                   | n/a   | n/a           | n/a          |   |
| 45   | Greece                   | 0.32  | 8.69          | 0.51         |   | n/a  | Jamaica                    | n/a   | n/a           | n/a          |   |
| 46   | India (2011)             | 0.29  | 8.03          | 0.49         |   | n/a  | Jordan                     | n/a   | n/a           | n/a          |   |
| 47   | Lithuania                | 0.28  | 7.62          | 0.48         |   | n/a  | Kuwait                     | n/a   | n/a           | n/a          |   |
| 48   | Serbia                   | 0.28  | 7.61          | 0.47         |   | n/a  | Lebanon                    | n/a   | n/a           | n/a          |   |
| 49   | Romania                  | 0.21  | 5.84          | 0.46         |   | n/a  | Madagascar                 | n/a   | n/a           | n/a          |   |
| 50   | Morocco (2010)           | 0.21  | 5.83          | 0.45         |   | n/a  | Malawi                     | n/a   | n/a           | n/a          |   |
| 51   | Costa Rica (2014)        | 0.21  | 5.80          | 0.44         |   | n/a  | Mauritius                  | n/a   | n/a           | n/a          |   |
| 52   | Viet Nam (2013)          | 0.19  | 5.26          | 0.43         |   | n/a  | Nepal                      | n/a   | n/a           | n/a          |   |
| 53   | Ecuador (2014)           | 0.19  | 5.14          | 0.42         |   | n/a  | Niger                      | n/a   | n/a           | n/a          |   |
| 54   | Mexico                   | 0.17  | 4.64          | 0.40         |   | n/a  | Nigeria                    | n/a   | n/a           | n/a          |   |
| 55   | Uganda (2010)            | 0.17  | 4.50          | 0.39         |   | n/a  | Pakistan                   | n/a   | n/a           | n/a          |   |
| 56   | Latvia                   | 0.15  | 4.21          | 0.38         |   | n/a  | Peru                       | n/a   | n/a           | n/a          |   |
| 57   | Montenegro (2014)        | 0.14  | 3.81          | 0.37         |   | n/a  | Rwanda                     | n/a   | n/a           | n/a          |   |
| 58   | Chile                    | 0.13  | 3.61          | 0.36         |   | n/a  | Saudi Arabia               | n/a   | n/a           | n/a          |   |
| 59   | Argentina (2014)         | 0.12  | 3.35          | 0.35         |   | n/a  | Tajikistan                 | n/a   | n/a           | n/a          |   |
| 60   | Qatar (2012)             | 0.12  | 3.31          | 0.34         |   | n/a  | Tanzania, United Rep.      | n/a   | n/a           | n/a          |   |
| 61   | Tunisia (2014)           | 0.12  | 3.30          | 0.33         |   | n/a  | Togo                       | n/a   | n/a           | n/a          |   |
| 62   | Botswana (2013)          | 0.10  | 2.60          | 0.31         |   | n/a  | Yemen                      | n/a   | n/a           | n/a          |   |
| 63   | Colombia                 | 0.08  | 2.13          | 0.30         |   | n/a  | Zimbabwe                   | n/a   | n/a           | n/a          |   |
| 64   | Moldova, Rep.            | 0.08  | 2.09          | 0.29         |   |      |                            |       |               |              |   |

SOURCE: UNESCO Institute for Statistics, *UIS online database*

NOTE: ● indicates a strength; ○ a weakness

# 5.1.4

## GERD financed by business enterprise

GERD: Financed by business enterprise (% of total GERD) | 2015

| Rank | Country/Economy             | Value | Score (0–100) | Percent rank |   | Rank | Country/Economy                   | Value | Score (0–100) | Percent rank |   |
|------|-----------------------------|-------|---------------|--------------|---|------|-----------------------------------|-------|---------------|--------------|---|
| 1    | Japan                       | 77.97 | 100.00        | 1.00         | ● | 65   | Botswana (2013)                   | 17.68 | 22.60         | 0.31         |   |
| 2    | China                       | 74.73 | 95.83         | 0.99         | ● | 66   | Luxembourg (2013)                 | 16.51 | 21.09         | 0.30         |   |
| 3    | Korea, Rep.                 | 74.55 | 95.60         | 0.98         | ● | 67   | Cyprus (2014)                     | 13.72 | 17.51         | 0.29         | ○ |
| 4    | United Arab Emirates (2014) | 74.29 | 95.27         | 0.97         | ● | 68   | Uganda (2010)                     | 13.67 | 17.45         | 0.28         |   |
| 5    | Slovenia                    | 69.21 | 88.75         | 0.96         | ● | 69   | Serbia                            | 12.78 | 16.31         | 0.27         |   |
| 6    | Thailand                    | 66.24 | 84.94         | 0.95         | ● | 70   | Burkina Faso (2009)               | 11.93 | 15.22         | 0.26         |   |
| 7    | Germany (2014)              | 65.84 | 84.43         | 0.94         |   | 71   | Namibia (2014)                    | 11.10 | 14.15         | 0.25         |   |
| 8    | United States of America    | 64.15 | 82.26         | 0.92         |   | 72   | Panama (2013)                     | 10.85 | 13.83         | 0.24         |   |
| 9    | Australia (2008)            | 61.91 | 79.38         | 0.91         |   | 73   | Mali (2007)                       | 10.10 | 12.87         | 0.23         |   |
| 10   | Belgium (2013)              | 61.32 | 78.62         | 0.90         |   | 74   | Mongolia                          | 7.35  | 9.33          | 0.22         |   |
| 11   | Sweden (2013)               | 60.96 | 78.15         | 0.89         |   | 75   | Malaysia (2014)                   | 6.91  | 8.77          | 0.20         | ○ |
| 12   | Switzerland (2012)          | 60.78 | 77.93         | 0.88         |   | 76   | Egypt                             | 6.20  | 7.86          | 0.19         |   |
| 13   | Denmark                     | 59.37 | 76.12         | 0.87         |   | 77   | Bolivia, Plurinational St. (2009) | 5.20  | 6.58          | 0.18         |   |
| 14   | France (2014)               | 55.65 | 71.35         | 0.86         |   | 78   | Uruguay (2014)                    | 4.57  | 5.76          | 0.17         | ○ |
| 15   | Finland                     | 54.76 | 70.21         | 0.85         |   | 79   | Kenya (2010)                      | 4.34  | 5.47          | 0.16         |   |
| 16   | Singapore (2014)            | 54.10 | 69.36         | 0.84         |   | 80   | Senegal (2010)                    | 4.10  | 5.16          | 0.15         |   |
| 17   | Ireland (2014)              | 52.78 | 67.66         | 0.83         |   | 81   | Albania (2008)                    | 3.26  | 4.08          | 0.14         |   |
| 18   | Austria (2016)              | 52.50 | 67.30         | 0.82         |   | 82   | Zambia (2008)                     | 3.23  | 4.04          | 0.13         |   |
| 19   | Turkey (2014)               | 50.87 | 65.20         | 0.81         | ● | 83   | Kyrgyzstan                        | 2.24  | 2.78          | 0.12         |   |
| 20   | Hungary                     | 49.72 | 63.73         | 0.80         |   | 84   | Tajikistan (2011)                 | 1.65  | 2.02          | 0.11         |   |
| 21   | Netherlands                 | 48.70 | 62.42         | 0.78         |   | 85   | Costa Rica (2014)                 | 1.49  | 1.81          | 0.10         | ○ |
| 22   | United Kingdom              | 48.39 | 62.02         | 0.77         |   | 86   | Kuwait (2013)                     | 1.41  | 1.71          | 0.09         | ○ |
| 23   | Croatia                     | 46.64 | 59.78         | 0.76         |   | 87   | Ethiopia (2013)                   | 0.75  | 0.86          | 0.08         |   |
| 24   | Spain (2014)                | 46.41 | 59.48         | 0.75         |   | 88   | El Salvador (2014)                | 0.66  | 0.74          | 0.06         | ○ |
| 25   | Hong Kong (China) (2014)    | 46.39 | 59.46         | 0.74         |   | 89   | Mozambique                        | 0.47  | 0.50          | 0.05         |   |
| 26   | Italy (2014)                | 46.23 | 59.25         | 0.73         |   | 90   | Paraguay                          | 0.28  | 0.26          | 0.04         | ○ |
| 27   | Canada (2014)               | 45.39 | 58.16         | 0.72         |   | 91   | Mauritius (2012)                  | 0.27  | 0.25          | 0.03         | ○ |
| 28   | Malta                       | 44.13 | 56.55         | 0.71         |   | 92   | Nigeria (2007)                    | 0.16  | 0.10          | 0.02         | ○ |
| 29   | Norway (2013)               | 43.14 | 55.29         | 0.70         |   | 93   | Ecuador (2014)                    | 0.12  | 0.05          | 0.01         | ○ |
| 30   | Portugal (2014)             | 41.80 | 53.56         | 0.69         |   | 94   | Tanzania, United Rep. (2010)      | 0.08  | 0.00          | 0.00         | ○ |
| 31   | South Africa (2013)         | 41.37 | 53.01         | 0.68         |   | n/a  | Algeria                           | n/a   | n/a           | n/a          |   |
| 32   | Belarus                     | 41.31 | 52.93         | 0.67         |   | n/a  | Armenia                           | n/a   | n/a           | n/a          |   |
| 33   | Estonia                     | 41.00 | 52.54         | 0.66         |   | n/a  | Bangladesh                        | n/a   | n/a           | n/a          |   |
| 34   | Sri Lanka (2013)            | 40.68 | 52.13         | 0.65         | ● | n/a  | Benin                             | n/a   | n/a           | n/a          |   |
| 35   | Ukraine                     | 40.28 | 51.60         | 0.63         |   | n/a  | Brunei Darussalam                 | n/a   | n/a           | n/a          |   |
| 36   | Viet Nam (2013)             | 39.97 | 51.22         | 0.62         |   | n/a  | Burundi                           | n/a   | n/a           | n/a          |   |
| 37   | New Zealand (2013)          | 39.78 | 50.96         | 0.61         |   | n/a  | Cambodia                          | n/a   | n/a           | n/a          |   |
| 38   | Poland                      | 39.00 | 49.97         | 0.60         |   | n/a  | Cameroon                          | n/a   | n/a           | n/a          |   |
| 39   | Romania                     | 37.29 | 47.77         | 0.59         |   | n/a  | Côte d'Ivoire                     | n/a   | n/a           | n/a          |   |
| 40   | Israel (2013)               | 37.05 | 47.46         | 0.58         |   | n/a  | Dominican Republic                | n/a   | n/a           | n/a          |   |
| 41   | Philippines (2013)          | 36.86 | 47.22         | 0.57         |   | n/a  | Georgia                           | n/a   | n/a           | n/a          |   |
| 42   | Brazil (2014)               | 36.36 | 46.57         | 0.56         |   | n/a  | Guatemala                         | n/a   | n/a           | n/a          |   |
| 43   | Czech Republic              | 34.53 | 44.22         | 0.55         |   | n/a  | Guinea                            | n/a   | n/a           | n/a          |   |
| 44   | Colombia                    | 33.60 | 43.03         | 0.54         |   | n/a  | Honduras                          | n/a   | n/a           | n/a          |   |
| 45   | Iceland                     | 33.25 | 42.59         | 0.53         |   | n/a  | India                             | n/a   | n/a           | n/a          |   |
| 46   | Chile                       | 32.78 | 41.98         | 0.52         |   | n/a  | Indonesia                         | n/a   | n/a           | n/a          |   |
| 47   | Greece                      | 31.76 | 40.67         | 0.51         |   | n/a  | Jamaica                           | n/a   | n/a           | n/a          |   |
| 48   | Bosnia and Herzegovina      | 31.39 | 40.20         | 0.49         |   | n/a  | Jordan                            | n/a   | n/a           | n/a          |   |
| 49   | Iran, Islamic Rep. (2008)   | 30.92 | 39.59         | 0.48         |   | n/a  | Lebanon                           | n/a   | n/a           | n/a          |   |
| 50   | Azerbaijan (2014)           | 30.53 | 39.10         | 0.47         |   | n/a  | Madagascar                        | n/a   | n/a           | n/a          |   |
| 51   | Morocco (2010)              | 29.94 | 38.33         | 0.46         |   | n/a  | Malawi                            | n/a   | n/a           | n/a          |   |
| 52   | Kazakhstan (2013)           | 28.92 | 37.03         | 0.45         |   | n/a  | Moldova, Rep.                     | n/a   | n/a           | n/a          |   |
| 53   | Montenegro (2014)           | 28.53 | 36.52         | 0.44         |   | n/a  | Nepal                             | n/a   | n/a           | n/a          |   |
| 54   | Lithuania                   | 28.01 | 35.86         | 0.43         |   | n/a  | Niger                             | n/a   | n/a           | n/a          |   |
| 55   | Argentina (2008)            | 26.52 | 33.95         | 0.42         |   | n/a  | Pakistan                          | n/a   | n/a           | n/a          |   |
| 56   | Russian Federation          | 26.47 | 33.89         | 0.41         |   | n/a  | Peru                              | n/a   | n/a           | n/a          |   |
| 57   | Slovakia                    | 25.06 | 32.07         | 0.40         |   | n/a  | Rwanda                            | n/a   | n/a           | n/a          |   |
| 58   | Qatar (2012)                | 24.18 | 30.95         | 0.39         |   | n/a  | Saudi Arabia                      | n/a   | n/a           | n/a          |   |
| 59   | Bulgaria (2014)             | 22.25 | 28.47         | 0.38         | ○ | n/a  | TFYR of Macedonia                 | n/a   | n/a           | n/a          |   |
| 60   | Bahrain (2014)              | 21.77 | 27.85         | 0.37         |   | n/a  | Togo                              | n/a   | n/a           | n/a          |   |
| 61   | Oman                        | 21.37 | 27.33         | 0.35         |   | n/a  | Trinidad and Tobago               | n/a   | n/a           | n/a          |   |
| 62   | Mexico                      | 20.59 | 26.33         | 0.34         |   | n/a  | Yemen                             | n/a   | n/a           | n/a          |   |
| 63   | Latvia                      | 20.09 | 25.69         | 0.33         | ○ | n/a  | Zimbabwe                          | n/a   | n/a           | n/a          |   |
| 64   | Tunisia (2014)              | 18.50 | 23.65         | 0.32         |   |      |                                   |       |               |              |   |

SOURCE: UNESCO Institute for Statistics, *UIS online database*

NOTE: ● indicates a strength; ○ a weakness

## 5.1.5

## Females employed with advanced degrees

Females employed with advanced degrees, % total employed (25+ years old) | 2015

II: Data Tables

| Rank | Country/Economy      | Value | Score (0–100) | Percent rank |   | Rank | Country/Economy              | Value | Score (0–100) | Percent rank |   |
|------|----------------------|-------|---------------|--------------|---|------|------------------------------|-------|---------------|--------------|---|
| 1    | Belarus (2009)       | 33.85 | 100.00        | 1.00         | ● | 65   | Albania                      | 9.25  | 27.20         | 0.26         |   |
| 2    | Russian Federation   | 33.24 | 98.19         | 0.99         | ● | 66   | Brazil (2014)                | 9.14  | 26.88         | 0.25         |   |
| 3    | Ukraine              | 29.71 | 87.75         | 0.98         | ● | 67   | Botswana (2010)              | 9.09  | 26.74         | 0.24         |   |
| 4    | Israel (2013)        | 28.39 | 83.85         | 0.97         | ● | 68   | Sri Lanka (2014)             | 8.76  | 25.75         | 0.23         |   |
| 5    | Lithuania            | 27.15 | 80.18         | 0.95         | ● | 69   | Mexico (2013)                | 8.16  | 23.98         | 0.22         | ○ |
| 6    | Finland              | 26.56 | 78.41         | 0.94         |   | 70   | Turkey                       | 7.97  | 23.42         | 0.21         | ○ |
| 7    | Estonia              | 25.84 | 76.30         | 0.93         |   | 71   | Thailand (2013)              | 7.55  | 22.17         | 0.20         |   |
| 8    | Ireland              | 24.90 | 73.52         | 0.92         |   | 72   | Viet Nam                     | 7.36  | 21.61         | 0.18         |   |
| 9    | Norway               | 24.69 | 72.88         | 0.91         |   | 73   | Mauritius (2010)             | 7.35  | 21.59         | 0.17         | ○ |
| 10   | Sweden               | 24.11 | 71.16         | 0.90         |   | 74   | Ethiopia (2012)              | 6.02  | 17.65         | 0.16         |   |
| 11   | Cyprus               | 24.02 | 70.92         | 0.89         |   | 75   | Saudi Arabia (2014)          | 5.76  | 16.88         | 0.15         | ○ |
| 12   | Latvia               | 23.58 | 69.60         | 0.87         |   | 76   | Egypt (2013)                 | 5.51  | 16.16         | 0.14         |   |
| 13   | Singapore (2014)     | 23.34 | 68.89         | 0.86         |   | 77   | Indonesia                    | 4.80  | 14.05         | 0.13         |   |
| 14   | Belgium              | 23.33 | 68.85         | 0.85         |   | 78   | Algeria (2014)               | 4.56  | 13.32         | 0.11         |   |
| 15   | Iceland              | 22.73 | 67.08         | 0.84         |   | 79   | Qatar (2013)                 | 4.50  | 13.16         | 0.10         | ○ |
| 16   | Australia (2013)     | 22.64 | 66.82         | 0.83         |   | 80   | Guatemala (2013)             | 3.51  | 10.24         | 0.09         |   |
| 17   | United Kingdom       | 22.16 | 65.39         | 0.82         |   | 81   | Bosnia and Herzegovina       | 3.20  | 9.30          | 0.08         | ○ |
| 18   | Denmark              | 21.77 | 64.24         | 0.80         |   | 82   | Uganda (2013)                | 2.71  | 7.86          | 0.07         |   |
| 19   | Spain                | 21.74 | 64.17         | 0.79         |   | 83   | Madagascar (2012)            | 2.32  | 6.69          | 0.06         |   |
| 20   | France               | 21.05 | 62.12         | 0.78         |   | 84   | Yemen (2010)                 | 1.60  | 4.58          | 0.05         |   |
| 21   | Luxembourg           | 20.59 | 60.75         | 0.77         |   | 85   | Tanzania, United Rep. (2014) | 1.35  | 3.82          | 0.03         |   |
| 22   | Japan                | 20.34 | 60.02         | 0.76         |   | 86   | Senegal (2011)               | 0.73  | 2.01          | 0.02         | ○ |
| 23   | Slovenia             | 20.07 | 59.22         | 0.75         |   | 87   | Mozambique (2012)            | 0.51  | 1.36          | 0.01         | ○ |
| 24   | Bulgaria             | 19.73 | 58.21         | 0.74         |   | 88   | El Salvador (2013)           | 0.05  | 0.00          | 0.00         | ○ |
| 25   | New Zealand (2013)   | 19.55 | 57.67         | 0.72         |   | n/a  | Bahrain                      | n/a   | n/a           | n/a          |   |
| 26   | Poland               | 19.53 | 57.63         | 0.71         |   | n/a  | Bangladesh                   | n/a   | n/a           | n/a          |   |
| 27   | Netherlands          | 18.74 | 55.30         | 0.70         |   | n/a  | Benin                        | n/a   | n/a           | n/a          |   |
| 28   | Switzerland          | 17.84 | 52.62         | 0.69         |   | n/a  | Bolivia, Plurinational St.   | n/a   | n/a           | n/a          |   |
| 29   | Kazakhstan (2013)    | 17.55 | 51.76         | 0.68         |   | n/a  | Brunei Darussalam            | n/a   | n/a           | n/a          |   |
| 30   | Canada (2016)        | 17.02 | 50.19         | 0.67         |   | n/a  | Burkina Faso                 | n/a   | n/a           | n/a          |   |
| 31   | Greece               | 16.85 | 49.70         | 0.66         |   | n/a  | Burundi                      | n/a   | n/a           | n/a          |   |
| 32   | Mongolia (2014)      | 16.67 | 49.15         | 0.64         |   | n/a  | Cambodia                     | n/a   | n/a           | n/a          |   |
| 33   | Panama (2012)        | 16.58 | 48.90         | 0.63         |   | n/a  | Cameroon                     | n/a   | n/a           | n/a          |   |
| 34   | Argentina (2014)     | 16.44 | 48.49         | 0.62         |   | n/a  | China                        | n/a   | n/a           | n/a          |   |
| 35   | Korea, Rep.          | 16.24 | 47.88         | 0.61         |   | n/a  | Côte d'Ivoire                | n/a   | n/a           | n/a          |   |
| 36   | Austria              | 16.01 | 47.20         | 0.60         |   | n/a  | Guinea                       | n/a   | n/a           | n/a          |   |
| 37   | Croatia              | 15.97 | 47.07         | 0.59         |   | n/a  | Honduras                     | n/a   | n/a           | n/a          |   |
| 38   | Chile                | 15.89 | 46.84         | 0.57         |   | n/a  | India                        | n/a   | n/a           | n/a          |   |
| 39   | Georgia              | 15.45 | 45.55         | 0.56         |   | n/a  | Iran, Islamic Rep.           | n/a   | n/a           | n/a          |   |
| 40   | Portugal             | 15.31 | 45.15         | 0.55         |   | n/a  | Jamaica                      | n/a   | n/a           | n/a          |   |
| 41   | Hungary              | 15.17 | 44.72         | 0.54         |   | n/a  | Jordan                       | n/a   | n/a           | n/a          |   |
| 42   | Armenia              | 14.52 | 42.81         | 0.53         |   | n/a  | Kenya                        | n/a   | n/a           | n/a          |   |
| 43   | Moldova, Rep. (2013) | 13.95 | 41.12         | 0.52         |   | n/a  | Kuwait                       | n/a   | n/a           | n/a          |   |
| 44   | Uruguay (2014)       | 13.70 | 40.36         | 0.51         |   | n/a  | Lebanon                      | n/a   | n/a           | n/a          |   |
| 45   | Peru                 | 13.50 | 39.78         | 0.49         |   | n/a  | Malawi                       | n/a   | n/a           | n/a          |   |
| 46   | Hong Kong (China)    | 13.38 | 39.42         | 0.48         |   | n/a  | Mali                         | n/a   | n/a           | n/a          |   |
| 47   | Philippines          | 12.98 | 38.24         | 0.47         |   | n/a  | Montenegro                   | n/a   | n/a           | n/a          |   |
| 48   | Costa Rica           | 12.97 | 38.21         | 0.46         |   | n/a  | Morocco                      | n/a   | n/a           | n/a          |   |
| 49   | TFYR of Macedonia    | 12.94 | 38.12         | 0.45         |   | n/a  | Namibia                      | n/a   | n/a           | n/a          |   |
| 50   | Azerbaijan (2013)    | 12.87 | 37.93         | 0.44         |   | n/a  | Nepal                        | n/a   | n/a           | n/a          |   |
| 51   | Germany              | 12.75 | 37.55         | 0.43         | ○ | n/a  | Niger                        | n/a   | n/a           | n/a          |   |
| 52   | Dominican Republic   | 12.73 | 37.51         | 0.41         |   | n/a  | Nigeria                      | n/a   | n/a           | n/a          |   |
| 53   | Slovakia             | 12.51 | 36.86         | 0.40         |   | n/a  | Oman                         | n/a   | n/a           | n/a          |   |
| 54   | Paraguay (2013)      | 12.44 | 36.66         | 0.39         |   | n/a  | Pakistan                     | n/a   | n/a           | n/a          |   |
| 55   | Malta                | 12.35 | 36.37         | 0.38         | ○ | n/a  | Rwanda                       | n/a   | n/a           | n/a          |   |
| 56   | Serbia (2013)        | 12.23 | 36.03         | 0.37         |   | n/a  | Tajikistan                   | n/a   | n/a           | n/a          |   |
| 57   | Malaysia             | 12.20 | 35.95         | 0.36         |   | n/a  | Togo                         | n/a   | n/a           | n/a          |   |
| 58   | Colombia (2014)      | 12.09 | 35.62         | 0.34         |   | n/a  | Trinidad and Tobago          | n/a   | n/a           | n/a          |   |
| 59   | Czech Republic       | 11.56 | 34.05         | 0.33         | ○ | n/a  | Tunisia                      | n/a   | n/a           | n/a          |   |
| 60   | Italy                | 11.46 | 33.74         | 0.32         | ○ | n/a  | United Arab Emirates         | n/a   | n/a           | n/a          |   |
| 61   | Kyrgyzstan (2013)    | 10.83 | 31.87         | 0.31         |   | n/a  | United States of America     | n/a   | n/a           | n/a          |   |
| 62   | Ecuador              | 10.63 | 31.29         | 0.30         |   | n/a  | Zambia                       | n/a   | n/a           | n/a          |   |
| 63   | Romania              | 10.59 | 31.17         | 0.29         |   | n/a  | Zimbabwe                     | n/a   | n/a           | n/a          |   |
| 64   | South Africa (2014)  | 10.16 | 29.90         | 0.28         |   |      |                              |       |               |              |   |

SOURCE: International Labour Organization, ILOSTAT Annual Indicators; and Statistics Canada, Table 282-0004; Labour Force Survey estimates (LFS) by educational attainment, sex and age group, annual, CANSIM, accessed 9 February 2017

NOTE: ● indicates a strength; ○ a weakness



# 5.2.1

## University/industry research collaboration

Average answer to the survey question: In your country, to what extent do businesses and universities collaborate on research and development (R&D)? [1 = do not collaborate at all; 7 = collaborate extensively] | 2016

| Rank | Country/Economy          | Value | Score (0–100) | Percent rank |   | Rank | Country/Economy            | Value | Score (0–100) | Percent rank |   |
|------|--------------------------|-------|---------------|--------------|---|------|----------------------------|-------|---------------|--------------|---|
| 1    | Switzerland              | 5.80  | 80.00         | 1.00         | ● | 65   | Pakistan                   | 3.44  | 40.70         | 0.48         |   |
| 2    | Finland                  | 5.72  | 78.62         | 0.99         | ● | 66   | Uruguay                    | 3.44  | 40.70         | 0.47         |   |
| 3    | Israel                   | 5.60  | 76.67         | 0.98         | ● | 67   | TFYR of Macedonia          | 3.44  | 40.65         | 0.46         |   |
| 4    | United States of America | 5.57  | 76.22         | 0.98         |   | 68   | Argentina                  | 3.43  | 40.43         | 0.45         |   |
| 5    | Netherlands              | 5.50  | 75.00         | 0.97         | ● | 69   | Botswana                   | 3.41  | 40.25         | 0.44         |   |
| 6    | United Kingdom           | 5.47  | 74.51         | 0.96         |   | 70   | Madagascar                 | 3.40  | 40.00         | 0.43         |   |
| 7    | Singapore                | 5.47  | 74.47         | 0.95         |   | 71   | Bulgaria                   | 3.38  | 39.71         | 0.43         |   |
| 8    | Germany                  | 5.35  | 72.52         | 0.94         |   | 72   | Panama                     | 3.38  | 39.66         | 0.42         |   |
| 9    | Belgium                  | 5.26  | 71.00         | 0.93         | ● | 73   | Cyprus                     | 3.35  | 39.23         | 0.41         |   |
| 10   | Qatar                    | 5.23  | 70.53         | 0.93         | ● | 74   | Latvia                     | 3.35  | 39.17         | 0.40         |   |
| 11   | Malaysia                 | 5.20  | 70.00         | 0.92         | ● | 75   | Rwanda                     | 3.34  | 38.94         | 0.39         |   |
| 12   | Sweden                   | 5.16  | 69.33         | 0.91         |   | 76   | Viet Nam                   | 3.33  | 38.89         | 0.39         |   |
| 13   | Ireland                  | 5.11  | 68.52         | 0.90         |   | 77   | Romania                    | 3.33  | 38.83         | 0.38         |   |
| 14   | Denmark                  | 4.84  | 63.99         | 0.89         |   | 78   | Slovakia                   | 3.31  | 38.56         | 0.37         |   |
| 15   | Austria                  | 4.81  | 63.58         | 0.89         |   | 79   | Brunei Darussalam          | 3.30  | 38.41         | 0.36         |   |
| 16   | Iceland                  | 4.78  | 63.05         | 0.88         |   | 80   | Poland                     | 3.29  | 38.22         | 0.35         | ○ |
| 17   | Japan                    | 4.75  | 62.54         | 0.87         |   | 81   | Côte d'Ivoire              | 3.29  | 38.19         | 0.34         |   |
| 18   | New Zealand              | 4.75  | 62.50         | 0.86         |   | 82   | Mozambique                 | 3.27  | 37.78         | 0.34         |   |
| 19   | Norway                   | 4.74  | 62.37         | 0.85         |   | 83   | Namibia                    | 3.26  | 37.67         | 0.33         |   |
| 20   | Luxembourg               | 4.65  | 60.83         | 0.84         |   | 84   | Brazil                     | 3.25  | 37.43         | 0.32         |   |
| 21   | Hong Kong (China) (2015) | 4.59  | 59.78         | 0.84         |   | 85   | Cameroon                   | 3.23  | 37.23         | 0.31         |   |
| 22   | Canada                   | 4.58  | 59.63         | 0.83         |   | 86   | Armenia                    | 3.21  | 36.89         | 0.30         |   |
| 23   | India                    | 4.54  | 58.93         | 0.82         |   | 87   | Mauritius                  | 3.19  | 36.48         | 0.30         |   |
| 24   | United Arab Emirates     | 4.51  | 58.47         | 0.81         |   | 88   | Montenegro                 | 3.18  | 36.40         | 0.29         |   |
| 25   | Kenya                    | 4.46  | 57.63         | 0.80         | ● | 89   | Serbia                     | 3.15  | 35.86         | 0.28         |   |
| 26   | South Africa             | 4.44  | 57.36         | 0.80         | ● | 90   | Mali                       | 3.15  | 35.82         | 0.27         |   |
| 27   | Indonesia                | 4.42  | 57.03         | 0.79         | ● | 91   | Benin                      | 3.14  | 35.61         | 0.26         |   |
| 28   | Korea, Rep.              | 4.36  | 56.00         | 0.78         |   | 92   | Honduras                   | 3.12  | 35.37         | 0.25         |   |
| 29   | China                    | 4.32  | 55.27         | 0.77         |   | 93   | Morocco                    | 3.12  | 35.35         | 0.25         |   |
| 30   | Tajikistan               | 4.31  | 55.19         | 0.76         | ● | 94   | Ecuador                    | 3.11  | 35.14         | 0.24         |   |
| 31   | France                   | 4.29  | 54.79         | 0.75         |   | 95   | Cambodia                   | 3.08  | 34.70         | 0.23         |   |
| 32   | Australia                | 4.27  | 54.49         | 0.75         |   | 96   | Albania                    | 3.03  | 33.86         | 0.22         |   |
| 33   | Lithuania                | 4.12  | 51.93         | 0.74         |   | 97   | Iran, Islamic Rep.         | 3.02  | 33.63         | 0.21         |   |
| 34   | Estonia                  | 4.08  | 51.37         | 0.73         |   | 98   | Tunisia                    | 2.97  | 32.79         | 0.20         |   |
| 35   | Portugal                 | 4.03  | 50.46         | 0.72         |   | 99   | Hungary                    | 2.92  | 32.03         | 0.20         | ○ |
| 36   | Malta                    | 4.00  | 50.00         | 0.71         |   | 100  | Peru                       | 2.91  | 31.78         | 0.19         | ○ |
| 37   | Jordan                   | 3.84  | 47.31         | 0.70         | ● | 101  | Dominican Republic         | 2.91  | 31.78         | 0.18         |   |
| 38   | Ethiopia                 | 3.83  | 47.19         | 0.70         | ● | 102  | Trinidad and Tobago        | 2.90  | 31.67         | 0.17         |   |
| 39   | Uganda                   | 3.79  | 46.48         | 0.69         | ● | 103  | Croatia                    | 2.87  | 31.10         | 0.16         | ○ |
| 40   | Thailand                 | 3.77  | 46.15         | 0.68         |   | 104  | Burundi                    | 2.81  | 30.21         | 0.16         |   |
| 41   | Slovenia                 | 3.76  | 45.98         | 0.67         |   | 105  | Bosnia and Herzegovina     | 2.78  | 29.65         | 0.15         |   |
| 42   | Bahrain                  | 3.73  | 45.44         | 0.66         |   | 106  | El Salvador                | 2.78  | 29.59         | 0.14         |   |
| 43   | Italy                    | 3.68  | 44.68         | 0.66         |   | 107  | Georgia                    | 2.72  | 28.68         | 0.13         | ○ |
| 44   | Russian Federation       | 3.68  | 44.63         | 0.65         |   | 108  | Algeria                    | 2.71  | 28.53         | 0.12         |   |
| 45   | Czech Republic           | 3.66  | 44.39         | 0.64         |   | 109  | Kyrgyzstan                 | 2.71  | 28.52         | 0.11         |   |
| 46   | Colombia                 | 3.66  | 44.30         | 0.63         |   | 110  | Malawi                     | 2.71  | 28.48         | 0.11         |   |
| 47   | Senegal                  | 3.64  | 43.97         | 0.62         | ● | 111  | Nigeria                    | 2.67  | 27.78         | 0.10         |   |
| 48   | Lebanon                  | 3.64  | 43.94         | 0.61         |   | 112  | Greece                     | 2.65  | 27.56         | 0.09         | ○ |
| 49   | Sri Lanka                | 3.63  | 43.83         | 0.61         |   | 113  | Kuwait                     | 2.64  | 27.30         | 0.08         | ○ |
| 50   | Mexico                   | 3.63  | 43.75         | 0.60         |   | 114  | Mongolia                   | 2.59  | 26.58         | 0.07         | ○ |
| 51   | Oman                     | 3.61  | 43.44         | 0.59         |   | 115  | Nepal                      | 2.55  | 25.87         | 0.07         |   |
| 52   | Azerbaijan               | 3.56  | 42.67         | 0.58         |   | 116  | Bangladesh                 | 2.54  | 25.74         | 0.06         |   |
| 53   | Tanzania, United Rep.    | 3.54  | 42.28         | 0.57         | ● | 117  | Moldova, Rep.              | 2.52  | 25.34         | 0.05         | ○ |
| 54   | Saudi Arabia             | 3.51  | 41.86         | 0.57         |   | 118  | Zimbabwe                   | 2.50  | 25.00         | 0.04         |   |
| 55   | Spain                    | 3.51  | 41.83         | 0.55         |   | 119  | Paraguay                   | 2.47  | 24.57         | 0.03         | ○ |
| 55   | Ukraine                  | 3.51  | 41.83         | 0.55         |   | 120  | Bolivia, Plurinational St. | 2.43  | 23.81         | 0.02         | ○ |
| 57   | Guatemala                | 3.51  | 41.77         | 0.54         |   | 121  | Egypt (2015)               | 2.43  | 23.78         | 0.02         | ○ |
| 58   | Zambia                   | 3.49  | 41.42         | 0.53         | ● | 122  | Guinea (2015)              | 2.18  | 19.72         | 0.01         | ○ |
| 59   | Philippines              | 3.48  | 41.35         | 0.52         |   | 123  | Yemen                      | 1.89  | 14.76         | 0.00         | ○ |
| 60   | Turkey                   | 3.47  | 41.15         | 0.52         |   | n/a  | Belarus                    | n/a   | n/a           | n/a          |   |
| 61   | Chile                    | 3.47  | 41.14         | 0.51         |   | n/a  | Burkina Faso               | n/a   | n/a           | n/a          |   |
| 62   | Costa Rica               | 3.45  | 40.91         | 0.50         |   | n/a  | Niger                      | n/a   | n/a           | n/a          |   |
| 63   | Kazakhstan               | 3.45  | 40.86         | 0.49         |   | n/a  | Togo                       | n/a   | n/a           | n/a          |   |
| 64   | Jamaica                  | 3.45  | 40.77         | 0.48         |   |      |                            |       |               |              |   |

SOURCE: World Economic Forum, *Executive Opinion Survey 2016–2017*

NOTE: ● indicates a strength; ○ a weakness

## 5.2.2 State of cluster development

Average answer to the survey question on the role of clusters in the economy: In your country, how widespread are well-developed and deep clusters (geographic concentrations of firms, suppliers, producers of related products and services, and specialized institutions in a particular field)? [1 = nonexistent; 7 = widespread in many fields] | 2016

| Rank | Country/Economy          | Value | Score (0–100) | Percent rank |   | Rank | Country/Economy            | Value | Score (0–100) | Percent rank |   |
|------|--------------------------|-------|---------------|--------------|---|------|----------------------------|-------|---------------|--------------|---|
| 1    | United States of America | 5.56  | 75.99         | 1.00         | ● | 65   | Azerbaijan                 | 3.71  | 45.20         | 0.48         |   |
| 2    | United Arab Emirates     | 5.42  | 73.65         | 0.99         | ● | 66   | Poland                     | 3.69  | 44.88         | 0.47         |   |
| 3    | Germany                  | 5.36  | 72.70         | 0.98         | ● | 67   | Tanzania, United Rep.      | 3.69  | 44.80         | 0.46         |   |
| 4    | Italy                    | 5.35  | 72.58         | 0.98         | ● | 68   | Namibia                    | 3.67  | 44.54         | 0.45         |   |
| 5    | United Kingdom           | 5.34  | 72.27         | 0.97         |   | 69   | Senegal                    | 3.66  | 44.40         | 0.44         |   |
| 6    | Netherlands              | 5.27  | 71.18         | 0.96         |   | 70   | Jamaica                    | 3.66  | 44.27         | 0.43         |   |
| 7    | Japan                    | 5.22  | 70.32         | 0.95         |   | 71   | Pakistan                   | 3.65  | 44.25         | 0.43         |   |
| 8    | Norway                   | 5.21  | 70.19         | 0.94         | ● | 72   | Bangladesh                 | 3.64  | 44.05         | 0.42         |   |
| 9    | Qatar                    | 5.20  | 69.98         | 0.93         | ● | 73   | Bulgaria                   | 3.63  | 43.79         | 0.41         | ○ |
| 10   | Luxembourg               | 5.18  | 69.74         | 0.93         |   | 74   | Morocco                    | 3.61  | 43.57         | 0.40         |   |
| 11   | Singapore                | 5.17  | 69.49         | 0.92         |   | 75   | Colombia                   | 3.61  | 43.48         | 0.39         |   |
| 12   | Malaysia                 | 5.17  | 69.45         | 0.91         | ● | 76   | Iran, Islamic Rep.         | 3.60  | 43.28         | 0.39         |   |
| 13   | Switzerland              | 5.14  | 68.93         | 0.90         |   | 77   | Ethiopia                   | 3.54  | 42.30         | 0.38         |   |
| 14   | Hong Kong (China)        | 5.04  | 67.28         | 0.89         |   | 78   | Trinidad and Tobago        | 3.49  | 41.54         | 0.37         |   |
| 15   | Sweden                   | 4.99  | 66.42         | 0.89         |   | 79   | Slovenia                   | 3.49  | 41.53         | 0.36         | ○ |
| 16   | Ireland                  | 4.95  | 65.78         | 0.88         |   | 80   | Nigeria                    | 3.49  | 41.49         | 0.35         |   |
| 17   | Finland                  | 4.89  | 64.88         | 0.87         |   | 81   | Uganda                     | 3.48  | 41.33         | 0.34         |   |
| 18   | Austria                  | 4.83  | 63.81         | 0.86         |   | 82   | Latvia                     | 3.47  | 41.21         | 0.34         | ○ |
| 19   | Canada                   | 4.72  | 61.93         | 0.85         |   | 83   | Mali                       | 3.45  | 40.81         | 0.33         |   |
| 20   | China                    | 4.66  | 60.94         | 0.84         |   | 84   | Botswana                   | 3.44  | 40.62         | 0.32         |   |
| 21   | Denmark                  | 4.64  | 60.66         | 0.84         |   | 85   | Chile                      | 3.39  | 39.79         | 0.31         | ○ |
| 22   | Saudi Arabia             | 4.63  | 60.56         | 0.83         | ● | 86   | Russian Federation         | 3.36  | 39.36         | 0.30         |   |
| 23   | Bahrain                  | 4.62  | 60.33         | 0.82         | ● | 87   | Hungary                    | 3.36  | 39.34         | 0.30         |   |
| 24   | Belgium                  | 4.61  | 60.09         | 0.81         |   | 88   | Lithuania                  | 3.34  | 39.05         | 0.29         | ○ |
| 25   | France                   | 4.56  | 59.26         | 0.80         |   | 89   | Armenia                    | 3.33  | 38.86         | 0.28         |   |
| 26   | India                    | 4.52  | 58.73         | 0.80         |   | 90   | Benin                      | 3.31  | 38.57         | 0.27         |   |
| 27   | Korea, Rep.              | 4.51  | 58.56         | 0.79         |   | 91   | Uruguay                    | 3.27  | 37.91         | 0.26         |   |
| 28   | Indonesia                | 4.46  | 57.59         | 0.78         | ● | 92   | Ecuador                    | 3.26  | 37.71         | 0.25         |   |
| 29   | South Africa             | 4.38  | 56.38         | 0.77         |   | 93   | Peru                       | 3.24  | 37.38         | 0.25         |   |
| 30   | Jordan                   | 4.28  | 54.65         | 0.76         | ● | 94   | Argentina                  | 3.23  | 37.20         | 0.24         |   |
| 31   | Egypt                    | 4.27  | 54.48         | 0.75         | ● | 95   | Romania                    | 3.22  | 36.98         | 0.23         | ○ |
| 32   | Spain                    | 4.25  | 54.21         | 0.75         |   | 96   | Cameroon                   | 3.21  | 36.79         | 0.22         |   |
| 33   | Israel                   | 4.23  | 53.82         | 0.74         |   | 97   | Tunisia                    | 3.18  | 36.25         | 0.21         |   |
| 34   | Mexico                   | 4.23  | 53.79         | 0.73         |   | 98   | El Salvador                | 3.17  | 36.16         | 0.20         |   |
| 35   | Malta                    | 4.21  | 53.57         | 0.72         |   | 99   | Bosnia and Herzegovina     | 3.15  | 35.84         | 0.20         |   |
| 36   | Panama                   | 4.20  | 53.27         | 0.71         |   | 100  | Nepal                      | 3.14  | 35.70         | 0.19         |   |
| 37   | Portugal                 | 4.16  | 52.61         | 0.70         |   | 101  | Madagascar                 | 3.14  | 35.60         | 0.18         |   |
| 38   | Kenya                    | 4.16  | 52.61         | 0.70         |   | 102  | Serbia                     | 3.10  | 35.05         | 0.17         | ○ |
| 39   | Mauritius                | 4.14  | 52.27         | 0.69         |   | 103  | Montenegro                 | 3.09  | 34.77         | 0.16         | ○ |
| 40   | Rwanda                   | 4.13  | 52.15         | 0.68         | ● | 104  | Mozambique                 | 3.07  | 34.54         | 0.16         |   |
| 41   | Iceland                  | 4.09  | 51.52         | 0.67         |   | 105  | Algeria                    | 3.05  | 34.19         | 0.15         |   |
| 42   | Australia                | 3.97  | 49.56         | 0.66         |   | 106  | Guinea (2015)              | 3.02  | 33.75         | 0.14         |   |
| 43   | Brazil                   | 3.96  | 49.33         | 0.66         |   | 107  | Greece                     | 3.01  | 33.56         | 0.13         | ○ |
| 44   | Cambodia                 | 3.95  | 49.10         | 0.65         | ● | 108  | Tajikistan                 | 3.01  | 33.55         | 0.12         |   |
| 45   | New Zealand              | 3.94  | 49.07         | 0.64         |   | 109  | Kazakhstan                 | 3.00  | 33.33         | 0.11         | ○ |
| 46   | Kuwait                   | 3.94  | 49.05         | 0.63         |   | 110  | Albania                    | 2.98  | 32.93         | 0.11         | ○ |
| 47   | Brunei Darussalam        | 3.94  | 48.92         | 0.62         |   | 111  | Georgia                    | 2.97  | 32.89         | 0.10         | ○ |
| 48   | Costa Rica               | 3.92  | 48.72         | 0.61         |   | 112  | Kyrgyzstan                 | 2.96  | 32.72         | 0.09         |   |
| 49   | Slovakia                 | 3.91  | 48.48         | 0.61         |   | 113  | Croatia                    | 2.96  | 32.70         | 0.08         | ○ |
| 50   | Viet Nam                 | 3.85  | 47.53         | 0.60         |   | 114  | Ukraine                    | 2.95  | 32.54         | 0.07         | ○ |
| 51   | Guatemala                | 3.84  | 47.36         | 0.59         |   | 115  | Yemen                      | 2.94  | 32.40         | 0.07         |   |
| 52   | TFYR of Macedonia        | 3.84  | 47.27         | 0.58         |   | 116  | Paraguay                   | 2.91  | 31.88         | 0.06         | ○ |
| 53   | Lebanon                  | 3.83  | 47.19         | 0.57         |   | 117  | Burundi                    | 2.88  | 31.28         | 0.05         |   |
| 54   | Turkey                   | 3.82  | 47.00         | 0.57         |   | 118  | Malawi                     | 2.87  | 31.19         | 0.04         |   |
| 55   | Cyprus                   | 3.80  | 46.74         | 0.56         |   | 119  | Bolivia, Plurinational St. | 2.85  | 30.83         | 0.03         | ○ |
| 56   | Czech Republic           | 3.80  | 46.74         | 0.55         |   | 120  | Côte d'Ivoire              | 2.85  | 30.77         | 0.02         | ○ |
| 57   | Sri Lanka                | 3.78  | 46.28         | 0.54         |   | 121  | Mongolia                   | 2.73  | 28.76         | 0.02         | ○ |
| 58   | Thailand                 | 3.77  | 46.18         | 0.53         |   | 122  | Zimbabwe                   | 2.71  | 28.45         | 0.01         | ○ |
| 59   | Estonia                  | 3.76  | 46.00         | 0.52         |   | 123  | Moldova, Rep.              | 2.33  | 22.15         | 0.00         | ○ |
| 60   | Dominican Republic       | 3.75  | 45.89         | 0.52         |   | n/a  | Belarus                    | n/a   | n/a           | n/a          |   |
| 61   | Oman                     | 3.74  | 45.73         | 0.51         |   | n/a  | Burkina Faso               | n/a   | n/a           | n/a          |   |
| 62   | Philippines              | 3.74  | 45.70         | 0.50         |   | n/a  | Niger                      | n/a   | n/a           | n/a          |   |
| 63   | Honduras                 | 3.73  | 45.53         | 0.49         |   | n/a  | Togo                       | n/a   | n/a           | n/a          |   |
| 64   | Zambia                   | 3.72  | 45.34         | 0.48         | ● |      |                            |       |               |              |   |

SOURCE: World Economic Forum, *Executive Opinion Survey 2016–2017*

NOTE: ● indicates a strength; ○ a weakness

## 5.2.3 GERD financed by abroad

### GERD: Financed by abroad (% of total GERD) | 2015

| Rank | Country/Economy              | Value | Score (0–100) | Percent rank |   | Rank | Country/Economy                   | Value | Score (0–100) | Percent rank |   |
|------|------------------------------|-------|---------------|--------------|---|------|-----------------------------------|-------|---------------|--------------|---|
| 1    | Burkina Faso (2009)          | 59.61 | 100.00        | 1.00         | ● | 65   | Germany (2014)                    | 4.99  | 8.38          | 0.35         | ○ |
| 2    | Uganda (2010)                | 57.30 | 96.14         | 0.99         | ● | 66   | United States of America          | 4.67  | 7.83          | 0.34         | ○ |
| 3    | Bulgaria (2014)              | 50.88 | 85.36         | 0.98         | ● | 67   | Tunisia (2014)                    | 4.00  | 6.71          | 0.33         |   |
| 4    | Israel (2013)                | 49.25 | 82.62         | 0.97         | ● | 68   | Mongolia (2014)                   | 2.85  | 4.78          | 0.32         |   |
| 5    | Guatemala (2012)             | 49.01 | 82.22         | 0.96         | ● | 69   | Pakistan                          | 2.66  | 4.46          | 0.31         |   |
| 6    | Kenya (2010)                 | 47.14 | 79.09         | 0.95         | ● | 70   | Russian Federation                | 2.65  | 4.44          | 0.30         |   |
| 7    | Latvia                       | 44.98 | 75.46         | 0.94         | ● | 71   | Ecuador (2014)                    | 2.46  | 4.13          | 0.29         |   |
| 8    | Tanzania, United Rep. (2010) | 42.00 | 70.47         | 0.93         | ● | 72   | Colombia                          | 2.42  | 4.07          | 0.28         |   |
| 9    | Senegal (2010)               | 40.53 | 68.00         | 0.92         | ● | 73   | Qatar (2012)                      | 2.42  | 4.06          | 0.27         |   |
| 10   | Burundi (2008)               | 39.92 | 66.97         | 0.91         | ● | 74   | Armenia                           | 2.28  | 3.82          | 0.26         |   |
| 11   | Mozambique                   | 39.88 | 66.91         | 0.90         | ● | 75   | Ethiopia (2013)                   | 2.15  | 3.61          | 0.24         |   |
| 12   | Slovakia                     | 39.43 | 66.15         | 0.89         | ● | 76   | Bolivia, Plurinational St. (2009) | 1.86  | 3.12          | 0.23         |   |
| 13   | Lithuania                    | 34.58 | 58.02         | 0.88         | ● | 77   | Philippines (2013)                | 1.84  | 3.08          | 0.22         |   |
| 14   | Czech Republic               | 32.50 | 54.52         | 0.87         | ● | 78   | Morocco (2010)                    | 1.71  | 2.87          | 0.21         |   |
| 15   | Luxembourg (2013)            | 32.34 | 54.26         | 0.86         |   | 79   | Zambia (2008)                     | 1.62  | 2.71          | 0.20         |   |
| 16   | Iceland                      | 26.35 | 44.21         | 0.85         |   | 80   | Australia (2008)                  | 1.61  | 2.70          | 0.19         | ○ |
| 17   | Cyprus (2014)                | 23.66 | 39.69         | 0.84         |   | 81   | Thailand                          | 1.55  | 2.59          | 0.18         | ○ |
| 18   | Botswana (2013)              | 21.66 | 36.34         | 0.83         | ● | 82   | Viet Nam (2013)                   | 1.51  | 2.53          | 0.17         |   |
| 19   | Malta                        | 21.27 | 35.68         | 0.82         |   | 83   | Costa Rica (2014)                 | 1.42  | 2.38          | 0.16         | ○ |
| 20   | Montenegro (2014)            | 20.70 | 34.73         | 0.81         | ● | 84   | Kuwait (2009)                     | 1.18  | 1.97          | 0.15         |   |
| 21   | Romania                      | 19.23 | 32.26         | 0.80         | ● | 85   | Turkey (2014)                     | 1.08  | 1.81          | 0.14         | ○ |
| 22   | Ireland (2014)               | 18.62 | 31.23         | 0.79         |   | 86   | Nigeria (2007)                    | 1.04  | 1.74          | 0.13         |   |
| 23   | Ukraine                      | 18.18 | 30.50         | 0.78         |   | 87   | Kyrgyzstan                        | 1.00  | 1.68          | 0.12         |   |
| 24   | United Kingdom               | 17.59 | 29.51         | 0.77         |   | 88   | Kazakhstan (2013)                 | 0.76  | 1.27          | 0.11         | ○ |
| 25   | Bosnia and Herzegovina       | 16.90 | 28.35         | 0.76         | ● | 89   | Korea, Rep.                       | 0.75  | 1.26          | 0.10         | ○ |
| 26   | El Salvador (2014)           | 16.88 | 28.32         | 0.74         | ● | 90   | China                             | 0.74  | 1.24          | 0.09         | ○ |
| 27   | Poland                       | 16.74 | 28.09         | 0.73         |   | 91   | Argentina (2008)                  | 0.60  | 1.00          | 0.08         | ○ |
| 28   | Austria (2016)               | 16.02 | 26.88         | 0.72         |   | 92   | Japan                             | 0.48  | 0.80          | 0.07         | ○ |
| 29   | Namibia (2014)               | 15.81 | 26.52         | 0.71         | ● | 93   | Mexico                            | 0.38  | 0.64          | 0.06         | ○ |
| 30   | Netherlands                  | 15.13 | 25.38         | 0.70         |   | 94   | Panama (2013)                     | 0.25  | 0.43          | 0.05         | ○ |
| 31   | Hungary                      | 14.95 | 25.08         | 0.69         |   | 95   | Tajikistan (2013)                 | 0.21  | 0.35          | 0.04         |   |
| 32   | Finland                      | 14.52 | 24.36         | 0.68         |   | 96   | Malaysia (2014)                   | 0.17  | 0.28          | 0.03         | ○ |
| 33   | Croatia                      | 14.48 | 24.28         | 0.67         |   | 97   | Azerbaijan (2014)                 | 0.16  | 0.27          | 0.02         | ○ |
| 34   | Georgia (2014)               | 14.27 | 23.94         | 0.66         |   | 98   | Egypt (2014)                      | 0.12  | 0.20          | 0.01         | ○ |
| 35   | Belgium (2013)               | 13.17 | 22.09         | 0.65         |   | 99   | Oman (2013)                       | 0.00  | 0.00          | 0.00         | ○ |
| 36   | South Africa (2013)          | 12.92 | 21.67         | 0.64         |   | n/a  | Algeria                           | n/a   | n/a           | n/a          |   |
| 37   | Chile                        | 12.88 | 21.61         | 0.63         |   | n/a  | Bangladesh                        | n/a   | n/a           | n/a          |   |
| 38   | Greece                       | 12.85 | 21.55         | 0.62         |   | n/a  | Benin                             | n/a   | n/a           | n/a          |   |
| 39   | Belarus                      | 12.72 | 21.34         | 0.61         |   | n/a  | Brazil                            | n/a   | n/a           | n/a          |   |
| 40   | Serbia                       | 12.55 | 21.06         | 0.60         |   | n/a  | Brunei Darussalam                 | n/a   | n/a           | n/a          |   |
| 41   | Bahrain (2014)               | 12.44 | 20.87         | 0.59         |   | n/a  | Cambodia                          | n/a   | n/a           | n/a          |   |
| 42   | Estonia                      | 12.19 | 20.44         | 0.58         |   | n/a  | Cameroon                          | n/a   | n/a           | n/a          |   |
| 43   | Switzerland (2012)           | 12.07 | 20.26         | 0.57         |   | n/a  | Côte d'Ivoire                     | n/a   | n/a           | n/a          |   |
| 44   | Moldova, Rep.                | 11.64 | 19.53         | 0.56         |   | n/a  | Dominican Republic                | n/a   | n/a           | n/a          |   |
| 45   | Madagascar (2009)            | 10.58 | 17.75         | 0.55         | ● | n/a  | Guinea                            | n/a   | n/a           | n/a          |   |
| 46   | Slovenia                     | 10.56 | 17.71         | 0.54         |   | n/a  | Honduras                          | n/a   | n/a           | n/a          |   |
| 47   | Paraguay                     | 10.33 | 17.33         | 0.53         |   | n/a  | India                             | n/a   | n/a           | n/a          |   |
| 48   | Norway (2013)                | 9.47  | 15.88         | 0.52         |   | n/a  | Indonesia                         | n/a   | n/a           | n/a          |   |
| 49   | Italy (2014)                 | 9.33  | 15.65         | 0.51         |   | n/a  | Iran, Islamic Rep.                | n/a   | n/a           | n/a          |   |
| 50   | Mali (2010)                  | 8.81  | 14.78         | 0.50         |   | n/a  | Jamaica                           | n/a   | n/a           | n/a          |   |
| 51   | France (2014)                | 7.79  | 13.06         | 0.49         | ○ | n/a  | Jordan                            | n/a   | n/a           | n/a          |   |
| 52   | Spain (2014)                 | 7.41  | 12.43         | 0.48         | ○ | n/a  | Lebanon                           | n/a   | n/a           | n/a          |   |
| 53   | Uruguay (2014)               | 7.38  | 12.37         | 0.47         |   | n/a  | Malawi                            | n/a   | n/a           | n/a          |   |
| 54   | Albania (2008)               | 7.37  | 12.36         | 0.46         |   | n/a  | Nepal                             | n/a   | n/a           | n/a          |   |
| 55   | New Zealand (2013)           | 7.23  | 12.12         | 0.45         | ○ | n/a  | Niger                             | n/a   | n/a           | n/a          |   |
| 56   | Hong Kong (China) (2014)     | 7.01  | 11.76         | 0.44         | ○ | n/a  | Peru                              | n/a   | n/a           | n/a          |   |
| 57   | Singapore (2014)             | 6.85  | 11.48         | 0.43         | ○ | n/a  | Rwanda                            | n/a   | n/a           | n/a          |   |
| 58   | Sweden (2013)                | 6.71  | 11.26         | 0.42         | ○ | n/a  | Saudi Arabia                      | n/a   | n/a           | n/a          |   |
| 59   | Denmark                      | 6.52  | 10.94         | 0.41         | ○ | n/a  | TFYR of Macedonia                 | n/a   | n/a           | n/a          |   |
| 60   | Mauritius (2012)             | 6.43  | 10.79         | 0.40         |   | n/a  | Trinidad and Tobago               | n/a   | n/a           | n/a          |   |
| 61   | Canada (2014)                | 6.01  | 10.09         | 0.39         | ○ | n/a  | United Arab Emirates              | n/a   | n/a           | n/a          |   |
| 62   | Portugal (2014)              | 5.61  | 9.42          | 0.38         | ○ | n/a  | Yemen                             | n/a   | n/a           | n/a          |   |
| 63   | Togo (2014)                  | 5.54  | 9.30          | 0.37         |   | n/a  | Zimbabwe                          | n/a   | n/a           | n/a          |   |
| 64   | Sri Lanka (2013)             | 5.03  | 8.43          | 0.36         |   |      |                                   |       |               |              |   |

SOURCE: UNESCO Institute for Statistics, *UIS online database*

NOTE: ● indicates a strength; ○ a weakness

## 5.2.4 Joint venture/strategic alliance deals

Joint ventures/strategic alliances: Number of deals, fractional counting (per billion PPP\$ GDP) | 2016

II: Data Tables

| Rank | Country/Economy          | Value | Score (0–100) | Percent rank |   | Rank | Country/Economy            | Value | Score (0–100) | Percent rank |   |
|------|--------------------------|-------|---------------|--------------|---|------|----------------------------|-------|---------------|--------------|---|
| 1    | Hong Kong (China)        | 0.28  | 100.00        | 1.00         | ● | 65   | Viet Nam                   | 0.02  | 6.33          | 0.42         |   |
| 2    | Bahrain                  | 0.19  | 68.67         | 0.99         | ● | 66   | Uruguay                    | 0.02  | 6.32          | 0.41         |   |
| 3    | Estonia                  | 0.18  | 62.63         | 0.98         | ● | 67   | Azerbaijan                 | 0.02  | 6.24          | 0.40         |   |
| 4    | Singapore                | 0.17  | 59.50         | 0.97         |   | 68   | Latvia                     | 0.02  | 6.10          | 0.39         |   |
| 5    | Canada                   | 0.16  | 56.16         | 0.96         | ● | 69   | Costa Rica                 | 0.02  | 5.83          | 0.38         |   |
| 6    | Cyprus                   | 0.15  | 54.42         | 0.95         | ● | 70   | Armenia                    | 0.02  | 5.79          | 0.37         |   |
| 7    | Australia                | 0.15  | 53.87         | 0.95         |   | 71   | Uganda                     | 0.02  | 5.38          | 0.36         |   |
| 8    | Luxembourg               | 0.15  | 52.68         | 0.94         |   | 72   | Portugal                   | 0.02  | 5.32          | 0.35         | ○ |
| 9    | Sweden                   | 0.14  | 48.51         | 0.93         |   | 73   | Tanzania, United Rep.      | 0.02  | 4.99          | 0.35         |   |
| 10   | Switzerland              | 0.12  | 40.68         | 0.92         |   | 74   | Croatia                    | 0.02  | 4.75          | 0.34         |   |
| 11   | Finland                  | 0.12  | 40.53         | 0.91         |   | 75   | Lebanon                    | 0.02  | 4.65          | 0.33         |   |
| 12   | Israel                   | 0.11  | 39.95         | 0.90         |   | 76   | Ukraine                    | 0.01  | 4.33          | 0.32         |   |
| 13   | United Kingdom           | 0.10  | 35.01         | 0.89         |   | 77   | Nepal                      | 0.01  | 4.05          | 0.31         |   |
| 14   | New Zealand              | 0.10  | 33.70         | 0.88         |   | 78   | Kazakhstan                 | 0.01  | 3.97          | 0.30         |   |
| 15   | Denmark                  | 0.09  | 30.87         | 0.87         |   | 79   | Turkey                     | 0.01  | 3.87          | 0.29         |   |
| 16   | United Arab Emirates     | 0.09  | 30.42         | 0.86         |   | 80   | Saudi Arabia               | 0.01  | 3.83          | 0.28         |   |
| 17   | United States of America | 0.08  | 29.45         | 0.85         |   | 81   | Georgia                    | 0.01  | 3.83          | 0.27         |   |
| 18   | Malaysia                 | 0.08  | 29.29         | 0.85         |   | 82   | Madagascar                 | 0.01  | 3.82          | 0.26         |   |
| 19   | Kyrgyzstan               | 0.07  | 24.73         | 0.84         | ● | 83   | Poland                     | 0.01  | 3.72          | 0.25         | ○ |
| 20   | Botswana                 | 0.07  | 23.68         | 0.83         | ● | 84   | Bangladesh                 | 0.01  | 3.69          | 0.25         |   |
| 21   | Rwanda                   | 0.07  | 23.61         | 0.82         | ● | 85   | Bolivia, Plurinational St. | 0.01  | 3.61          | 0.24         |   |
| 22   | Norway                   | 0.06  | 21.98         | 0.81         |   | 86   | Senegal                    | 0.01  | 3.55          | 0.23         |   |
| 23   | Netherlands              | 0.06  | 21.23         | 0.80         |   | 87   | Mexico                     | 0.01  | 2.96          | 0.22         | ○ |
| 24   | Malta                    | 0.06  | 21.09         | 0.79         |   | 88   | Colombia                   | 0.01  | 2.84          | 0.21         | ○ |
| 25   | Cambodia                 | 0.06  | 20.41         | 0.78         | ● | 89   | Morocco                    | 0.01  | 2.83          | 0.20         |   |
| 26   | Ireland                  | 0.06  | 19.69         | 0.77         |   | 90   | Brazil                     | 0.01  | 2.77          | 0.19         | ○ |
| 27   | Moldova, Rep.            | 0.05  | 18.45         | 0.76         |   | 91   | Serbia (2015)              | 0.01  | 2.72          | 0.18         | ○ |
| 28   | Zimbabwe                 | 0.05  | 18.09         | 0.75         | ● | 92   | Czech Republic             | 0.01  | 2.61          | 0.17         | ○ |
| 29   | Belgium                  | 0.05  | 17.19         | 0.75         |   | 93   | Brunei Darussalam          | 0.01  | 2.57          | 0.16         | ○ |
| 30   | Tunisia                  | 0.05  | 16.91         | 0.74         | ● | 94   | Iran, Islamic Rep.         | 0.01  | 2.14          | 0.15         |   |
| 31   | Sri Lanka                | 0.05  | 16.81         | 0.73         | ● | 95   | Peru                       | 0.01  | 1.65          | 0.15         | ○ |
| 32   | Jordan                   | 0.05  | 15.73         | 0.72         | ● | 96   | Cameroon                   | 0.01  | 1.34          | 0.14         |   |
| 33   | Slovenia                 | 0.05  | 15.36         | 0.71         |   | 97   | Indonesia                  | 0.01  | 1.27          | 0.13         |   |
| 34   | Jamaica                  | 0.04  | 13.20         | 0.70         |   | 98   | Argentina                  | 0.01  | 1.27          | 0.12         |   |
| 35   | Mali                     | 0.04  | 13.20         | 0.69         | ● | 99   | Lithuania                  | 0.01  | 1.11          | 0.11         | ○ |
| 36   | South Africa             | 0.04  | 12.92         | 0.68         |   | 100  | Côte d'Ivoire              | 0.01  | 1.08          | 0.10         |   |
| 37   | Oman                     | 0.04  | 12.89         | 0.67         | ● | 101  | Ethiopia                   | 0.01  | 1.07          | 0.09         |   |
| 38   | Japan                    | 0.04  | 12.41         | 0.66         |   | 102  | Mozambique                 | 0.01  | 1.05          | 0.08         |   |
| 39   | France                   | 0.04  | 12.41         | 0.65         |   | 103  | Egypt                      | 0.01  | 1.02          | 0.07         |   |
| 40   | Namibia                  | 0.04  | 12.34         | 0.65         |   | 104  | Panama                     | 0.01  | 0.95          | 0.06         | ○ |
| 41   | Qatar                    | 0.04  | 12.12         | 0.64         |   | 105  | Zambia (2015)              | 0.01  | 0.87          | 0.05         | ○ |
| 42   | Bulgaria                 | 0.03  | 11.60         | 0.63         |   | 106  | Nigeria                    | 0.01  | 0.83          | 0.05         |   |
| 43   | Korea, Rep.              | 0.03  | 11.60         | 0.62         |   | 107  | Algeria                    | 0.00  | 0.79          | 0.04         |   |
| 44   | Kenya                    | 0.03  | 10.81         | 0.61         |   | 108  | Romania                    | 0.00  | 0.65          | 0.03         | ○ |
| 45   | China                    | 0.03  | 10.73         | 0.60         |   | 109  | Dominican Republic         | 0.00  | 0.13          | 0.02         | ○ |
| 46   | Germany                  | 0.03  | 10.66         | 0.59         |   | 110  | Slovakia                   | 0.00  | 0.08          | 0.01         | ○ |
| 47   | Thailand                 | 0.03  | 10.57         | 0.58         |   | 111  | Ecuador                    | 0.00  | 0.00          | 0.00         | ○ |
| 48   | Iceland                  | 0.03  | 10.17         | 0.57         |   | n/a  | Albania                    | n/a   | n/a           | n/a          |   |
| 49   | India                    | 0.03  | 9.08          | 0.56         |   | n/a  | Benin                      | n/a   | n/a           | n/a          |   |
| 50   | Philippines              | 0.03  | 9.05          | 0.55         |   | n/a  | Burkina Faso               | n/a   | n/a           | n/a          |   |
| 51   | Greece                   | 0.03  | 8.73          | 0.55         |   | n/a  | Burundi                    | n/a   | n/a           | n/a          |   |
| 52   | Austria                  | 0.03  | 8.61          | 0.54         | ○ | n/a  | El Salvador                | n/a   | n/a           | n/a          |   |
| 53   | Belarus                  | 0.03  | 8.09          | 0.53         |   | n/a  | Guatemala                  | n/a   | n/a           | n/a          |   |
| 54   | Chile                    | 0.02  | 7.96          | 0.52         |   | n/a  | Guinea                     | n/a   | n/a           | n/a          |   |
| 55   | Kuwait                   | 0.02  | 7.59          | 0.51         |   | n/a  | Honduras                   | n/a   | n/a           | n/a          |   |
| 56   | Bosnia and Herzegovina   | 0.02  | 7.48          | 0.50         |   | n/a  | Malawi                     | n/a   | n/a           | n/a          |   |
| 57   | Pakistan                 | 0.02  | 7.46          | 0.49         |   | n/a  | Montenegro                 | n/a   | n/a           | n/a          |   |
| 58   | Paraguay                 | 0.02  | 7.44          | 0.48         |   | n/a  | Niger                      | n/a   | n/a           | n/a          |   |
| 59   | Mongolia                 | 0.02  | 7.20          | 0.47         |   | n/a  | Tajikistan                 | n/a   | n/a           | n/a          |   |
| 60   | Spain                    | 0.02  | 7.13          | 0.46         | ○ | n/a  | TFYR of Macedonia          | n/a   | n/a           | n/a          |   |
| 61   | Italy                    | 0.02  | 7.12          | 0.45         | ○ | n/a  | Togo                       | n/a   | n/a           | n/a          |   |
| 62   | Russian Federation       | 0.02  | 7.00          | 0.45         |   | n/a  | Trinidad and Tobago        | n/a   | n/a           | n/a          |   |
| 63   | Hungary                  | 0.02  | 6.91          | 0.44         |   | n/a  | Yemen                      | n/a   | n/a           | n/a          |   |
| 64   | Mauritius (2015)         | 0.02  | 6.36          | 0.43         |   |      |                            |       |               |              |   |

SOURCE: Thomson Reuters, *Thomson One Banker Private Equity*, *SDC Platinum* database; International Monetary Fund, *World Economic Outlook Database*, October 2016 (PPP\$ GDP)

NOTE: ● Indicates a strength; ○ a weakness

## 5.2.5 Patent families filed in two offices

Number of patent families filed by residents in at least two offices (per billion PPP\$ GDP) | 2013

| Rank | Country/Economy          | Value | Score (0–100) | Percent rank |   | Rank | Country/Economy                   | Value | Score (0–100) | Percent rank |   |
|------|--------------------------|-------|---------------|--------------|---|------|-----------------------------------|-------|---------------|--------------|---|
| 1    | Finland                  | 9.39  | 100.00        | 0.97         | ● | 65   | Jordan                            | 0.10  | 1.12          | 0.46         |   |
| 1    | Japan                    | 15.53 | 100.00        | 0.97         | ● | 66   | Colombia                          | 0.10  | 1.11          | 0.45         |   |
| 1    | Korea, Rep.              | 16.31 | 100.00        | 0.97         | ● | 67   | Argentina                         | 0.10  | 1.05          | 0.44         |   |
| 1    | Switzerland              | 10.55 | 100.00        | 0.97         | ● | 68   | United Arab Emirates              | 0.10  | 1.04          | 0.43         |   |
| 5    | Sweden                   | 8.81  | 93.74         | 0.97         |   | 69   | Tunisia                           | 0.09  | 0.98          | 0.42         |   |
| 6    | Malta                    | 8.76  | 93.29         | 0.96         |   | 70   | Guinea (2009)                     | 0.08  | 0.87          | 0.42         | ● |
| 7    | Luxembourg               | 8.42  | 89.61         | 0.95         |   | 71   | Zimbabwe (2012)                   | 0.08  | 0.87          | 0.41         |   |
| 8    | Israel                   | 8.02  | 85.39         | 0.94         |   | 72   | Botswana (2008)                   | 0.08  | 0.85          | 0.40         |   |
| 9    | Denmark                  | 7.96  | 84.74         | 0.93         |   | 73   | Mexico                            | 0.08  | 0.84          | 0.39         |   |
| 10   | Germany                  | 6.66  | 70.85         | 0.92         |   | 74   | Azerbaijan                        | 0.08  | 0.80          | 0.38         |   |
| 11   | Netherlands              | 6.17  | 65.70         | 0.92         |   | 75   | Romania                           | 0.07  | 0.73          | 0.37         |   |
| 12   | Iceland                  | 5.10  | 54.28         | 0.91         |   | 76   | Senegal (2012)                    | 0.07  | 0.70          | 0.36         |   |
| 13   | United States of America | 4.95  | 52.70         | 0.90         |   | 77   | Thailand                          | 0.06  | 0.62          | 0.36         |   |
| 14   | Austria                  | 4.90  | 52.14         | 0.89         |   | 78   | Tajikistan (2011)                 | 0.06  | 0.62          | 0.35         |   |
| 15   | New Zealand              | 4.73  | 50.38         | 0.88         |   | 79   | Philippines                       | 0.06  | 0.61          | 0.34         |   |
| 16   | France                   | 3.90  | 41.53         | 0.87         |   | 80   | Kyrgyzstan                        | 0.05  | 0.58          | 0.33         |   |
| 17   | Belgium                  | 3.79  | 40.32         | 0.86         |   | 81   | Lebanon                           | 0.05  | 0.54          | 0.32         |   |
| 18   | Canada                   | 2.90  | 30.85         | 0.86         |   | 82   | Qatar                             | 0.05  | 0.51          | 0.31         |   |
| 19   | Singapore                | 2.79  | 29.73         | 0.85         |   | 83   | Egypt                             | 0.05  | 0.51          | 0.31         |   |
| 20   | Ireland                  | 2.55  | 27.15         | 0.84         |   | 84   | Sri Lanka                         | 0.05  | 0.48          | 0.30         |   |
| 21   | United Kingdom           | 2.52  | 26.81         | 0.83         |   | 85   | Trinidad and Tobago               | 0.05  | 0.48          | 0.29         |   |
| 22   | Cyprus                   | 2.39  | 25.46         | 0.82         |   | 86   | TFYR of Macedonia                 | 0.04  | 0.40          | 0.28         |   |
| 23   | Norway                   | 2.22  | 23.64         | 0.81         |   | 87   | Mongolia (2012)                   | 0.04  | 0.38          | 0.27         |   |
| 24   | Slovenia                 | 1.97  | 21.02         | 0.81         |   | 88   | Madagascar (2010)                 | 0.03  | 0.37          | 0.26         |   |
| 25   | Italy                    | 1.77  | 18.82         | 0.80         |   | 89   | Bahrain                           | 0.03  | 0.37          | 0.25         |   |
| 26   | Hong Kong (China)        | 1.26  | 13.44         | 0.79         |   | 90   | Albania                           | 0.03  | 0.35          | 0.25         |   |
| 27   | Estonia                  | 1.05  | 11.20         | 0.78         |   | 91   | Kenya                             | 0.03  | 0.34          | 0.24         |   |
| 28   | Australia                | 1.05  | 11.13         | 0.77         |   | 92   | Georgia                           | 0.03  | 0.33          | 0.23         |   |
| 29   | China                    | 0.93  | 9.87          | 0.76         |   | 93   | Cambodia (2008)                   | 0.03  | 0.33          | 0.22         |   |
| 30   | Spain                    | 0.79  | 8.40          | 0.75         |   | 94   | Côte d'Ivoire                     | 0.03  | 0.32          | 0.21         |   |
| 31   | Czech Republic           | 0.74  | 7.86          | 0.75         |   | 95   | Honduras (2011)                   | 0.03  | 0.32          | 0.20         |   |
| 32   | Portugal                 | 0.73  | 7.76          | 0.74         |   | 96   | Viet Nam                          | 0.03  | 0.31          | 0.19         |   |
| 33   | South Africa             | 0.69  | 7.31          | 0.73         |   | 97   | Costa Rica                        | 0.03  | 0.31          | 0.19         | ○ |
| 34   | Ukraine                  | 0.57  | 6.07          | 0.72         |   | 98   | Zambia (2009)                     | 0.03  | 0.27          | 0.18         |   |
| 35   | Turkey                   | 0.55  | 5.82          | 0.71         |   | 99   | Morocco                           | 0.02  | 0.26          | 0.17         | ○ |
| 36   | Latvia                   | 0.53  | 5.63          | 0.70         |   | 100  | Dominican Republic                | 0.02  | 0.25          | 0.16         |   |
| 37   | Armenia                  | 0.52  | 5.52          | 0.69         |   | 101  | Algeria                           | 0.02  | 0.24          | 0.15         |   |
| 38   | Hungary                  | 0.47  | 5.01          | 0.69         |   | 102  | Kuwait                            | 0.02  | 0.23          | 0.14         |   |
| 39   | Belarus                  | 0.45  | 4.77          | 0.68         |   | 103  | Oman (2012)                       | 0.02  | 0.22          | 0.14         |   |
| 40   | Poland                   | 0.44  | 4.68          | 0.67         |   | 104  | El Salvador                       | 0.02  | 0.22          | 0.13         |   |
| 41   | Greece                   | 0.40  | 4.30          | 0.66         |   | 105  | Peru                              | 0.02  | 0.21          | 0.12         | ○ |
| 42   | Lithuania                | 0.39  | 4.17          | 0.65         |   | 106  | Paraguay                          | 0.02  | 0.19          | 0.11         |   |
| 43   | India                    | 0.32  | 3.46          | 0.64         |   | 107  | Cameroon (2012)                   | 0.02  | 0.18          | 0.10         |   |
| 44   | Slovakia                 | 0.31  | 3.32          | 0.64         |   | 108  | Bolivia, Plurinational St. (2012) | 0.02  | 0.18          | 0.09         |   |
| 45   | Malaysia                 | 0.27  | 2.91          | 0.63         |   | 109  | Pakistan                          | 0.01  | 0.13          | 0.08         | ○ |
| 46   | Bulgaria                 | 0.27  | 2.84          | 0.62         |   | 110  | Yemen (2010)                      | 0.01  | 0.10          | 0.08         |   |
| 47   | Moldova, Rep.            | 0.24  | 2.55          | 0.61         |   | 111  | Iran, Islamic Rep.                | 0.01  | 0.10          | 0.07         | ○ |
| 48   | Montenegro (2012)        | 0.23  | 2.43          | 0.60         |   | 112  | Guatemala (2012)                  | 0.01  | 0.10          | 0.06         |   |
| 49   | Chile                    | 0.22  | 2.34          | 0.59         |   | 113  | Tanzania, United Rep.             | 0.01  | 0.09          | 0.05         |   |
| 50   | Russian Federation       | 0.21  | 2.26          | 0.58         |   | 114  | Ecuador                           | 0.01  | 0.06          | 0.04         | ○ |
| 51   | Saudi Arabia             | 0.20  | 2.11          | 0.58         |   | 115  | Nigeria                           | 0.00  | 0.04          | 0.03         | ○ |
| 52   | Niger                    | 0.18  | 1.92          | 0.57         |   | 116  | Bangladesh                        | 0.00  | 0.04          | 0.03         | ○ |
| 53   | Mauritius                | 0.18  | 1.91          | 0.56         |   | 117  | Indonesia                         | 0.00  | 0.04          | 0.02         | ○ |
| 54   | Burundi (2009)           | 0.17  | 1.82          | 0.55         | ● | 118  | Mozambique                        | 0.00  | 0.00          | 0.00         | ○ |
| 55   | Jamaica                  | 0.17  | 1.80          | 0.54         |   | 118  | Uganda                            | 0.00  | 0.00          | 0.00         | ○ |
| 56   | Bosnia and Herzegovina   | 0.16  | 1.68          | 0.53         |   | n/a  | Benin                             | n/a   | n/a           | n/a          |   |
| 57   | Kazakhstan               | 0.16  | 1.66          | 0.53         |   | n/a  | Burkina Faso                      | n/a   | n/a           | n/a          |   |
| 58   | Serbia                   | 0.15  | 1.55          | 0.52         |   | n/a  | Ethiopia                          | n/a   | n/a           | n/a          |   |
| 59   | Namibia                  | 0.14  | 1.44          | 0.51         |   | n/a  | Malawi                            | n/a   | n/a           | n/a          |   |
| 60   | Uruguay                  | 0.13  | 1.41          | 0.50         |   | n/a  | Mali                              | n/a   | n/a           | n/a          |   |
| 61   | Brazil                   | 0.13  | 1.37          | 0.49         |   | n/a  | Nepal                             | n/a   | n/a           | n/a          |   |
| 62   | Croatia                  | 0.13  | 1.34          | 0.48         |   | n/a  | Rwanda                            | n/a   | n/a           | n/a          |   |
| 63   | Brunei Darussalam        | 0.12  | 1.28          | 0.47         |   | n/a  | Togo                              | n/a   | n/a           | n/a          |   |
| 64   | Panama                   | 0.11  | 1.13          | 0.47         |   |      |                                   |       |               |              |   |

SOURCE: World Intellectual Property Organization, *Intellectual Property Statistics*; International Monetary Fund, *World Economic Outlook Database*, October 2016 (PPPS GDP)

NOTE: ● indicates a strength; ○ a weakness

# 5.3.1 Intellectual property payments

## Charges for use of intellectual property n.i.e., payments (% of total trade) | 2015

| Rank | Country/Economy            | Value | Score (0–100) | Percent rank |   | Rank | Country/Economy              | Value | Score (0–100) | Percent rank |   |
|------|----------------------------|-------|---------------|--------------|---|------|------------------------------|-------|---------------|--------------|---|
| 1    | Ireland                    | 26.27 | 100.00        | 0.98         | ● | 65   | Dominican Republic (2014)    | 0.44  | 12.27         | 0.44         |   |
| 1    | Netherlands                | 5.39  | 100.00        | 0.98         | ● | 66   | Egypt (2014)                 | 0.41  | 11.25         | 0.43         |   |
| 1    | Singapore                  | 3.62  | 100.00        | 0.98         | ● | 67   | Nigeria                      | 0.41  | 11.24         | 0.43         | ● |
| 4    | Switzerland                | 3.28  | 90.57         | 0.97         |   | 68   | Uruguay                      | 0.40  | 11.15         | 0.42         |   |
| 5    | Malta                      | 3.24  | 89.41         | 0.97         | ● | 69   | Belarus                      | 0.40  | 11.01         | 0.41         |   |
| 6    | Luxembourg                 | 2.60  | 71.82         | 0.96         |   | 70   | Panama                       | 0.40  | 10.95         | 0.40         |   |
| 7    | Argentina                  | 2.57  | 71.03         | 0.95         | ● | 71   | Zimbabwe (2012)              | 0.33  | 9.23          | 0.39         |   |
| 8    | Brazil                     | 2.26  | 62.41         | 0.94         | ● | 72   | Turkey                       | 0.33  | 8.98          | 0.38         |   |
| 9    | Japan                      | 2.16  | 59.55         | 0.93         |   | 73   | Ecuador                      | 0.32  | 8.86          | 0.37         |   |
| 10   | Sweden                     | 2.07  | 57.02         | 0.92         |   | 74   | Hong Kong (China) (2014)     | 0.31  | 8.59          | 0.37         | ○ |
| 11   | Chile (2014)               | 1.83  | 50.51         | 0.91         | ● | 75   | Kazakhstan                   | 0.31  | 8.51          | 0.36         |   |
| 12   | Canada                     | 1.83  | 50.49         | 0.90         |   | 76   | Mongolia                     | 0.30  | 8.23          | 0.35         |   |
| 13   | France                     | 1.78  | 49.14         | 0.90         |   | 77   | Mauritius (2014)             | 0.27  | 7.45          | 0.34         |   |
| 14   | South Africa               | 1.74  | 48.06         | 0.89         | ● | 78   | Mozambique (2014)            | 0.24  | 6.65          | 0.33         |   |
| 15   | New Zealand                | 1.72  | 47.53         | 0.88         |   | 79   | Estonia                      | 0.24  | 6.63          | 0.32         | ○ |
| 16   | Russian Federation         | 1.68  | 46.35         | 0.87         | ● | 80   | Uganda                       | 0.22  | 6.18          | 0.31         |   |
| 17   | Korea, Rep.                | 1.66  | 45.73         | 0.86         |   | 81   | Algeria (2014)               | 0.22  | 5.93          | 0.30         |   |
| 18   | Thailand                   | 1.63  | 45.12         | 0.85         | ● | 82   | Mexico                       | 0.21  | 5.80          | 0.30         |   |
| 19   | United States of America   | 1.58  | 43.55         | 0.84         |   | 83   | Latvia                       | 0.21  | 5.73          | 0.29         | ○ |
| 20   | Australia                  | 1.41  | 38.94         | 0.83         |   | 84   | Morocco (2013)               | 0.19  | 5.19          | 0.28         |   |
| 21   | United Kingdom             | 1.33  | 36.59         | 0.83         |   | 85   | Iran, Islamic Rep. (2014)    | 0.18  | 4.90          | 0.27         |   |
| 22   | Hungary                    | 1.33  | 36.57         | 0.82         |   | 86   | Montenegro                   | 0.17  | 4.57          | 0.26         | ○ |
| 23   | Guatemala                  | 1.23  | 33.87         | 0.81         | ● | 87   | Paraguay                     | 0.17  | 4.55          | 0.25         |   |
| 24   | Croatia                    | 1.22  | 33.75         | 0.80         | ● | 88   | Lithuania                    | 0.16  | 4.27          | 0.24         | ○ |
| 25   | Spain                      | 1.19  | 32.85         | 0.79         |   | 89   | Lebanon (2014)               | 0.14  | 3.86          | 0.23         |   |
| 26   | Iceland                    | 1.17  | 32.23         | 0.78         |   | 90   | Bosnia and Herzegovina       | 0.14  | 3.85          | 0.23         |   |
| 27   | Costa Rica                 | 1.10  | 30.44         | 0.77         |   | 91   | Brunei Darussalam (2009)     | 0.13  | 3.60          | 0.22         |   |
| 28   | Romania                    | 1.10  | 30.35         | 0.77         |   | 92   | Malawi (2014)                | 0.13  | 3.56          | 0.21         |   |
| 29   | India                      | 1.10  | 30.26         | 0.76         |   | 93   | Namibia                      | 0.11  | 3.07          | 0.20         |   |
| 30   | Poland                     | 1.07  | 29.57         | 0.75         |   | 94   | Niger (2009)                 | 0.11  | 3.02          | 0.19         |   |
| 31   | TFYR of Macedonia          | 0.99  | 27.19         | 0.74         |   | 95   | Kyrgyzstan (2014)            | 0.11  | 2.95          | 0.18         |   |
| 32   | China                      | 0.99  | 27.19         | 0.73         |   | 96   | Togo (2010)                  | 0.11  | 2.93          | 0.17         |   |
| 33   | Finland                    | 0.98  | 27.14         | 0.72         |   | 97   | Azerbaijan (2012)            | 0.10  | 2.88          | 0.17         |   |
| 34   | Kenya (2014)               | 0.97  | 26.68         | 0.71         |   | 98   | Senegal (2014)               | 0.10  | 2.86          | 0.16         |   |
| 35   | Jamaica                    | 0.95  | 26.27         | 0.70         | ● | 99   | Botswana (2014)              | 0.10  | 2.71          | 0.15         |   |
| 36   | Indonesia                  | 0.93  | 25.69         | 0.70         |   | 100  | Cameroon (2013)              | 0.09  | 2.57          | 0.14         |   |
| 37   | Serbia                     | 0.91  | 24.99         | 0.69         |   | 101  | Georgia                      | 0.09  | 2.54          | 0.13         | ○ |
| 38   | Belgium                    | 0.90  | 24.75         | 0.68         |   | 102  | Cambodia                     | 0.09  | 2.53          | 0.12         |   |
| 39   | Italy                      | 0.88  | 24.40         | 0.67         |   | 103  | Tunisia (2014)               | 0.08  | 2.23          | 0.11         | ○ |
| 40   | Portugal                   | 0.86  | 23.64         | 0.66         |   | 104  | Bangladesh (2014)            | 0.07  | 1.98          | 0.10         |   |
| 41   | Denmark                    | 0.83  | 22.78         | 0.65         |   | 105  | Mali (2010)                  | 0.07  | 1.81          | 0.10         |   |
| 42   | Colombia                   | 0.81  | 22.24         | 0.64         |   | 106  | Benin (2014)                 | 0.06  | 1.72          | 0.09         |   |
| 43   | El Salvador                | 0.80  | 22.14         | 0.63         | ● | 107  | Guinea (2013)                | 0.06  | 1.68          | 0.08         |   |
| 44   | Austria                    | 0.78  | 21.65         | 0.63         |   | 108  | Rwanda (2012)                | 0.05  | 1.41          | 0.07         | ○ |
| 45   | Philippines                | 0.77  | 21.13         | 0.62         |   | 109  | Yemen (2014)                 | 0.04  | 1.17          | 0.06         |   |
| 46   | Ukraine                    | 0.75  | 20.56         | 0.61         |   | 110  | Côte d'Ivoire (2013)         | 0.03  | 0.85          | 0.05         | ○ |
| 47   | Czech Republic             | 0.73  | 20.15         | 0.60         |   | 111  | Ethiopia (2012)              | 0.02  | 0.67          | 0.04         |   |
| 48   | Slovenia                   | 0.69  | 19.16         | 0.59         |   | 112  | Zambia (2014)                | 0.02  | 0.48          | 0.03         | ○ |
| 49   | Peru                       | 0.69  | 18.96         | 0.58         |   | 113  | Tanzania, United Rep. (2014) | 0.01  | 0.26          | 0.03         |   |
| 50   | Slovakia                   | 0.66  | 18.17         | 0.57         |   | 114  | Burkina Faso (2014)          | 0.01  | 0.17          | 0.02         | ○ |
| 51   | United Arab Emirates       | 0.63  | 17.51         | 0.57         |   | 115  | Burundi (2012)               | 0.00  | 0.08          | 0.01         | ○ |
| 52   | Malaysia                   | 0.63  | 17.34         | 0.56         |   | 116  | Tajikistan (2013)            | 0.00  | 0.00          | 0.00         | ○ |
| 53   | Cyprus                     | 0.62  | 17.18         | 0.55         |   | n/a  | Armenia                      | n/a   | n/a           | n/a          |   |
| 54   | Albania                    | 0.61  | 16.71         | 0.54         |   | n/a  | Bahrain                      | n/a   | n/a           | n/a          |   |
| 55   | Bulgaria                   | 0.58  | 16.06         | 0.53         |   | n/a  | Jordan                       | n/a   | n/a           | n/a          |   |
| 56   | Israel                     | 0.58  | 15.94         | 0.52         |   | n/a  | Kuwait                       | n/a   | n/a           | n/a          |   |
| 57   | Bolivia, Plurinational St. | 0.57  | 15.61         | 0.51         | ● | n/a  | Nepal                        | n/a   | n/a           | n/a          |   |
| 58   | Honduras                   | 0.55  | 15.06         | 0.50         |   | n/a  | Oman                         | n/a   | n/a           | n/a          |   |
| 59   | Madagascar (2013)          | 0.54  | 15.02         | 0.50         |   | n/a  | Qatar                        | n/a   | n/a           | n/a          |   |
| 60   | Germany                    | 0.54  | 14.99         | 0.49         | ○ | n/a  | Saudi Arabia                 | n/a   | n/a           | n/a          |   |
| 61   | Moldova, Rep.              | 0.52  | 14.41         | 0.48         |   | n/a  | Sri Lanka                    | n/a   | n/a           | n/a          |   |
| 62   | Greece                     | 0.50  | 13.77         | 0.47         |   | n/a  | Trinidad and Tobago          | n/a   | n/a           | n/a          |   |
| 63   | Pakistan                   | 0.49  | 13.63         | 0.46         |   | n/a  | Viet Nam                     | n/a   | n/a           | n/a          |   |
| 64   | Norway                     | 0.47  | 12.91         | 0.45         | ○ |      |                              |       |               |              |   |

SOURCE: World Trade Organization, *Trade in Commercial Services* database, based on the sixth (2009) edition of the International Monetary Fund's *Balance of Payments Manual* and *Balance of Payments* database

NOTE: ● indicates a strength; ○ a weakness



## 5.3.2 High-tech imports

### High-tech net imports (% of total trade) | 2015

| Rank | Country/Economy            | Value | Score (0–100) | Percent rank |   | Rank | Country/Economy            | Value | Score (0–100) | Percent rank |   |
|------|----------------------------|-------|---------------|--------------|---|------|----------------------------|-------|---------------|--------------|---|
| 1    | Hong Kong (China)          | 46.10 | 100.00        | 0.99         | ● | 65   | Ukraine                    | 7.98  | 24.70         | 0.48         |   |
| 1    | Malaysia                   | 24.74 | 100.00        | 0.99         | ● | 66   | United Arab Emirates       | 7.97  | 24.69         | 0.48         |   |
| 3    | Viet Nam                   | 22.58 | 90.27         | 0.98         | ● | 67   | Moldova, Rep.              | 7.77  | 23.76         | 0.47         |   |
| 4    | Ethiopia                   | 22.17 | 88.47         | 0.98         | ● | 68   | Niger (2014)               | 7.62  | 23.10         | 0.46         |   |
| 5    | Singapore                  | 21.41 | 85.05         | 0.97         |   | 69   | Kazakhstan                 | 7.62  | 23.09         | 0.45         |   |
| 6    | China                      | 19.26 | 75.36         | 0.96         |   | 70   | Croatia                    | 7.49  | 22.52         | 0.44         |   |
| 7    | Panama (2011)              | 18.82 | 73.42         | 0.95         | ● | 71   | Honduras (2014)            | 7.46  | 22.41         | 0.44         |   |
| 8    | Colombia                   | 18.68 | 72.79         | 0.94         | ● | 72   | Bulgaria                   | 7.42  | 22.21         | 0.43         |   |
| 9    | Mexico                     | 18.43 | 71.65         | 0.94         | ● | 73   | Malta                      | 7.41  | 22.15         | 0.42         |   |
| 10   | Czech Republic             | 17.74 | 68.54         | 0.93         | ● | 74   | Spain                      | 7.34  | 21.86         | 0.41         | ○ |
| 11   | United States of America   | 17.70 | 68.39         | 0.92         |   | 75   | Morocco                    | 7.34  | 21.83         | 0.40         |   |
| 12   | Thailand                   | 15.65 | 59.15         | 0.91         | ● | 76   | Tanzania, United Rep.      | 7.24  | 21.40         | 0.40         |   |
| 13   | Slovakia                   | 15.62 | 59.01         | 0.90         | ● | 77   | Norway                     | 7.02  | 20.39         | 0.39         | ○ |
| 14   | Korea, Rep.                | 15.19 | 57.10         | 0.90         |   | 78   | Uganda                     | 6.90  | 19.85         | 0.38         |   |
| 15   | Japan                      | 14.87 | 55.65         | 0.89         |   | 79   | Jordan                     | 6.84  | 19.61         | 0.37         |   |
| 16   | Hungary                    | 13.81 | 50.91         | 0.88         | ● | 80   | Iceland                    | 6.82  | 19.51         | 0.36         | ○ |
| 17   | Argentina                  | 13.45 | 49.27         | 0.87         | ● | 81   | Serbia                     | 6.76  | 19.22         | 0.35         |   |
| 18   | Paraguay                   | 13.34 | 48.80         | 0.86         | ● | 82   | Lithuania                  | 6.71  | 19.00         | 0.35         |   |
| 19   | Netherlands                | 12.91 | 46.88         | 0.85         |   | 83   | Greece                     | 6.65  | 18.76         | 0.34         |   |
| 20   | Rwanda                     | 12.78 | 46.29         | 0.85         | ● | 84   | Bosnia and Herzegovina     | 6.52  | 18.18         | 0.33         |   |
| 21   | United Kingdom             | 12.73 | 46.06         | 0.84         |   | 85   | Kyrgyzstan                 | 6.51  | 18.13         | 0.32         |   |
| 22   | Brazil                     | 12.43 | 44.70         | 0.83         | ● | 86   | Denmark                    | 6.47  | 17.92         | 0.31         | ○ |
| 23   | Estonia                    | 12.21 | 43.72         | 0.82         |   | 87   | Portugal                   | 6.45  | 17.86         | 0.31         | ○ |
| 24   | Costa Rica                 | 11.80 | 41.89         | 0.81         |   | 88   | Georgia                    | 6.45  | 17.85         | 0.30         |   |
| 25   | Algeria                    | 11.68 | 41.34         | 0.81         | ● | 89   | TFYR of Macedonia          | 6.43  | 17.78         | 0.29         |   |
| 26   | Germany                    | 11.61 | 41.03         | 0.80         |   | 90   | Montenegro                 | 6.41  | 17.65         | 0.28         |   |
| 27   | New Zealand                | 11.58 | 40.88         | 0.79         |   | 91   | Burkina Faso               | 6.40  | 17.62         | 0.27         |   |
| 28   | Australia                  | 11.49 | 40.47         | 0.78         |   | 92   | Kuwait                     | 6.38  | 17.53         | 0.27         |   |
| 29   | Israel                     | 11.40 | 40.07         | 0.77         |   | 93   | Jamaica                    | 6.02  | 15.92         | 0.26         |   |
| 30   | Nepal                      | 11.38 | 40.01         | 0.77         | ● | 94   | Sri Lanka                  | 6.01  | 15.89         | 0.25         |   |
| 31   | France                     | 11.38 | 39.97         | 0.76         |   | 95   | Namibia (2014)             | 5.99  | 15.78         | 0.24         |   |
| 32   | Canada                     | 11.12 | 38.82         | 0.75         |   | 96   | Brunei Darussalam          | 5.97  | 15.70         | 0.23         |   |
| 33   | Peru                       | 11.10 | 38.71         | 0.74         | ● | 97   | Slovenia                   | 5.95  | 15.62         | 0.23         | ○ |
| 34   | Latvia                     | 10.87 | 37.70         | 0.73         |   | 98   | Madagascar                 | 5.88  | 15.30         | 0.22         |   |
| 35   | Burundi (2014)             | 10.84 | 37.55         | 0.73         | ● | 99   | Dominican Republic         | 5.74  | 14.66         | 0.21         |   |
| 36   | Kenya (2013)               | 10.84 | 37.54         | 0.72         | ● | 100  | Mozambique                 | 5.70  | 14.48         | 0.20         |   |
| 37   | Poland                     | 10.66 | 36.73         | 0.71         |   | 101  | Côte d'Ivoire              | 5.60  | 14.05         | 0.19         |   |
| 38   | Tunisia                    | 10.47 | 35.91         | 0.70         | ● | 102  | Senegal                    | 5.55  | 13.79         | 0.19         |   |
| 39   | Turkey                     | 10.34 | 35.32         | 0.69         |   | 103  | Mongolia                   | 5.45  | 13.37         | 0.18         |   |
| 40   | Chile                      | 10.33 | 35.26         | 0.69         |   | 104  | Bahrain                    | 5.35  | 12.90         | 0.17         |   |
| 41   | Pakistan                   | 10.31 | 35.19         | 0.68         | ● | 105  | Belarus                    | 5.21  | 12.26         | 0.16         | ○ |
| 42   | Belgium                    | 10.29 | 35.11         | 0.67         |   | 106  | Zambia                     | 5.20  | 12.25         | 0.15         |   |
| 43   | Romania                    | 10.25 | 34.93         | 0.66         |   | 107  | Mali (2012)                | 5.12  | 11.87         | 0.15         |   |
| 44   | South Africa               | 9.97  | 33.68         | 0.65         |   | 108  | Cameroon                   | 5.09  | 11.74         | 0.14         |   |
| 45   | Bolivia, Plurinational St. | 9.97  | 33.67         | 0.65         | ● | 109  | Armenia                    | 5.06  | 11.62         | 0.13         |   |
| 46   | El Salvador                | 9.93  | 33.48         | 0.64         | ● | 110  | Trinidad and Tobago (2010) | 4.94  | 11.05         | 0.12         |   |
| 47   | Ecuador                    | 9.72  | 32.52         | 0.63         | ● | 111  | Guinea (2014)              | 4.53  | 9.25          | 0.11         |   |
| 48   | Bangladesh (2011)          | 9.44  | 31.29         | 0.62         | ● | 112  | Yemen (2014)               | 4.51  | 9.11          | 0.10         |   |
| 49   | Guatemala                  | 9.36  | 30.91         | 0.61         | ● | 113  | Qatar                      | 4.41  | 8.69          | 0.10         | ○ |
| 50   | Austria                    | 9.32  | 30.73         | 0.60         |   | 114  | Albania                    | 4.27  | 8.05          | 0.09         | ○ |
| 51   | Sweden                     | 9.30  | 30.63         | 0.60         | ○ | 115  | Iran, Islamic Rep. (2011)  | 4.00  | 6.83          | 0.08         | ○ |
| 52   | India                      | 9.17  | 30.07         | 0.59         |   | 116  | Lebanon (2014)             | 3.84  | 6.14          | 0.07         | ○ |
| 53   | Saudi Arabia               | 9.14  | 29.91         | 0.58         |   | 117  | Botswana                   | 3.70  | 5.50          | 0.06         | ○ |
| 54   | Ireland                    | 8.96  | 29.12         | 0.57         | ○ | 118  | Cyprus                     | 3.54  | 4.80          | 0.06         | ○ |
| 55   | Mauritius                  | 8.86  | 28.68         | 0.56         |   | 119  | Nigeria (2014)             | 3.36  | 3.95          | 0.05         |   |
| 56   | Egypt                      | 8.64  | 27.71         | 0.56         |   | 120  | Oman (2014)                | 3.14  | 2.98          | 0.04         | ○ |
| 57   | Malawi                     | 8.61  | 27.54         | 0.55         | ● | 121  | Azerbaijan                 | 3.11  | 2.83          | 0.03         | ○ |
| 58   | Indonesia                  | 8.54  | 27.22         | 0.54         |   | 122  | Cambodia                   | 2.94  | 2.08          | 0.02         | ○ |
| 59   | Russian Federation         | 8.51  | 27.11         | 0.53         |   | 123  | Togo (2014)                | 2.69  | 0.95          | 0.02         | ○ |
| 60   | Uruguay                    | 8.42  | 26.71         | 0.52         |   | 124  | Benin                      | 2.61  | 0.60          | 0.01         | ○ |
| 61   | Zimbabwe (2014)            | 8.39  | 26.56         | 0.52         | ● | 125  | Luxembourg                 | 2.48  | 0.00          | 0.00         | ○ |
| 62   | Finland                    | 8.16  | 25.53         | 0.51         | ○ | n/a  | Philippines                | n/a   | n/a           | n/a          |   |
| 63   | Switzerland                | 8.16  | 25.52         | 0.50         | ○ | n/a  | Tajikistan                 | n/a   | n/a           | n/a          |   |
| 64   | Italy                      | 8.08  | 25.17         | 0.49         |   |      |                            |       |               |              |   |

SOURCE: United Nations, COMTRADE database; Eurostat, Annex 5: High-tech aggregation by SITC Rev. 4, April 2009

NOTE: ● indicates a strength; ○ a weakness

## 5.3.3 ICT services imports

### Telecommunications, computers, and information services imports (% of total trade) | 2015

| Rank | Country/Economy          | Value | Score (0–100) | Percent rank |   | Rank | Country/Economy              | Value | Score (0–100) | Percent rank |   |
|------|--------------------------|-------|---------------|--------------|---|------|------------------------------|-------|---------------|--------------|---|
| 1    | Cyprus                   | 7.73  | 100.00        | 0.99         | ● | 65   | Bulgaria                     | 1.07  | 19.02         | 0.49         |   |
| 1    | Netherlands              | 5.53  | 100.00        | 0.99         | ● | 66   | Indonesia                    | 1.03  | 18.34         | 0.48         |   |
| 3    | Niger (2014)             | 4.98  | 90.08         | 0.98         | ● | 67   | Malta                        | 0.98  | 17.43         | 0.47         |   |
| 4    | Switzerland              | 3.67  | 66.29         | 0.98         |   | 68   | Philippines                  | 0.97  | 17.20         | 0.46         |   |
| 5    | Finland                  | 3.63  | 65.59         | 0.97         | ● | 69   | Australia                    | 0.96  | 17.15         | 0.46         | ○ |
| 6    | Sweden                   | 3.27  | 58.91         | 0.96         |   | 70   | Canada                       | 0.95  | 16.87         | 0.45         | ○ |
| 7    | Mali (2014)              | 3.12  | 56.30         | 0.95         | ● | 71   | Colombia                     | 0.95  | 16.85         | 0.44         |   |
| 8    | Madagascar (2013)        | 2.90  | 52.19         | 0.94         | ● | 72   | Mozambique                   | 0.95  | 16.85         | 0.43         |   |
| 9    | Luxembourg               | 2.84  | 51.16         | 0.94         |   | 73   | Armenia                      | 0.92  | 16.38         | 0.42         |   |
| 10   | Senegal (2014)           | 2.64  | 47.55         | 0.93         | ● | 74   | Slovakia                     | 0.90  | 15.98         | 0.42         |   |
| 11   | Burundi (2014)           | 2.62  | 47.10         | 0.92         | ● | 75   | Chile (2014)                 | 0.84  | 14.99         | 0.41         |   |
| 12   | Moldova, Rep.            | 2.46  | 44.32         | 0.91         | ● | 76   | Honduras                     | 0.84  | 14.87         | 0.40         |   |
| 13   | Denmark                  | 2.41  | 43.44         | 0.90         |   | 77   | Togo (2014)                  | 0.84  | 14.84         | 0.39         |   |
| 14   | Burkina Faso (2014)      | 2.38  | 42.86         | 0.90         | ● | 78   | India                        | 0.83  | 14.69         | 0.38         |   |
| 15   | Montenegro               | 2.35  | 42.21         | 0.89         | ● | 79   | Bosnia and Herzegovina       | 0.77  | 13.67         | 0.38         |   |
| 16   | Belgium                  | 2.26  | 40.70         | 0.88         |   | 80   | Bolivia, Plurinational St.   | 0.75  | 13.35         | 0.37         |   |
| 17   | France                   | 2.25  | 40.42         | 0.87         |   | 81   | Côte d'Ivoire (2013)         | 0.74  | 13.16         | 0.36         |   |
| 18   | Estonia                  | 2.22  | 39.95         | 0.86         |   | 82   | Kazakhstan                   | 0.72  | 12.79         | 0.35         |   |
| 19   | Sri Lanka                | 2.15  | 38.59         | 0.86         | ● | 83   | Azerbaijan                   | 0.72  | 12.78         | 0.34         |   |
| 20   | Norway                   | 2.12  | 38.19         | 0.85         |   | 84   | Costa Rica                   | 0.72  | 12.78         | 0.34         |   |
| 21   | Iceland                  | 2.11  | 37.92         | 0.84         |   | 85   | Ireland                      | 0.68  | 12.08         | 0.33         | ○ |
| 22   | Israel                   | 2.09  | 37.55         | 0.83         |   | 86   | Egypt (2014)                 | 0.66  | 11.58         | 0.32         |   |
| 23   | Qatar                    | 2.02  | 36.31         | 0.82         |   | 87   | Cambodia                     | 0.66  | 11.56         | 0.31         |   |
| 24   | Austria                  | 1.93  | 34.66         | 0.82         |   | 88   | Lithuania                    | 0.65  | 11.40         | 0.30         | ○ |
| 25   | Slovenia                 | 1.87  | 33.50         | 0.81         |   | 89   | Belarus                      | 0.64  | 11.24         | 0.30         |   |
| 26   | Romania                  | 1.80  | 32.40         | 0.80         | ● | 90   | Kuwait                       | 0.62  | 10.95         | 0.29         |   |
| 27   | United Kingdom           | 1.80  | 32.35         | 0.79         |   | 91   | Kyrgyzstan                   | 0.61  | 10.81         | 0.28         |   |
| 28   | Lebanon (2014)           | 1.75  | 31.46         | 0.78         | ● | 92   | United Arab Emirates         | 0.61  | 10.73         | 0.27         | ○ |
| 29   | Italy                    | 1.75  | 31.34         | 0.78         |   | 93   | Iran, Islamic Rep. (2014)    | 0.61  | 10.65         | 0.26         |   |
| 30   | Germany                  | 1.70  | 30.56         | 0.77         |   | 94   | Nepal (2014)                 | 0.58  | 10.26         | 0.26         |   |
| 31   | Spain                    | 1.68  | 30.06         | 0.76         |   | 95   | Rwanda (2014)                | 0.54  | 9.51          | 0.25         |   |
| 32   | Nigeria                  | 1.67  | 29.97         | 0.75         | ● | 96   | Morocco (2013)               | 0.53  | 9.31          | 0.24         |   |
| 33   | Singapore                | 1.66  | 29.83         | 0.74         |   | 97   | Georgia                      | 0.53  | 9.25          | 0.23         |   |
| 34   | Ethiopia (2012)          | 1.65  | 29.55         | 0.74         | ● | 98   | Botswana (2014)              | 0.52  | 9.11          | 0.22         |   |
| 35   | Russian Federation       | 1.65  | 29.51         | 0.73         |   | 99   | China                        | 0.51  | 8.92          | 0.22         | ○ |
| 36   | Croatia                  | 1.64  | 29.48         | 0.72         |   | 100  | Korea, Rep.                  | 0.47  | 8.15          | 0.21         | ○ |
| 37   | TFYR of Macedonia        | 1.63  | 29.16         | 0.71         |   | 101  | Tajikistan                   | 0.46  | 7.98          | 0.20         |   |
| 38   | Malaysia                 | 1.62  | 29.13         | 0.70         |   | 102  | Cameroon (2013)              | 0.45  | 7.88          | 0.19         |   |
| 39   | Serbia                   | 1.57  | 28.07         | 0.70         |   | 103  | Namibia                      | 0.45  | 7.87          | 0.18         |   |
| 40   | Mongolia                 | 1.56  | 28.00         | 0.69         |   | 104  | El Salvador                  | 0.44  | 7.72          | 0.18         |   |
| 41   | Jamaica                  | 1.51  | 26.97         | 0.68         |   | 105  | Uruguay                      | 0.41  | 7.07          | 0.17         | ○ |
| 42   | Albania                  | 1.49  | 26.75         | 0.67         |   | 106  | Tunisia (2014)               | 0.41  | 7.03          | 0.16         | ○ |
| 43   | Japan                    | 1.48  | 26.43         | 0.66         |   | 107  | Guatemala                    | 0.40  | 6.88          | 0.15         |   |
| 44   | Guinea (2013)            | 1.45  | 26.01         | 0.66         | ● | 108  | Zambia (2014)                | 0.37  | 6.45          | 0.14         |   |
| 45   | Brazil                   | 1.44  | 25.75         | 0.65         |   | 109  | Tanzania, United Rep. (2014) | 0.35  | 6.04          | 0.14         |   |
| 46   | Peru                     | 1.44  | 25.72         | 0.64         |   | 110  | Algeria (2014)               | 0.31  | 5.26          | 0.13         |   |
| 47   | Argentina                | 1.43  | 25.68         | 0.63         |   | 111  | Hong Kong (China) (2014)     | 0.31  | 5.21          | 0.12         | ○ |
| 48   | Yemen (2014)             | 1.41  | 25.30         | 0.62         | ● | 112  | Bahrain (2014)               | 0.30  | 5.10          | 0.11         |   |
| 49   | Saudi Arabia             | 1.36  | 24.31         | 0.62         |   | 113  | Brunei Darussalam (2009)     | 0.27  | 4.58          | 0.10         | ○ |
| 50   | New Zealand              | 1.35  | 24.16         | 0.61         |   | 114  | Panama                       | 0.27  | 4.50          | 0.10         |   |
| 51   | Hungary                  | 1.34  | 24.03         | 0.60         |   | 115  | Dominican Republic (2014)    | 0.26  | 4.43          | 0.09         |   |
| 52   | United States of America | 1.34  | 23.90         | 0.59         |   | 116  | Oman (2014)                  | 0.24  | 4.08          | 0.08         | ○ |
| 53   | Latvia                   | 1.34  | 23.90         | 0.58         |   | 117  | Thailand                     | 0.23  | 3.91          | 0.07         | ○ |
| 54   | Mauritius (2014)         | 1.33  | 23.81         | 0.58         |   | 118  | Zimbabwe (2012)              | 0.19  | 3.17          | 0.06         |   |
| 55   | Benin (2014)             | 1.32  | 23.62         | 0.57         | ● | 119  | Bangladesh (2014)            | 0.14  | 2.25          | 0.06         |   |
| 56   | Ukraine                  | 1.30  | 23.30         | 0.56         |   | 120  | Kenya (2014)                 | 0.14  | 2.23          | 0.05         | ○ |
| 57   | Uganda                   | 1.30  | 23.16         | 0.55         |   | 121  | Turkey                       | 0.10  | 1.40          | 0.04         | ○ |
| 58   | Portugal                 | 1.23  | 22.05         | 0.54         |   | 122  | Trinidad and Tobago (2011)   | 0.05  | 0.60          | 0.03         | ○ |
| 59   | Malawi (2014)            | 1.21  | 21.63         | 0.54         | ● | 123  | Viet Nam (2014)              | 0.05  | 0.58          | 0.02         | ○ |
| 60   | Poland                   | 1.19  | 21.23         | 0.53         |   | 124  | Ecuador                      | 0.04  | 0.41          | 0.02         | ○ |
| 61   | Pakistan                 | 1.12  | 19.95         | 0.52         | ● | 125  | Mexico                       | 0.04  | 0.35          | 0.01         | ○ |
| 62   | Czech Republic           | 1.11  | 19.84         | 0.51         |   | 126  | Paraguay                     | 0.02  | 0.00          | 0.00         | ○ |
| 63   | South Africa             | 1.07  | 19.05         | 0.50         |   | n/a  | Jordan                       | n/a   | n/a           | n/a          |   |
| 64   | Greece                   | 1.07  | 19.02         | 0.50         |   |      |                              |       |               |              |   |

SOURCE: World Trade Organization, *Trade in Commercial Services* database, based on the sixth (2009) edition of the International Monetary Fund's *Balance of Payments Manual* and *Balance of Payments* database

NOTE: ● indicates a strength; ○ a weakness

# 5.3.4 Foreign direct investment net inflows

## Foreign direct investment (FDI), net inflows (% of GDP, three-year average) | 2015

| Rank | Country/Economy            | Value | Score (0–100) | Percent rank |   | Rank | Country/Economy          | Value | Score (0–100) | Percent rank |   |
|------|----------------------------|-------|---------------|--------------|---|------|--------------------------|-------|---------------|--------------|---|
| 1    | Hong Kong (China)          | 43.65 | 100.00        | 1.00         | ● | 65   | Spain                    | 2.84  | 53.50         | 0.49         |   |
| 2    | Ireland                    | 42.15 | 99.18         | 0.99         | ● | 66   | Armenia                  | 2.76  | 53.26         | 0.48         |   |
| 3    | Mozambique                 | 32.47 | 93.19         | 0.98         | ● | 67   | United Arab Emirates     | 2.70  | 53.06         | 0.48         |   |
| 4    | Luxembourg                 | 28.68 | 90.42         | 0.98         | ● | 68   | China                    | 2.62  | 52.80         | 0.47         |   |
| 5    | Singapore                  | 22.22 | 84.91         | 0.97         |   | 69   | Estonia                  | 2.61  | 52.76         | 0.46         | ○ |
| 6    | Netherlands                | 21.01 | 83.73         | 0.96         | ● | 70   | Indonesia                | 2.57  | 52.64         | 0.45         |   |
| 7    | Montenegro                 | 12.79 | 73.99         | 0.95         | ● | 71   | Togo                     | 2.50  | 52.44         | 0.44         | ● |
| 8    | Kyrgyzstan                 | 10.26 | 70.09         | 0.94         | ● | 72   | Mauritius                | 2.49  | 52.39         | 0.44         |   |
| 9    | Panama                     | 10.13 | 69.88         | 0.94         | ● | 73   | Thailand                 | 2.43  | 52.21         | 0.43         |   |
| 10   | Malta                      | 9.51  | 68.81         | 0.93         |   | 74   | Senegal                  | 2.42  | 52.18         | 0.42         |   |
| 11   | Cambodia                   | 9.48  | 68.76         | 0.92         | ● | 75   | TFYR of Macedonia        | 2.40  | 52.10         | 0.41         |   |
| 12   | Georgia                    | 9.26  | 68.37         | 0.91         | ● | 76   | Poland                   | 2.24  | 51.58         | 0.40         |   |
| 13   | Albania                    | 9.07  | 68.03         | 0.90         | ● | 77   | Tunisia                  | 2.23  | 51.53         | 0.40         |   |
| 14   | Niger                      | 8.90  | 67.72         | 0.90         | ● | 78   | Ukraine                  | 2.15  | 51.28         | 0.39         |   |
| 15   | Malawi                     | 8.74  | 67.44         | 0.89         | ● | 79   | Romania                  | 2.13  | 51.18         | 0.38         |   |
| 16   | Chile                      | 8.04  | 66.11         | 0.88         | ● | 80   | Bosnia and Herzegovina   | 2.12  | 51.17         | 0.37         |   |
| 17   | Trinidad and Tobago        | 7.97  | 65.99         | 0.87         | ● | 81   | Guatemala                | 2.11  | 51.14         | 0.37         |   |
| 18   | Zambia                     | 6.84  | 63.69         | 0.87         | ● | 82   | Slovenia                 | 2.07  | 50.99         | 0.36         | ○ |
| 19   | Mongolia                   | 6.65  | 63.28         | 0.86         | ● | 83   | United Kingdom           | 2.05  | 50.92         | 0.35         | ○ |
| 20   | Namibia                    | 6.36  | 62.66         | 0.85         | ● | 84   | Cameroon                 | 1.92  | 50.48         | 0.34         |   |
| 21   | Honduras                   | 6.31  | 62.56         | 0.84         | ● | 85   | Turkey                   | 1.81  | 50.09         | 0.33         |   |
| 22   | Costa Rica                 | 5.97  | 61.78         | 0.83         | ● | 86   | Philippines              | 1.80  | 50.04         | 0.33         |   |
| 23   | Lebanon                    | 5.81  | 61.41         | 0.83         | ● | 87   | India                    | 1.77  | 49.94         | 0.32         |   |
| 24   | Azerbaijan                 | 5.69  | 61.15         | 0.82         | ● | 88   | Egypt                    | 1.71  | 49.74         | 0.31         |   |
| 25   | Switzerland                | 5.61  | 60.95         | 0.81         |   | 89   | El Salvador              | 1.68  | 49.62         | 0.30         |   |
| 26   | Viet Nam                   | 5.41  | 60.48         | 0.80         | ● | 90   | United States of America | 1.65  | 49.52         | 0.29         | ○ |
| 27   | Serbia                     | 5.12  | 59.78         | 0.79         | ● | 91   | Bangladesh               | 1.65  | 49.50         | 0.29         |   |
| 28   | Jamaica                    | 4.86  | 59.12         | 0.79         | ● | 92   | Lithuania                | 1.64  | 49.49         | 0.28         | ○ |
| 29   | Jordan                     | 4.79  | 58.97         | 0.78         | ● | 93   | Argentina                | 1.59  | 49.32         | 0.27         |   |
| 30   | Madagascar                 | 4.65  | 58.59         | 0.77         | ● | 94   | Russian Federation       | 1.55  | 49.17         | 0.26         | ○ |
| 31   | Iceland                    | 4.61  | 58.50         | 0.76         |   | 95   | Mali                     | 1.54  | 49.13         | 0.25         |   |
| 32   | Tanzania, United Rep.      | 4.42  | 57.99         | 0.75         | ● | 96   | Kenya                    | 1.49  | 48.95         | 0.25         |   |
| 33   | Peru                       | 4.23  | 57.49         | 0.75         | ● | 97   | Guinea                   | 1.49  | 48.93         | 0.24         | ● |
| 34   | Cyprus                     | 4.22  | 57.49         | 0.74         |   | 98   | South Africa             | 1.46  | 48.83         | 0.23         | ○ |
| 35   | Colombia                   | 4.20  | 57.42         | 0.73         |   | 99   | Hungary                  | 1.36  | 48.46         | 0.22         | ○ |
| 36   | Uganda                     | 4.01  | 56.92         | 0.72         | ● | 100  | Côte d'Ivoire            | 1.31  | 48.27         | 0.21         |   |
| 37   | Uruguay                    | 4.00  | 56.89         | 0.71         | ● | 101  | Saudi Arabia             | 1.17  | 47.73         | 0.21         | ○ |
| 38   | Finland                    | 3.95  | 56.74         | 0.71         |   | 102  | Germany                  | 1.10  | 47.44         | 0.20         | ○ |
| 39   | Moldova, Rep.              | 3.86  | 56.50         | 0.70         |   | 103  | Sri Lanka                | 1.07  | 47.32         | 0.19         |   |
| 40   | Rwanda                     | 3.70  | 56.05         | 0.69         | ● | 104  | Greece                   | 0.99  | 47.00         | 0.18         | ○ |
| 41   | Brazil                     | 3.68  | 55.99         | 0.68         |   | 105  | Paraguay                 | 0.97  | 46.93         | 0.17         |   |
| 42   | Canada                     | 3.68  | 55.99         | 0.67         |   | 106  | Ecuador                  | 0.86  | 46.50         | 0.17         |   |
| 43   | Kazakhstan                 | 3.67  | 55.96         | 0.67         |   | 107  | Nigeria                  | 0.85  | 46.46         | 0.16         |   |
| 44   | Bulgaria                   | 3.63  | 55.86         | 0.66         |   | 108  | France                   | 0.84  | 46.44         | 0.15         | ○ |
| 45   | Benin                      | 3.62  | 55.83         | 0.65         | ● | 109  | Italy                    | 0.81  | 46.29         | 0.14         | ○ |
| 46   | Portugal                   | 3.62  | 55.82         | 0.64         |   | 110  | Sweden                   | 0.67  | 45.71         | 0.13         | ○ |
| 47   | Malaysia                   | 3.45  | 55.32         | 0.63         |   | 111  | Korea, Rep.              | 0.67  | 45.71         | 0.13         | ○ |
| 48   | Israel                     | 3.42  | 55.25         | 0.63         |   | 112  | Slovakia                 | 0.66  | 45.68         | 0.12         | ○ |
| 49   | Tajikistan                 | 3.42  | 55.23         | 0.62         | ● | 113  | Pakistan                 | 0.57  | 45.29         | 0.11         |   |
| 50   | Morocco                    | 3.20  | 54.59         | 0.61         |   | 114  | Austria                  | 0.55  | 45.20         | 0.10         | ○ |
| 51   | Latvia                     | 3.19  | 54.55         | 0.60         |   | 115  | Iran, Islamic Rep.       | 0.55  | 45.19         | 0.10         |   |
| 52   | Dominican Republic         | 3.18  | 54.53         | 0.60         | ● | 116  | New Zealand              | 0.51  | 45.05         | 0.09         | ○ |
| 53   | Australia                  | 3.17  | 54.50         | 0.59         |   | 117  | Kuwait                   | 0.46  | 44.82         | 0.08         | ○ |
| 54   | Ethiopia                   | 3.12  | 54.35         | 0.58         | ● | 118  | Algeria                  | 0.42  | 44.67         | 0.07         |   |
| 55   | Bolivia, Plurinational St. | 3.00  | 53.99         | 0.57         | ● | 119  | Bahrain                  | 0.40  | 44.58         | 0.06         | ○ |
| 56   | Brunei Darussalam          | 2.98  | 53.94         | 0.56         |   | 120  | Nepal                    | 0.26  | 43.95         | 0.06         | ○ |
| 57   | Croatia                    | 2.96  | 53.87         | 0.56         |   | 121  | Qatar                    | 0.24  | 43.88         | 0.05         | ○ |
| 58   | Zimbabwe                   | 2.95  | 53.85         | 0.55         | ● | 122  | Japan                    | 0.20  | 43.66         | 0.04         | ○ |
| 59   | Czech Republic             | 2.91  | 53.73         | 0.54         |   | 123  | Denmark                  | 0.04  | 42.95         | 0.03         | ○ |
| 60   | Botswana                   | 2.89  | 53.65         | 0.53         |   | 124  | Oman                     | 0.02  | 42.84         | 0.02         | ○ |
| 61   | Mexico                     | 2.87  | 53.58         | 0.52         |   | 125  | Norway                   | 0.00  | 42.79         | 0.02         | ○ |
| 62   | Burkina Faso               | 2.86  | 53.57         | 0.52         | ● | 126  | Yemen                    | -0.30 | 41.31         | 0.01         |   |
| 63   | Belarus                    | 2.85  | 53.53         | 0.51         |   | 127  | Belgium                  | -4.55 | 0.00          | 0.00         | ○ |
| 64   | Burundi                    | 2.85  | 53.53         | 0.50         |   |      |                          |       |               |              |   |

SOURCE: International Monetary Fund, *International Financial Statistics* and *Balance of Payments* databases, World Bank, *International Debt Statistics*, and World Bank and OECD GDP estimates; extracted from the World Bank's *World Development Indicators* database

NOTE: ● indicates a strength; ○ a weakness

## 5.3.5 Research talent in business enterprise

### Researchers in business enterprise, per thousand population (%) | 2015

| Rank | Country/Economy                 | Value | Score (0–100) | Percent rank |   | Rank | Country/Economy                   | Value | Score (0–100) | Percent rank |   |
|------|---------------------------------|-------|---------------|--------------|---|------|-----------------------------------|-------|---------------|--------------|---|
| 1    | Israel (2012)                   | 83.68 | 100.00        | 1.00         | ● | 65   | Oman                              | 10.58 | 12.56         | 0.24         |   |
| 2    | Korea, Rep.                     | 79.71 | 95.25         | 0.99         | ● | 66   | Malaysia (2014)                   | 10.25 | 12.16         | 0.23         | ○ |
| 3    | Japan                           | 73.44 | 87.74         | 0.98         | ● | 67   | Serbia                            | 9.59  | 11.37         | 0.21         |   |
| 4    | United States of America (2014) | 71.01 | 84.84         | 0.96         |   | 68   | Moldova, Rep.                     | 7.65  | 9.04          | 0.20         |   |
| 5    | Costa Rica (2011)               | 69.18 | 82.65         | 0.95         | ● | 69   | Morocco (2014)                    | 7.52  | 8.89          | 0.19         | ○ |
| 6    | Sweden                          | 68.56 | 81.91         | 0.94         |   | 70   | Namibia (2014)                    | 6.95  | 8.21          | 0.18         |   |
| 7    | Austria                         | 63.70 | 76.10         | 0.93         | ● | 71   | Bosnia and Herzegovina            | 6.51  | 7.68          | 0.17         |   |
| 8    | Philippines (2013)              | 63.21 | 75.51         | 0.92         | ● | 72   | Argentina (2014)                  | 6.20  | 7.32          | 0.15         |   |
| 9    | China                           | 62.67 | 74.86         | 0.90         |   | 73   | Egypt                             | 5.44  | 6.40          | 0.14         |   |
| 10   | United Arab Emirates            | 60.88 | 72.72         | 0.89         |   | 74   | Zambia (2008)                     | 4.85  | 5.70          | 0.13         |   |
| 11   | France (2014)                   | 60.52 | 72.29         | 0.88         |   | 75   | Tunisia                           | 4.01  | 4.70          | 0.12         | ○ |
| 12   | Hungary                         | 59.35 | 70.90         | 0.87         | ● | 76   | Malawi (2007)                     | 1.73  | 1.96          | 0.11         |   |
| 13   | Netherlands                     | 59.08 | 70.57         | 0.86         |   | 77   | Botswana (2013)                   | 1.05  | 1.15          | 0.10         | ○ |
| 14   | Malta                           | 58.02 | 69.30         | 0.85         |   | 78   | Uruguay                           | 0.94  | 1.03          | 0.08         | ○ |
| 15   | Denmark                         | 58.02 | 69.30         | 0.83         |   | 79   | Panama (2008)                     | 0.86  | 0.93          | 0.07         | ○ |
| 16   | Finland                         | 56.77 | 67.80         | 0.82         |   | 80   | Colombia (2014)                   | 0.63  | 0.65          | 0.06         | ○ |
| 17   | Germany                         | 56.51 | 67.49         | 0.81         |   | 81   | Ethiopia (2013)                   | 0.48  | 0.48          | 0.05         |   |
| 18   | Canada (2013)                   | 56.01 | 66.90         | 0.80         |   | 82   | Bahrain (2014)                    | 0.41  | 0.38          | 0.04         | ○ |
| 19   | Ireland                         | 53.82 | 64.27         | 0.79         |   | 83   | Bolivia, Plurinational St. (2010) | 0.36  | 0.33          | 0.02         | ○ |
| 20   | Slovenia                        | 53.05 | 63.36         | 0.77         |   | 84   | Mozambique                        | 0.30  | 0.26          | 0.01         | ○ |
| 21   | Thailand                        | 50.89 | 60.77         | 0.76         |   | 85   | Senegal (2010)                    | 0.09  | 0.00          | 0.00         | ○ |
| 22   | Uganda (2010)                   | 50.61 | 60.43         | 0.75         | ● | n/a  | Albania                           | n/a   | n/a           | n/a          |   |
| 23   | Singapore (2014)                | 50.51 | 60.32         | 0.74         |   | n/a  | Algeria                           | n/a   | n/a           | n/a          |   |
| 24   | Czech Republic                  | 50.32 | 60.09         | 0.73         |   | n/a  | Armenia                           | n/a   | n/a           | n/a          |   |
| 25   | Norway                          | 49.44 | 59.03         | 0.71         |   | n/a  | Azerbaijan                        | n/a   | n/a           | n/a          |   |
| 26   | Mali (2010)                     | 49.04 | 58.56         | 0.70         | ● | n/a  | Bangladesh                        | n/a   | n/a           | n/a          |   |
| 27   | Belgium                         | 48.28 | 57.65         | 0.69         |   | n/a  | Belarus                           | n/a   | n/a           | n/a          |   |
| 28   | Turkey (2014)                   | 46.67 | 55.73         | 0.68         |   | n/a  | Benin                             | n/a   | n/a           | n/a          |   |
| 29   | Russian Federation              | 46.44 | 55.45         | 0.67         |   | n/a  | Brunei Darussalam                 | n/a   | n/a           | n/a          |   |
| 30   | Switzerland (2012)              | 46.16 | 55.12         | 0.65         |   | n/a  | Burkina Faso                      | n/a   | n/a           | n/a          |   |
| 31   | Iceland                         | 41.81 | 49.91         | 0.64         |   | n/a  | Burundi                           | n/a   | n/a           | n/a          |   |
| 32   | Hong Kong (China) (2014)        | 40.86 | 48.78         | 0.63         |   | n/a  | Cambodia                          | n/a   | n/a           | n/a          |   |
| 33   | India (2010)                    | 38.73 | 46.22         | 0.62         |   | n/a  | Cameroon                          | n/a   | n/a           | n/a          |   |
| 34   | Italy                           | 38.62 | 46.10         | 0.61         |   | n/a  | Côte d'Ivoire                     | n/a   | n/a           | n/a          |   |
| 35   | Bulgaria                        | 38.60 | 46.07         | 0.60         |   | n/a  | Dominican Republic                | n/a   | n/a           | n/a          |   |
| 36   | United Kingdom                  | 38.16 | 45.55         | 0.58         | ○ | n/a  | El Salvador                       | n/a   | n/a           | n/a          |   |
| 37   | Spain                           | 36.88 | 44.01         | 0.57         |   | n/a  | Georgia                           | n/a   | n/a           | n/a          |   |
| 38   | Luxembourg                      | 36.01 | 42.97         | 0.56         |   | n/a  | Guatemala                         | n/a   | n/a           | n/a          |   |
| 39   | Indonesia (2009)                | 35.54 | 42.41         | 0.55         |   | n/a  | Guinea                            | n/a   | n/a           | n/a          |   |
| 40   | Poland                          | 34.80 | 41.53         | 0.54         |   | n/a  | Honduras                          | n/a   | n/a           | n/a          |   |
| 41   | New Zealand (2013)              | 34.08 | 40.66         | 0.52         |   | n/a  | Jamaica                           | n/a   | n/a           | n/a          |   |
| 42   | Ukraine                         | 32.52 | 38.79         | 0.51         |   | n/a  | Jordan                            | n/a   | n/a           | n/a          |   |
| 43   | Sri Lanka (2013)                | 30.67 | 36.58         | 0.50         |   | n/a  | Kazakhstan                        | n/a   | n/a           | n/a          |   |
| 44   | Portugal                        | 28.96 | 34.54         | 0.49         |   | n/a  | Kuwait                            | n/a   | n/a           | n/a          |   |
| 45   | Qatar (2012)                    | 27.97 | 33.35         | 0.48         |   | n/a  | Kyrgyzstan                        | n/a   | n/a           | n/a          |   |
| 46   | Australia (2010)                | 27.87 | 33.24         | 0.46         | ○ | n/a  | Lebanon                           | n/a   | n/a           | n/a          |   |
| 47   | Estonia                         | 27.52 | 32.82         | 0.45         | ○ | n/a  | Madagascar                        | n/a   | n/a           | n/a          |   |
| 48   | Chile                           | 27.37 | 32.64         | 0.44         |   | n/a  | Mauritius                         | n/a   | n/a           | n/a          |   |
| 49   | Brazil (2010)                   | 25.94 | 30.93         | 0.43         |   | n/a  | Mongolia                          | n/a   | n/a           | n/a          |   |
| 50   | Mexico (2013)                   | 24.48 | 29.18         | 0.42         |   | n/a  | Nepal                             | n/a   | n/a           | n/a          |   |
| 51   | Romania                         | 24.25 | 28.91         | 0.40         |   | n/a  | Niger                             | n/a   | n/a           | n/a          |   |
| 52   | Lithuania                       | 22.71 | 27.06         | 0.39         |   | n/a  | Nigeria                           | n/a   | n/a           | n/a          |   |
| 53   | Cyprus                          | 21.51 | 25.63         | 0.38         |   | n/a  | Pakistan                          | n/a   | n/a           | n/a          |   |
| 54   | Viet Nam (2013)                 | 21.06 | 25.09         | 0.37         |   | n/a  | Paraguay                          | n/a   | n/a           | n/a          |   |
| 55   | South Africa (2013)             | 19.40 | 23.11         | 0.36         |   | n/a  | Peru                              | n/a   | n/a           | n/a          |   |
| 56   | Slovakia                        | 19.36 | 23.06         | 0.35         |   | n/a  | Rwanda                            | n/a   | n/a           | n/a          |   |
| 57   | Montenegro (2014)               | 19.00 | 22.63         | 0.33         |   | n/a  | Saudi Arabia                      | n/a   | n/a           | n/a          |   |
| 58   | Croatia                         | 16.73 | 19.91         | 0.32         |   | n/a  | Tajikistan                        | n/a   | n/a           | n/a          |   |
| 59   | Latvia                          | 16.72 | 19.90         | 0.31         | ○ | n/a  | Tanzania, United Rep.             | n/a   | n/a           | n/a          |   |
| 60   | Iran, Islamic Rep. (2008)       | 14.96 | 17.80         | 0.30         |   | n/a  | Togo                              | n/a   | n/a           | n/a          |   |
| 61   | Ecuador (2008)                  | 14.95 | 17.78         | 0.29         |   | n/a  | Trinidad and Tobago               | n/a   | n/a           | n/a          |   |
| 62   | Greece                          | 14.34 | 17.05         | 0.27         | ○ | n/a  | Yemen                             | n/a   | n/a           | n/a          |   |
| 63   | TFYR of Macedonia (2014)        | 11.70 | 13.89         | 0.26         |   | n/a  | Zimbabwe                          | n/a   | n/a           | n/a          |   |
| 64   | Kenya (2010)                    | 11.41 | 13.55         | 0.25         |   |      |                                   |       |               |              |   |

SOURCE: UNESCO Institute for Statistics, *UIS online database*

NOTE: ● indicates a strength; ○ a weakness

# 6.1.1

## Patent applications by origin

Number of resident patent applications filed at a given national or regional patent office (per billion PPP\$ GDP) | 2015

| Rank | Country/Economy               | Value | Score (0–100) | Percent rank |   | Rank | Country/Economy                   | Value | Score (0–100) | Percent rank |   |
|------|-------------------------------|-------|---------------|--------------|---|------|-----------------------------------|-------|---------------|--------------|---|
| 1    | China                         | 49.16 | 100.00        | 0.98         | ● | 65   | Kenya                             | 0.96  | 5.11          | 0.48         |   |
| 1    | Germany                       | 18.71 | 100.00        | 0.98         | ● | 66   | Thailand (2014)                   | 0.94  | 5.00          | 0.47         |   |
| 1    | Japan                         | 53.44 | 100.00        | 0.98         | ● | 67   | Morocco                           | 0.82  | 4.33          | 0.46         |   |
| 1    | Korea, Rep.                   | 90.26 | 100.00        | 0.98         | ● | 68   | Brunei Darussalam (2014)          | 0.79  | 4.17          | 0.46         |   |
| 5    | Switzerland                   | 17.74 | 94.85         | 0.97         |   | 69   | Egypt (2014)                      | 0.75  | 3.99          | 0.45         |   |
| 6    | United States of America      | 15.99 | 85.44         | 0.96         |   | 70   | Mozambique                        | 0.72  | 3.81          | 0.44         | ● |
| 7    | Finland                       | 14.63 | 78.20         | 0.95         |   | 71   | Argentina                         | 0.62  | 3.26          | 0.43         |   |
| 8    | Denmark                       | 13.09 | 69.97         | 0.94         |   | 72   | Mexico                            | 0.61  | 3.23          | 0.42         |   |
| 9    | Sweden                        | 12.37 | 66.11         | 0.93         |   | 73   | Hong Kong (China)                 | 0.57  | 3.03          | 0.41         | ○ |
| 10   | Netherlands                   | 11.06 | 59.12         | 0.93         |   | 74   | Saudi Arabia                      | 0.54  | 2.86          | 0.41         |   |
| 11   | Austria                       | 10.37 | 55.41         | 0.92         | ● | 75   | Philippines                       | 0.50  | 2.66          | 0.40         |   |
| 12   | Iran, Islamic Rep. (2014)     | 10.07 | 53.81         | 0.91         | ● | 76   | Jordan                            | 0.50  | 2.61          | 0.39         |   |
| 13   | Luxembourg                    | 9.68  | 51.70         | 0.90         |   | 77   | Colombia                          | 0.48  | 2.54          | 0.38         |   |
| 14   | France                        | 9.41  | 50.28         | 0.89         |   | 78   | Albania                           | 0.43  | 2.25          | 0.37         |   |
| 15   | Russian Federation            | 7.94  | 42.41         | 0.89         | ● | 79   | Senegal                           | 0.41  | 2.14          | 0.37         |   |
| 16   | United Kingdom                | 7.37  | 39.35         | 0.88         |   | 80   | Paraguay (2010)                   | 0.41  | 2.13          | 0.36         |   |
| 17   | New Zealand                   | 7.05  | 37.66         | 0.87         |   | 81   | Indonesia                         | 0.37  | 1.95          | 0.35         |   |
| 18   | Ukraine                       | 6.68  | 35.66         | 0.86         | ● | 82   | Cameroon                          | 0.37  | 1.95          | 0.34         |   |
| 19   | Kyrgyzstan                    | 6.36  | 33.96         | 0.85         | ● | 83   | Uruguay                           | 0.36  | 1.87          | 0.33         |   |
| 20   | Belgium                       | 6.04  | 32.25         | 0.85         |   | 84   | Zimbabwe                          | 0.32  | 1.68          | 0.33         |   |
| 21   | Malta                         | 6.01  | 32.10         | 0.84         |   | 85   | Niger                             | 0.32  | 1.65          | 0.32         |   |
| 22   | Iceland                       | 5.60  | 29.89         | 0.83         |   | 86   | Côte d'Ivoire                     | 0.30  | 1.57          | 0.31         |   |
| 23   | Poland                        | 5.21  | 27.84         | 0.82         | ● | 87   | Malawi                            | 0.29  | 1.53          | 0.30         |   |
| 24   | Norway                        | 4.66  | 24.90         | 0.81         |   | 88   | Togo (2014)                       | 0.29  | 1.53          | 0.29         |   |
| 25   | Armenia                       | 4.53  | 24.18         | 0.80         | ● | 89   | Jamaica                           | 0.28  | 1.48          | 0.28         |   |
| 26   | Israel                        | 4.50  | 24.05         | 0.80         |   | 90   | Mali (2014)                       | 0.27  | 1.41          | 0.28         |   |
| 27   | Belarus                       | 4.23  | 22.59         | 0.79         | ● | 91   | Rwanda                            | 0.24  | 1.27          | 0.27         |   |
| 28   | Portugal                      | 3.66  | 19.54         | 0.78         |   | 92   | Zambia (2014)                     | 0.23  | 1.21          | 0.26         |   |
| 29   | Turkey                        | 3.63  | 19.39         | 0.77         |   | 93   | Costa Rica                        | 0.23  | 1.17          | 0.25         |   |
| 30   | Moldova, Rep.                 | 3.57  | 19.04         | 0.76         |   | 94   | Burkina Faso                      | 0.23  | 1.17          | 0.24         |   |
| 31   | Latvia                        | 3.37  | 17.98         | 0.76         |   | 95   | Pakistan                          | 0.22  | 1.16          | 0.24         |   |
| 32   | Czech Republic                | 3.23  | 17.25         | 0.75         |   | 96   | Benin                             | 0.22  | 1.13          | 0.23         |   |
| 33   | Singapore                     | 3.11  | 16.58         | 0.74         |   | 97   | Peru                              | 0.17  | 0.88          | 0.22         |   |
| 34   | Mongolia                      | 3.01  | 16.08         | 0.73         |   | 98   | Panama                            | 0.16  | 0.82          | 0.21         |   |
| 35   | Kazakhstan                    | 2.89  | 15.40         | 0.72         |   | 99   | Nepal                             | 0.16  | 0.80          | 0.20         |   |
| 36   | Georgia                       | 2.77  | 14.80         | 0.72         |   | 100  | Bahrain                           | 0.16  | 0.79          | 0.20         |   |
| 37   | Ireland                       | 2.74  | 14.60         | 0.71         |   | 101  | Algeria                           | 0.15  | 0.78          | 0.19         |   |
| 38   | Spain                         | 2.67  | 14.24         | 0.70         |   | 102  | Dominican Republic                | 0.14  | 0.71          | 0.18         |   |
| 39   | Canada                        | 2.62  | 13.96         | 0.69         |   | 103  | El Salvador                       | 0.13  | 0.67          | 0.17         |   |
| 40   | Hungary                       | 2.58  | 13.75         | 0.68         |   | 104  | Bolivia, Plurinational St. (2014) | 0.13  | 0.65          | 0.16         |   |
| 41   | Romania                       | 2.43  | 12.96         | 0.67         |   | 105  | Botswana (2014)                   | 0.12  | 0.58          | 0.15         |   |
| 42   | Montenegro                    | 2.31  | 12.30         | 0.67         |   | 106  | Uganda                            | 0.11  | 0.56          | 0.15         |   |
| 43   | Bulgaria                      | 2.28  | 12.17         | 0.66         |   | 107  | Honduras                          | 0.10  | 0.48          | 0.14         |   |
| 44   | Greece                        | 2.23  | 11.90         | 0.65         |   | 108  | Madagascar                        | 0.08  | 0.41          | 0.13         |   |
| 45   | Australia                     | 2.01  | 10.70         | 0.64         |   | 109  | Tajikistan                        | 0.08  | 0.41          | 0.12         |   |
| 46   | Croatia                       | 1.95  | 10.39         | 0.63         |   | 110  | Bangladesh                        | 0.07  | 0.34          | 0.11         |   |
| 47   | Serbia                        | 1.86  | 9.92          | 0.63         |   | 111  | Trinidad and Tobago               | 0.07  | 0.32          | 0.11         |   |
| 48   | Slovenia                      | 1.85  | 9.85          | 0.62         |   | 112  | Yemen                             | 0.07  | 0.31          | 0.10         |   |
| 49   | Italy                         | 1.83  | 9.76          | 0.61         |   | 113  | Guinea                            | 0.07  | 0.31          | 0.09         |   |
| 50   | Slovakia                      | 1.72  | 9.14          | 0.60         |   | 114  | United Arab Emirates              | 0.06  | 0.30          | 0.08         | ○ |
| 51   | Lithuania                     | 1.70  | 9.03          | 0.59         |   | 115  | Guatemala                         | 0.06  | 0.26          | 0.07         |   |
| 52   | Estonia                       | 1.65  | 8.77          | 0.59         |   | 116  | Nigeria (2013)                    | 0.05  | 0.24          | 0.07         |   |
| 53   | India                         | 1.57  | 8.37          | 0.58         |   | 117  | Mauritius                         | 0.04  | 0.18          | 0.06         | ○ |
| 54   | Malaysia                      | 1.56  | 8.28          | 0.57         |   | 118  | Cambodia (2014)                   | 0.04  | 0.17          | 0.05         | ○ |
| 55   | Cyprus                        | 1.53  | 8.14          | 0.56         |   | 119  | TFYR of Macedonia (2014)          | 0.04  | 0.15          | 0.04         | ○ |
| 56   | Brazil                        | 1.45  | 7.72          | 0.55         |   | 120  | Qatar                             | 0.03  | 0.13          | 0.03         | ○ |
| 57   | Tunisia                       | 1.41  | 7.53          | 0.54         |   | 121  | Ecuador (2010)                    | 0.03  | 0.12          | 0.02         | ○ |
| 58   | Lebanon                       | 1.32  | 7.03          | 0.54         |   | 122  | Oman                              | 0.02  | 0.09          | 0.02         | ○ |
| 59   | Azerbaijan                    | 1.30  | 6.92          | 0.53         |   | 123  | Kuwait                            | 0.02  | 0.05          | 0.01         | ○ |
| 60   | South Africa                  | 1.22  | 6.51          | 0.52         |   | 124  | Tanzania, United Rep.             | 0.01  | 0.00          | 0.00         | ○ |
| 61   | Viet Nam                      | 1.05  | 5.58          | 0.51         |   | n/a  | Burundi                           | n/a   | n/a           | n/a          |   |
| 62   | Bosnia and Herzegovina (2014) | 1.05  | 5.57          | 0.50         |   | n/a  | Ethiopia                          | n/a   | n/a           | n/a          |   |
| 63   | Chile                         | 1.05  | 5.56          | 0.50         |   | n/a  | Namibia                           | n/a   | n/a           | n/a          |   |
| 64   | Sri Lanka                     | 0.98  | 5.18          | 0.49         |   |      |                                   |       |               |              |   |

SOURCE: World Intellectual Property Organization, *Intellectual Property Statistics*; International Monetary Fund, *World Economic Outlook Database*, October 2016 (PPPS GDP)

NOTE: ● Indicates a strength; ○ a weakness

# 6.1.2 PCT international applications by origin

Number of international patent applications filed by residents at the Patent Cooperation Treaty (per billion PPP\$ GDP) | 2016

| Rank | Country/Economy          | Value | Score (0–100) | Percent rank |   | Rank | Country/Economy              | Value | Score (0–100) | Percent rank |   |
|------|--------------------------|-------|---------------|--------------|---|------|------------------------------|-------|---------------|--------------|---|
| 1    | Japan                    | 9.17  | 100.00        | 0.97         | ● | 65   | Romania                      | 0.10  | 1.23          | 0.38         |   |
| 1    | Korea, Rep.              | 8.07  | 100.00        | 0.97         | ● | 66   | Bosnia and Herzegovina       | 0.09  | 1.21          | 0.37         |   |
| 1    | Sweden                   | 7.47  | 100.00        | 0.97         | ● | 67   | Bahrain                      | 0.09  | 1.16          | 0.36         |   |
| 1    | Switzerland              | 8.83  | 100.00        | 0.97         | ● | 68   | Namibia                      | 0.07  | 0.94          | 0.35         |   |
| 5    | Luxembourg               | 7.34  | 98.25         | 0.96         |   | 69   | Zimbabwe                     | 0.07  | 0.90          | 0.34         |   |
| 6    | Finland                  | 6.63  | 88.74         | 0.95         |   | 70   | Sri Lanka                    | 0.07  | 0.85          | 0.33         |   |
| 7    | Israel                   | 6.19  | 82.85         | 0.94         |   | 71   | Dominican Republic           | 0.06  | 0.78          | 0.32         |   |
| 8    | Netherlands              | 5.40  | 72.34         | 0.93         |   | 72   | Albania (2015)               | 0.06  | 0.77          | 0.31         |   |
| 9    | Malta                    | 5.33  | 71.38         | 0.92         |   | 73   | Madagascar (2014)            | 0.06  | 0.74          | 0.30         |   |
| 10   | Denmark                  | 5.11  | 68.34         | 0.91         |   | 74   | Uganda (2014)                | 0.05  | 0.66          | 0.29         |   |
| 11   | Germany                  | 4.60  | 61.62         | 0.90         |   | 75   | Niger (2015)                 | 0.05  | 0.66          | 0.28         |   |
| 12   | Iceland                  | 3.47  | 46.42         | 0.89         |   | 76   | Kazakhstan                   | 0.05  | 0.65          | 0.27         |   |
| 13   | Austria                  | 3.42  | 45.75         | 0.88         |   | 77   | Costa Rica                   | 0.05  | 0.63          | 0.26         |   |
| 14   | United States of America | 3.05  | 40.80         | 0.87         |   | 78   | Ecuador                      | 0.05  | 0.61          | 0.25         |   |
| 15   | France                   | 3.00  | 40.13         | 0.86         |   | 79   | Kyrgyzstan (2015)            | 0.05  | 0.61          | 0.24         |   |
| 16   | Belgium                  | 2.40  | 32.09         | 0.85         |   | 80   | Rwanda (2015)                | 0.05  | 0.61          | 0.23         |   |
| 17   | China                    | 2.03  | 27.14         | 0.84         |   | 81   | Peru                         | 0.05  | 0.60          | 0.22         |   |
| 18   | United Kingdom           | 1.97  | 26.36         | 0.83         |   | 82   | Malawi                       | 0.05  | 0.58          | 0.21         |   |
| 19   | Singapore                | 1.81  | 24.14         | 0.83         |   | 83   | Benin (2014)                 | 0.05  | 0.57          | 0.20         |   |
| 20   | Norway                   | 1.79  | 23.94         | 0.82         |   | 84   | Tunisia                      | 0.05  | 0.57          | 0.19         |   |
| 21   | New Zealand              | 1.76  | 23.47         | 0.81         |   | 85   | Iran, Islamic Rep.           | 0.04  | 0.53          | 0.18         |   |
| 22   | Australia                | 1.54  | 20.63         | 0.80         |   | 86   | Qatar                        | 0.04  | 0.51          | 0.17         |   |
| 23   | Italy                    | 1.51  | 20.21         | 0.79         |   | 87   | Oman                         | 0.04  | 0.49          | 0.17         |   |
| 24   | Canada                   | 1.39  | 18.62         | 0.78         |   | 88   | Egypt                        | 0.04  | 0.47          | 0.16         |   |
| 25   | Ireland                  | 1.35  | 18.09         | 0.77         |   | 89   | Philippines                  | 0.04  | 0.44          | 0.15         |   |
| 26   | Cyprus                   | 1.23  | 16.44         | 0.76         |   | 90   | Mozambique                   | 0.03  | 0.33          | 0.14         |   |
| 27   | Slovenia                 | 1.04  | 13.93         | 0.75         |   | 91   | Botswana                     | 0.03  | 0.32          | 0.13         |   |
| 28   | Spain                    | 0.89  | 11.88         | 0.74         |   | 92   | Mongolia                     | 0.03  | 0.32          | 0.12         |   |
| 29   | Trinidad and Tobago      | 0.87  | 11.64         | 0.73         | ● | 93   | Kenya                        | 0.03  | 0.30          | 0.11         | ○ |
| 30   | Hungary                  | 0.67  | 8.86          | 0.72         |   | 94   | Cameroon                     | 0.03  | 0.30          | 0.10         |   |
| 31   | Panama                   | 0.64  | 8.58          | 0.71         |   | 95   | Honduras                     | 0.02  | 0.26          | 0.09         | ○ |
| 32   | Turkey                   | 0.64  | 8.52          | 0.70         |   | 96   | Côte d'Ivoire                | 0.02  | 0.26          | 0.08         |   |
| 33   | Estonia                  | 0.62  | 8.26          | 0.69         |   | 97   | Algeria                      | 0.02  | 0.21          | 0.07         |   |
| 34   | Portugal                 | 0.62  | 8.25          | 0.68         |   | 98   | El Salvador                  | 0.02  | 0.20          | 0.06         | ○ |
| 35   | Czech Republic           | 0.57  | 7.55          | 0.67         |   | 99   | Azerbaijan                   | 0.02  | 0.19          | 0.05         | ○ |
| 36   | Moldova, Rep.            | 0.54  | 7.18          | 0.66         |   | 100  | Viet Nam                     | 0.02  | 0.18          | 0.04         | ○ |
| 37   | Ukraine                  | 0.47  | 6.19          | 0.65         |   | 101  | Guatemala                    | 0.02  | 0.15          | 0.03         | ○ |
| 38   | Latvia                   | 0.45  | 6.01          | 0.64         |   | 102  | Tanzania, United Rep. (2015) | 0.01  | 0.14          | 0.02         |   |
| 39   | Chile                    | 0.45  | 6.00          | 0.63         |   | 103  | Indonesia                    | 0.00  | 0.02          | 0.01         | ○ |
| 40   | Bulgaria                 | 0.44  | 5.85          | 0.62         |   | 104  | Nigeria                      | 0.00  | 0.00          | 0.00         | ○ |
| 41   | Croatia                  | 0.41  | 5.50          | 0.61         |   | n/a  | Argentina                    | n/a   | n/a           | n/a          |   |
| 42   | South Africa             | 0.39  | 5.17          | 0.60         |   | n/a  | Bangladesh                   | n/a   | n/a           | n/a          |   |
| 43   | Greece                   | 0.38  | 5.07          | 0.59         |   | n/a  | Bolivia, Plurinational St.   | n/a   | n/a           | n/a          |   |
| 44   | Georgia                  | 0.35  | 4.61          | 0.58         |   | n/a  | Burkina Faso                 | n/a   | n/a           | n/a          |   |
| 45   | Armenia                  | 0.34  | 4.49          | 0.57         |   | n/a  | Burundi                      | n/a   | n/a           | n/a          |   |
| 46   | Lithuania                | 0.33  | 4.32          | 0.56         |   | n/a  | Cambodia                     | n/a   | n/a           | n/a          |   |
| 47   | Poland                   | 0.33  | 4.32          | 0.55         |   | n/a  | Ethiopia                     | n/a   | n/a           | n/a          |   |
| 48   | Slovakia                 | 0.33  | 4.31          | 0.54         |   | n/a  | Guinea                       | n/a   | n/a           | n/a          |   |
| 49   | Russian Federation       | 0.23  | 3.00          | 0.53         |   | n/a  | Hong Kong (China)            | n/a   | n/a           | n/a          |   |
| 50   | Malaysia                 | 0.22  | 2.90          | 0.52         |   | n/a  | Jamaica                      | n/a   | n/a           | n/a          |   |
| 51   | Montenegro               | 0.19  | 2.48          | 0.51         |   | n/a  | Jordan                       | n/a   | n/a           | n/a          |   |
| 52   | Brazil                   | 0.18  | 2.38          | 0.50         |   | n/a  | Kuwait                       | n/a   | n/a           | n/a          |   |
| 53   | Senegal                  | 0.18  | 2.31          | 0.50         |   | n/a  | Lebanon                      | n/a   | n/a           | n/a          |   |
| 54   | India                    | 0.18  | 2.30          | 0.49         |   | n/a  | Mali                         | n/a   | n/a           | n/a          |   |
| 55   | Saudi Arabia             | 0.17  | 2.24          | 0.48         |   | n/a  | Mauritius                    | n/a   | n/a           | n/a          |   |
| 56   | Brunei Darussalam        | 0.15  | 1.94          | 0.47         |   | n/a  | Nepal                        | n/a   | n/a           | n/a          |   |
| 57   | Serbia                   | 0.15  | 1.93          | 0.46         |   | n/a  | Pakistan                     | n/a   | n/a           | n/a          |   |
| 58   | Colombia                 | 0.14  | 1.87          | 0.45         |   | n/a  | Paraguay                     | n/a   | n/a           | n/a          |   |
| 59   | Morocco                  | 0.14  | 1.80          | 0.44         |   | n/a  | Tajikistan                   | n/a   | n/a           | n/a          |   |
| 60   | Thailand                 | 0.13  | 1.74          | 0.43         |   | n/a  | Togo                         | n/a   | n/a           | n/a          |   |
| 61   | Mexico                   | 0.12  | 1.62          | 0.42         |   | n/a  | Uruguay                      | n/a   | n/a           | n/a          |   |
| 62   | United Arab Emirates     | 0.12  | 1.58          | 0.41         |   | n/a  | Yemen                        | n/a   | n/a           | n/a          |   |
| 63   | Belarus                  | 0.10  | 1.33          | 0.40         |   | n/a  | Zambia                       | n/a   | n/a           | n/a          |   |
| 64   | TFYR of Macedonia        | 0.10  | 1.28          | 0.39         |   |      |                              |       |               |              |   |

SOURCE: World Intellectual Property Organization, *Intellectual Property Statistics*; International Monetary Fund, *World Economic Outlook Database*, October 2016 (PPPS GDP)

NOTE: ● Indicates a strength; ○ a weakness



# 6.1.3

## Utility model applications by origin

Number of utility model applications filed by residents at the national patent office (per billion PPP\$ GDP) | 2015

| Rank | Country/Economy                   | Value | Score (0–100) | Percent rank |   | Rank | Country/Economy          | Value | Score (0–100) | Percent rank |
|------|-----------------------------------|-------|---------------|--------------|---|------|--------------------------|-------|---------------|--------------|
| 1    | China                             | 56.85 | 100.00        | 0.95         | ● | n/a  | Bahrain                  | n/a   | n/a           | n/a          |
| 1    | Korea, Rep.                       | 4.48  | 100.00        | 0.95         | ● | n/a  | Bangladesh               | n/a   | n/a           | n/a          |
| 1    | Moldova, Rep.                     | 9.25  | 100.00        | 0.95         | ● | n/a  | Belgium                  | n/a   | n/a           | n/a          |
| 1    | Ukraine                           | 24.95 | 100.00        | 0.95         | ● | n/a  | Benin                    | n/a   | n/a           | n/a          |
| 5    | Mongolia                          | 4.12  | 92.03         | 0.94         | ● | n/a  | Bosnia and Herzegovina   | n/a   | n/a           | n/a          |
| 6    | Czech Republic                    | 4.04  | 90.12         | 0.92         | ● | n/a  | Brunei Darussalam        | n/a   | n/a           | n/a          |
| 7    | Tajikistan                        | 3.74  | 83.60         | 0.90         | ● | n/a  | Burundi                  | n/a   | n/a           | n/a          |
| 8    | Russian Federation                | 3.06  | 68.27         | 0.89         | ● | n/a  | Cambodia                 | n/a   | n/a           | n/a          |
| 9    | Germany                           | 2.68  | 59.78         | 0.87         | ● | n/a  | Cameroon                 | n/a   | n/a           | n/a          |
| 10   | Slovakia                          | 2.31  | 51.45         | 0.85         | ● | n/a  | Canada                   | n/a   | n/a           | n/a          |
| 11   | Belarus                           | 2.26  | 50.38         | 0.84         | ● | n/a  | Côte d'Ivoire            | n/a   | n/a           | n/a          |
| 12   | Turkey                            | 2.16  | 48.09         | 0.82         | ● | n/a  | Cyprus                   | n/a   | n/a           | n/a          |
| 13   | Armenia                           | 2.13  | 47.29         | 0.81         | ● | n/a  | Egypt                    | n/a   | n/a           | n/a          |
| 14   | Estonia                           | 2.02  | 44.90         | 0.79         |   | n/a  | Ethiopia                 | n/a   | n/a           | n/a          |
| 15   | Bulgaria                          | 1.92  | 42.61         | 0.77         |   | n/a  | Guinea                   | n/a   | n/a           | n/a          |
| 16   | Thailand                          | 1.87  | 41.59         | 0.76         |   | n/a  | Iceland                  | n/a   | n/a           | n/a          |
| 17   | Finland                           | 1.82  | 40.37         | 0.74         |   | n/a  | India                    | n/a   | n/a           | n/a          |
| 18   | Georgia                           | 1.71  | 37.93         | 0.73         |   | n/a  | Iran, Islamic Rep.       | n/a   | n/a           | n/a          |
| 19   | Austria                           | 1.40  | 30.98         | 0.71         |   | n/a  | Ireland                  | n/a   | n/a           | n/a          |
| 20   | Spain                             | 1.38  | 30.45         | 0.69         |   | n/a  | Israel                   | n/a   | n/a           | n/a          |
| 21   | Italy (2014)                      | 1.10  | 24.24         | 0.68         |   | n/a  | Jamaica                  | n/a   | n/a           | n/a          |
| 22   | Japan                             | 1.08  | 23.72         | 0.66         |   | n/a  | Jordan                   | n/a   | n/a           | n/a          |
| 23   | Philippines                       | 1.06  | 23.37         | 0.65         |   | n/a  | Kuwait                   | n/a   | n/a           | n/a          |
| 24   | Hong Kong (China)                 | 1.06  | 23.26         | 0.63         |   | n/a  | Latvia                   | n/a   | n/a           | n/a          |
| 25   | Poland                            | 0.99  | 21.72         | 0.61         |   | n/a  | Lebanon                  | n/a   | n/a           | n/a          |
| 26   | Kazakhstan                        | 0.97  | 21.41         | 0.60         |   | n/a  | Lithuania                | n/a   | n/a           | n/a          |
| 27   | Australia                         | 0.97  | 21.37         | 0.58         |   | n/a  | Luxembourg               | n/a   | n/a           | n/a          |
| 28   | Hungary                           | 0.84  | 18.46         | 0.56         |   | n/a  | Madagascar               | n/a   | n/a           | n/a          |
| 29   | Brazil                            | 0.81  | 17.85         | 0.55         |   | n/a  | Malawi                   | n/a   | n/a           | n/a          |
| 30   | Kenya                             | 0.80  | 17.55         | 0.53         |   | n/a  | Mali                     | n/a   | n/a           | n/a          |
| 31   | Croatia                           | 0.80  | 17.52         | 0.52         |   | n/a  | Malta                    | n/a   | n/a           | n/a          |
| 32   | Kyrgyzstan                        | 0.69  | 15.05         | 0.50         |   | n/a  | Mauritius                | n/a   | n/a           | n/a          |
| 33   | Serbia                            | 0.59  | 12.89         | 0.48         |   | n/a  | Montenegro               | n/a   | n/a           | n/a          |
| 34   | Uruguay                           | 0.56  | 12.19         | 0.47         |   | n/a  | Morocco                  | n/a   | n/a           | n/a          |
| 35   | Viet Nam                          | 0.56  | 12.14         | 0.45         |   | n/a  | Mozambique               | n/a   | n/a           | n/a          |
| 36   | Peru                              | 0.51  | 10.91         | 0.44         |   | n/a  | Namibia                  | n/a   | n/a           | n/a          |
| 37   | Denmark                           | 0.46  | 9.97          | 0.42         | ○ | n/a  | Nepal                    | n/a   | n/a           | n/a          |
| 38   | Portugal                          | 0.40  | 8.61          | 0.40         | ○ | n/a  | Netherlands              | n/a   | n/a           | n/a          |
| 39   | Colombia                          | 0.29  | 6.06          | 0.39         |   | n/a  | New Zealand              | n/a   | n/a           | n/a          |
| 40   | Mexico                            | 0.26  | 5.37          | 0.37         |   | n/a  | Niger                    | n/a   | n/a           | n/a          |
| 41   | Rwanda                            | 0.24  | 5.05          | 0.35         |   | n/a  | Nigeria                  | n/a   | n/a           | n/a          |
| 42   | Chile                             | 0.20  | 4.02          | 0.34         |   | n/a  | Norway                   | n/a   | n/a           | n/a          |
| 43   | Slovenia (2010)                   | 0.16  | 3.09          | 0.32         | ○ | n/a  | Oman                     | n/a   | n/a           | n/a          |
| 44   | Bolivia, Plurinational St. (2014) | 0.16  | 3.08          | 0.31         |   | n/a  | Pakistan                 | n/a   | n/a           | n/a          |
| 45   | Argentina                         | 0.15  | 2.92          | 0.29         |   | n/a  | Paraguay                 | n/a   | n/a           | n/a          |
| 46   | Azerbaijan (2014)                 | 0.14  | 2.81          | 0.27         |   | n/a  | Qatar                    | n/a   | n/a           | n/a          |
| 47   | Burkina Faso (2010)               | 0.14  | 2.66          | 0.26         |   | n/a  | Saudi Arabia             | n/a   | n/a           | n/a          |
| 48   | Romania                           | 0.14  | 2.65          | 0.24         | ○ | n/a  | Senegal                  | n/a   | n/a           | n/a          |
| 49   | El Salvador (2014)                | 0.14  | 2.65          | 0.23         |   | n/a  | Singapore                | n/a   | n/a           | n/a          |
| 50   | Ecuador (2010)                    | 0.13  | 2.52          | 0.21         |   | n/a  | South Africa             | n/a   | n/a           | n/a          |
| 51   | Malaysia                          | 0.13  | 2.40          | 0.19         | ○ | n/a  | Sri Lanka                | n/a   | n/a           | n/a          |
| 52   | Costa Rica                        | 0.11  | 1.96          | 0.18         | ○ | n/a  | Sweden                   | n/a   | n/a           | n/a          |
| 53   | Indonesia                         | 0.10  | 1.85          | 0.16         |   | n/a  | Switzerland              | n/a   | n/a           | n/a          |
| 54   | Guatemala                         | 0.09  | 1.52          | 0.15         |   | n/a  | Tanzania, United Rep.    | n/a   | n/a           | n/a          |
| 55   | France                            | 0.08  | 1.29          | 0.13         | ○ | n/a  | TFYR of Macedonia        | n/a   | n/a           | n/a          |
| 56   | Honduras                          | 0.07  | 1.21          | 0.11         |   | n/a  | Togo                     | n/a   | n/a           | n/a          |
| 57   | Dominican Republic                | 0.07  | 1.07          | 0.10         |   | n/a  | Tunisia                  | n/a   | n/a           | n/a          |
| 58   | Panama                            | 0.06  | 0.85          | 0.08         |   | n/a  | Uganda                   | n/a   | n/a           | n/a          |
| 59   | Greece                            | 0.03  | 0.35          | 0.06         | ○ | n/a  | United Arab Emirates     | n/a   | n/a           | n/a          |
| 60   | Albania (2014)                    | 0.03  | 0.28          | 0.05         | ○ | n/a  | United Kingdom           | n/a   | n/a           | n/a          |
| 61   | Botswana (2014)                   | 0.03  | 0.22          | 0.03         | ○ | n/a  | United States of America | n/a   | n/a           | n/a          |
| 62   | Trinidad and Tobago (2014)        | 0.02  | 0.07          | 0.02         | ○ | n/a  | Zambia                   | n/a   | n/a           | n/a          |
| 63   | Yemen (2014)                      | 0.02  | 0.00          | 0.00         | ○ | n/a  | Zimbabwe                 | n/a   | n/a           | n/a          |
| n/a  | Algeria                           | n/a   | n/a           | n/a          |   |      |                          |       |               |              |

SOURCE: World Intellectual Property Organization, *Intellectual Property Statistics*; International Monetary Fund, *World Economic Outlook Database*, October 2016 (PPPS GDP)

NOTE: ● indicates a strength; ○ a weakness

# 6.1.4 Scientific and technical publications

## Number of scientific and technical journal articles (per billion PPP\$ GDP) | 2016

| Rank | Country/Economy          | Value | Score (0–100) | Percent rank |   | Rank | Country/Economy            | Value | Score (0–100) | Percent rank |   |
|------|--------------------------|-------|---------------|--------------|---|------|----------------------------|-------|---------------|--------------|---|
| 1    | Iceland                  | 71.10 | 100.00        | 1.00         | ● | 65   | Senegal                    | 10.30 | 13.84         | 0.49         |   |
| 2    | Denmark                  | 66.80 | 93.91         | 0.99         | ● | 66   | Bosnia and Herzegovina     | 10.23 | 13.74         | 0.48         |   |
| 3    | Switzerland              | 58.07 | 81.54         | 0.98         | ● | 67   | Egypt                      | 9.75  | 13.06         | 0.47         |   |
| 4    | Slovenia                 | 55.45 | 77.83         | 0.98         | ● | 68   | Argentina                  | 9.60  | 12.85         | 0.46         |   |
| 5    | Finland                  | 55.04 | 77.24         | 0.97         | ● | 69   | Rwanda                     | 9.51  | 12.73         | 0.46         |   |
| 6    | Sweden                   | 52.85 | 74.14         | 0.96         |   | 70   | Russian Federation         | 8.84  | 11.78         | 0.45         |   |
| 7    | New Zealand              | 50.85 | 71.31         | 0.95         |   | 71   | Pakistan                   | 8.73  | 11.62         | 0.44         |   |
| 8    | Serbia                   | 49.19 | 68.96         | 0.94         | ● | 72   | Nepal                      | 8.54  | 11.36         | 0.43         | ● |
| 9    | Australia                | 48.75 | 68.33         | 0.94         |   | 73   | Botswana                   | 8.22  | 10.90         | 0.42         |   |
| 10   | Estonia                  | 47.57 | 66.66         | 0.93         |   | 74   | Saudi Arabia               | 7.96  | 10.53         | 0.42         |   |
| 11   | Israel                   | 45.82 | 64.17         | 0.92         |   | 75   | Costa Rica                 | 7.46  | 9.82          | 0.41         |   |
| 12   | Portugal                 | 45.49 | 63.71         | 0.91         | ● | 76   | Mozambique                 | 7.45  | 9.80          | 0.40         |   |
| 13   | Netherlands              | 42.90 | 60.04         | 0.90         |   | 77   | Ethiopia                   | 7.06  | 9.25          | 0.39         |   |
| 14   | United Kingdom           | 41.63 | 58.24         | 0.90         |   | 78   | Morocco                    | 6.97  | 9.13          | 0.38         |   |
| 15   | Cyprus                   | 40.98 | 57.32         | 0.89         |   | 79   | India                      | 6.90  | 9.02          | 0.38         |   |
| 16   | Belgium                  | 40.13 | 56.12         | 0.88         |   | 80   | Togo                       | 6.72  | 8.77          | 0.37         |   |
| 17   | Canada                   | 37.24 | 52.02         | 0.87         |   | 81   | Namibia                    | 6.66  | 8.69          | 0.36         |   |
| 18   | Austria                  | 36.09 | 50.39         | 0.86         |   | 82   | Jamaica                    | 6.62  | 8.63          | 0.35         |   |
| 19   | Croatia                  | 35.24 | 49.19         | 0.86         | ● | 83   | Mongolia                   | 6.55  | 8.53          | 0.34         |   |
| 20   | Norway                   | 34.97 | 48.80         | 0.85         |   | 84   | Thailand                   | 6.51  | 8.48          | 0.34         |   |
| 21   | Czech Republic           | 34.67 | 48.37         | 0.84         |   | 85   | Belarus                    | 6.47  | 8.42          | 0.33         |   |
| 22   | Greece                   | 33.39 | 46.57         | 0.83         | ● | 86   | Qatar                      | 6.33  | 8.23          | 0.32         |   |
| 23   | Spain                    | 32.10 | 44.74         | 0.82         |   | 87   | Tanzania, United Rep.      | 6.20  | 8.04          | 0.31         |   |
| 24   | Tunisia                  | 31.83 | 44.36         | 0.82         | ● | 88   | Brunei Darussalam          | 6.14  | 7.95          | 0.30         |   |
| 25   | Korea, Rep.              | 29.19 | 40.61         | 0.81         |   | 89   | Ecuador                    | 6.03  | 7.80          | 0.30         |   |
| 26   | Armenia                  | 28.95 | 40.28         | 0.80         | ● | 90   | Niger                      | 6.02  | 7.78          | 0.29         |   |
| 27   | Italy                    | 27.61 | 38.37         | 0.79         |   | 91   | Colombia                   | 6.00  | 7.75          | 0.28         |   |
| 28   | Singapore                | 26.06 | 36.18         | 0.78         |   | 92   | Madagascar                 | 5.84  | 7.53          | 0.27         |   |
| 29   | Germany                  | 25.66 | 35.61         | 0.78         |   | 93   | Mexico                     | 5.84  | 7.52          | 0.26         |   |
| 30   | France                   | 25.34 | 35.16         | 0.77         |   | 94   | Viet Nam                   | 5.63  | 7.23          | 0.26         |   |
| 31   | Hungary                  | 25.30 | 35.11         | 0.76         |   | 95   | Kyrgyzstan                 | 5.57  | 7.14          | 0.25         |   |
| 32   | Poland                   | 25.09 | 34.81         | 0.75         |   | 96   | Zambia                     | 5.43  | 6.95          | 0.24         |   |
| 33   | Lithuania                | 24.79 | 34.38         | 0.74         |   | 97   | Algeria                    | 5.36  | 6.85          | 0.23         |   |
| 34   | Ireland                  | 23.26 | 32.21         | 0.74         |   | 98   | Albania                    | 5.20  | 6.62          | 0.22         |   |
| 35   | Iran, Islamic Rep.       | 21.54 | 29.77         | 0.73         | ● | 99   | Cambodia                   | 5.02  | 6.37          | 0.22         |   |
| 36   | Montenegro               | 21.48 | 29.69         | 0.72         |   | 100  | Mauritius                  | 4.64  | 5.83          | 0.21         |   |
| 37   | Malawi                   | 20.73 | 28.62         | 0.71         | ● | 101  | Mali                       | 4.62  | 5.80          | 0.20         |   |
| 38   | United States of America | 19.84 | 27.36         | 0.70         |   | 102  | Panama                     | 4.53  | 5.67          | 0.19         |   |
| 39   | Slovakia                 | 19.58 | 27.00         | 0.70         |   | 103  | Oman                       | 4.24  | 5.25          | 0.18         |   |
| 40   | Luxembourg               | 18.73 | 25.79         | 0.69         |   | 104  | Burundi                    | 3.93  | 4.82          | 0.18         |   |
| 41   | Chile                    | 18.45 | 25.40         | 0.68         |   | 105  | Sri Lanka                  | 3.53  | 4.26          | 0.17         |   |
| 42   | Malta                    | 17.90 | 24.61         | 0.67         |   | 106  | United Arab Emirates       | 3.51  | 4.23          | 0.16         | ○ |
| 43   | Turkey                   | 17.47 | 24.01         | 0.66         |   | 107  | Trinidad and Tobago        | 3.28  | 3.90          | 0.15         |   |
| 44   | South Africa             | 17.15 | 23.56         | 0.66         |   | 108  | Azerbaijan                 | 3.23  | 3.83          | 0.14         |   |
| 45   | Romania                  | 16.49 | 22.62         | 0.65         |   | 109  | Bolivia, Plurinational St. | 3.17  | 3.74          | 0.14         |   |
| 46   | Jordan                   | 16.03 | 21.97         | 0.64         |   | 110  | Bangladesh                 | 2.89  | 3.35          | 0.13         |   |
| 47   | Georgia                  | 16.02 | 21.96         | 0.63         |   | 111  | Côte d'Ivoire              | 2.86  | 3.30          | 0.12         |   |
| 48   | Lebanon                  | 15.72 | 21.53         | 0.62         |   | 112  | Yemen                      | 2.82  | 3.24          | 0.11         |   |
| 49   | Zimbabwe                 | 15.64 | 21.41         | 0.62         | ● | 113  | Peru                       | 2.71  | 3.10          | 0.10         | ○ |
| 50   | Bulgaria                 | 15.28 | 20.90         | 0.61         |   | 114  | Bahrain                    | 2.68  | 3.05          | 0.10         | ○ |
| 51   | Japan                    | 15.14 | 20.70         | 0.60         |   | 115  | Kuwait                     | 2.64  | 3.00          | 0.09         | ○ |
| 52   | Latvia                   | 14.90 | 20.37         | 0.59         |   | 116  | Tajikistan                 | 2.56  | 2.87          | 0.08         |   |
| 53   | TFYR of Macedonia        | 14.24 | 19.43         | 0.58         |   | 117  | Nigeria                    | 2.34  | 2.57          | 0.07         |   |
| 54   | China                    | 14.09 | 19.22         | 0.58         |   | 118  | Kazakhstan                 | 1.84  | 1.86          | 0.06         | ○ |
| 55   | Brazil                   | 13.55 | 18.45         | 0.57         |   | 119  | Paraguay                   | 1.64  | 1.57          | 0.06         | ○ |
| 56   | Uruguay                  | 13.24 | 18.02         | 0.56         |   | 120  | Philippines                | 1.58  | 1.49          | 0.05         | ○ |
| 57   | Moldova, Rep.            | 13.16 | 17.90         | 0.55         |   | 121  | Guatemala                  | 1.25  | 1.03          | 0.04         | ○ |
| 58   | Malaysia                 | 12.32 | 16.71         | 0.54         |   | 122  | Honduras                   | 1.18  | 0.92          | 0.03         | ○ |
| 59   | Ukraine                  | 12.23 | 16.57         | 0.54         |   | 123  | El Salvador                | 1.11  | 0.83          | 0.02         | ○ |
| 60   | Uganda                   | 12.05 | 16.32         | 0.53         |   | 124  | Indonesia                  | 0.69  | 0.23          | 0.02         | ○ |
| 61   | Kenya                    | 11.58 | 15.65         | 0.52         |   | 125  | Guinea                     | 0.68  | 0.22          | 0.01         | ○ |
| 62   | Benin                    | 11.31 | 15.28         | 0.51         |   | 126  | Dominican Republic         | 0.53  | 0.00          | 0.00         | ○ |
| 63   | Burkina Faso             | 10.61 | 14.29         | 0.50         | ● | n/a  | Hong Kong (China)          | n/a   | n/a           | n/a          |   |
| 64   | Cameroon                 | 10.60 | 14.28         | 0.50         | ● |      |                            |       |               |              |   |

SOURCE: Clarivate Analytics, special tabulations from Thomson Reuters, Web of Science, Science Citation Index (SCI) and Social Sciences Citation Index (SSCI); International Monetary Fund, *World Economic Outlook Database*, October 2016

NOTE: ● indicates a strength; ○ a weakness

# 6.1.5 Citable documents H index

The H index is the economy's number of published articles (H) that have received at least H citations | 2016

| Rank | Country/Economy          | Value    | Score (0–100) | Percent rank |   | Rank | Country/Economy            | Value  | Score (0–100) | Percent rank |   |
|------|--------------------------|----------|---------------|--------------|---|------|----------------------------|--------|---------------|--------------|---|
| 1    | United Kingdom           | 1,099.00 | 100.00        | 0.99         | ● | 65   | Uruguay                    | 132.00 | 9.63          | 0.49         |   |
| 1    | United States of America | 1,783.00 | 100.00        | 0.99         | ● | 66   | Nigeria                    | 131.00 | 9.53          | 0.48         | ● |
| 3    | Germany                  | 961.00   | 87.10         | 0.98         | ● | 67   | United Arab Emirates       | 130.00 | 9.44          | 0.48         |   |
| 4    | France                   | 878.00   | 79.35         | 0.98         | ● | 68   | Morocco                    | 129.00 | 9.35          | 0.47         |   |
| 5    | Canada                   | 862.00   | 77.85         | 0.97         | ● | 69   | Uganda                     | 128.00 | 9.25          | 0.46         |   |
| 6    | Japan                    | 797.00   | 71.78         | 0.96         |   | 70   | Cyprus                     | 127.00 | 9.16          | 0.45         |   |
| 7    | Italy                    | 766.00   | 68.88         | 0.95         | ● | 71   | Tunisia                    | 123.00 | 8.79          | 0.44         |   |
| 8    | Netherlands              | 752.00   | 67.57         | 0.94         |   | 72   | Tanzania, United Rep.      | 122.00 | 8.69          | 0.44         |   |
| 9    | Switzerland              | 744.00   | 66.82         | 0.94         |   | 73   | Sri Lanka                  | 120.00 | 8.50          | 0.43         |   |
| 10   | Australia                | 709.00   | 63.55         | 0.93         |   | 74   | Serbia                     | 118.00 | 8.32          | 0.42         |   |
| 11   | Sweden                   | 666.00   | 59.53         | 0.92         |   | 75   | Georgia                    | 114.00 | 7.94          | 0.40         |   |
| 12   | Spain                    | 648.00   | 57.85         | 0.91         | ● | 75   | Luxembourg                 | 114.00 | 7.94          | 0.40         |   |
| 13   | Belgium                  | 593.00   | 52.71         | 0.90         |   | 77   | Jordan                     | 112.00 | 7.76          | 0.39         |   |
| 14   | China                    | 563.00   | 49.91         | 0.90         |   | 77   | Latvia                     | 112.00 | 7.76          | 0.39         |   |
| 15   | Denmark                  | 558.00   | 49.44         | 0.89         |   | 79   | Ecuador                    | 111.00 | 7.66          | 0.38         |   |
| 16   | Israel                   | 536.00   | 47.38         | 0.88         |   | 80   | Kuwait                     | 108.00 | 7.38          | 0.37         |   |
| 17   | Austria                  | 487.00   | 42.80         | 0.87         |   | 81   | Algeria                    | 106.00 | 7.20          | 0.37         |   |
| 18   | Finland                  | 479.00   | 42.06         | 0.87         |   | 82   | Malawi                     | 104.00 | 7.01          | 0.36         |   |
| 19   | Korea, Rep.              | 476.00   | 41.78         | 0.86         |   | 83   | Ethiopia                   | 101.00 | 6.73          | 0.35         |   |
| 20   | Norway                   | 439.00   | 38.32         | 0.85         |   | 84   | Zimbabwe                   | 99.00  | 6.54          | 0.34         |   |
| 21   | India                    | 426.00   | 37.10         | 0.84         | ● | 85   | Senegal                    | 95.00  | 6.17          | 0.33         |   |
| 22   | Russian Federation       | 421.00   | 36.64         | 0.83         | ● | 86   | Cameroon                   | 94.00  | 6.07          | 0.32         |   |
| 23   | Brazil                   | 412.00   | 35.79         | 0.83         | ● | 86   | Nepal                      | 94.00  | 6.07          | 0.32         |   |
| 24   | Poland                   | 401.00   | 34.77         | 0.82         | ● | 88   | Zambia                     | 92.00  | 5.89          | 0.31         |   |
| 25   | Hong Kong (China)        | 392.00   | 33.93         | 0.80         |   | 89   | Oman                       | 91.00  | 5.79          | 0.30         |   |
| 25   | Singapore                | 392.00   | 33.93         | 0.80         |   | 90   | Côte d'Ivoire              | 89.00  | 5.61          | 0.29         |   |
| 27   | New Zealand              | 387.00   | 33.46         | 0.79         |   | 91   | Bolivia, Plurinational St. | 88.00  | 5.51          | 0.29         |   |
| 28   | Ireland                  | 364.00   | 31.31         | 0.79         |   | 92   | Qatar                      | 86.00  | 5.33          | 0.28         |   |
| 29   | Greece                   | 354.00   | 30.37         | 0.78         |   | 93   | Malta                      | 83.00  | 5.05          | 0.27         | ○ |
| 30   | Portugal                 | 334.00   | 28.50         | 0.77         |   | 94   | Burkina Faso               | 82.00  | 4.95          | 0.26         |   |
| 31   | Hungary                  | 329.00   | 28.04         | 0.76         |   | 95   | TFYR of Macedonia          | 81.00  | 4.86          | 0.25         | ○ |
| 32   | Czech Republic           | 322.00   | 27.38         | 0.75         |   | 96   | Moldova, Rep.              | 80.00  | 4.77          | 0.25         |   |
| 33   | South Africa             | 320.00   | 27.20         | 0.75         |   | 97   | Botswana                   | 79.00  | 4.67          | 0.24         |   |
| 34   | Mexico                   | 316.00   | 26.82         | 0.74         |   | 98   | Trinidad and Tobago        | 76.00  | 4.39          | 0.23         |   |
| 35   | Argentina                | 300.00   | 25.33         | 0.73         | ● | 99   | Jamaica                    | 75.00  | 4.30          | 0.21         |   |
| 36   | Turkey                   | 296.00   | 24.95         | 0.72         |   | 99   | Mali                       | 75.00  | 4.30          | 0.21         |   |
| 37   | Chile                    | 257.00   | 21.31         | 0.71         |   | 101  | Madagascar                 | 74.00  | 4.21          | 0.21         |   |
| 38   | Thailand                 | 236.00   | 19.35         | 0.71         |   | 102  | Mozambique                 | 73.00  | 4.11          | 0.20         |   |
| 39   | Iceland                  | 218.00   | 17.66         | 0.70         |   | 103  | Cambodia                   | 72.00  | 4.02          | 0.17         |   |
| 40   | Slovenia                 | 204.00   | 16.36         | 0.69         |   | 103  | Mongolia                   | 72.00  | 4.02          | 0.17         |   |
| 41   | Iran, Islamic Rep.       | 199.00   | 15.89         | 0.68         | ● | 103  | Namibia                    | 72.00  | 4.02          | 0.17         |   |
| 42   | Saudi Arabia             | 195.00   | 15.51         | 0.67         |   | 106  | Guatemala                  | 69.00  | 3.74          | 0.17         |   |
| 42   | Slovakia                 | 195.00   | 15.51         | 0.67         |   | 107  | Kazakhstan                 | 68.00  | 3.64          | 0.16         |   |
| 44   | Croatia                  | 194.00   | 15.42         | 0.66         |   | 108  | Benin                      | 65.00  | 3.36          | 0.15         |   |
| 45   | Malaysia                 | 190.00   | 15.05         | 0.65         |   | 109  | Azerbaijan                 | 64.00  | 3.27          | 0.14         |   |
| 46   | Ukraine                  | 188.00   | 14.86         | 0.64         |   | 110  | Bosnia and Herzegovina     | 61.00  | 2.99          | 0.13         | ○ |
| 47   | Romania                  | 187.00   | 14.77         | 0.63         |   | 111  | Paraguay                   | 60.00  | 2.90          | 0.13         |   |
| 48   | Colombia                 | 186.00   | 14.67         | 0.63         |   | 112  | Niger                      | 59.00  | 2.80          | 0.12         |   |
| 49   | Estonia                  | 185.00   | 14.58         | 0.62         |   | 113  | Bahrain                    | 55.00  | 2.43          | 0.11         |   |
| 50   | Bulgaria                 | 184.00   | 14.49         | 0.60         |   | 114  | Mauritius                  | 54.00  | 2.34          | 0.10         | ○ |
| 50   | Egypt                    | 184.00   | 14.49         | 0.60         |   | 114  | Rwanda                     | 54.00  | 2.34          | 0.10         |   |
| 52   | Kenya                    | 179.00   | 14.02         | 0.60         |   | 116  | Brunei Darussalam          | 52.00  | 2.15          | 0.09         | ○ |
| 53   | Pakistan                 | 166.00   | 12.80         | 0.59         | ● | 117  | Dominican Republic         | 51.00  | 2.06          | 0.07         | ○ |
| 54   | Philippines              | 163.00   | 12.52         | 0.58         |   | 117  | Honduras                   | 51.00  | 2.06          | 0.07         | ○ |
| 55   | Indonesia                | 155.00   | 11.78         | 0.57         |   | 119  | Yemen                      | 50.00  | 1.96          | 0.06         |   |
| 56   | Peru                     | 154.00   | 11.68         | 0.56         |   | 120  | Albania                    | 48.00  | 1.78          | 0.06         | ○ |
| 57   | Lithuania                | 144.00   | 10.75         | 0.56         |   | 121  | Guinea                     | 46.00  | 1.59          | 0.05         |   |
| 58   | Panama                   | 142.00   | 10.56         | 0.54         |   | 122  | Kyrgyzstan                 | 45.00  | 1.50          | 0.04         | ○ |
| 58   | Viet Nam                 | 142.00   | 10.56         | 0.54         |   | 123  | El Salvador                | 44.00  | 1.40          | 0.03         | ○ |
| 60   | Lebanon                  | 138.00   | 10.19         | 0.53         |   | 124  | Togo                       | 39.00  | 0.93          | 0.02         | ○ |
| 61   | Costa Rica               | 137.00   | 10.09         | 0.52         |   | 125  | Burundi                    | 32.00  | 0.28          | 0.01         | ○ |
| 62   | Armenia                  | 135.00   | 9.91          | 0.52         |   | 125  | Montenegro                 | 32.00  | 0.28          | 0.01         | ○ |
| 63   | Bangladesh               | 134.00   | 9.81          | 0.51         | ● | 127  | Tajikistan                 | 29.00  | 0.00          | 0.00         | ○ |
| 64   | Belarus                  | 133.00   | 9.72          | 0.50         |   |      |                            |        |               |              |   |

SOURCE: SCImago (2017) SJR—SCImago Journal & Country Rank. Retrieved February 2017  
 NOTE: ● indicates a strength; ○ a weakness

# 6.2.1 Growth rate of GDP per person engaged

## Growth rate of GDP per person engaged (constant 1990 PPP\$) | 2015

| Rank | Country/Economy            | Value | Score (0–100) | Percent rank |   | Rank | Country/Economy          | Value  | Score (0–100) | Percent rank |   |
|------|----------------------------|-------|---------------|--------------|---|------|--------------------------|--------|---------------|--------------|---|
| 1    | Viet Nam                   | 6.90  | 100.00        | 1.00         | ● | 65   | United Kingdom           | 0.79   | 47.56         | 0.42         | ○ |
| 2    | China                      | 6.63  | 97.65         | 0.99         | ● | 66   | Cyprus                   | 0.72   | 46.95         | 0.41         |   |
| 3    | Ethiopia                   | 5.56  | 88.46         | 0.98         | ● | 67   | United States of America | 0.71   | 46.91         | 0.40         | ○ |
| 4    | Côte d'Ivoire              | 5.43  | 87.39         | 0.97         | ● | 68   | Colombia                 | 0.68   | 46.63         | 0.39         |   |
| 5    | India                      | 5.20  | 85.45         | 0.96         | ● | 69   | Egypt                    | 0.68   | 46.62         | 0.38         |   |
| 6    | Ireland                    | 5.05  | 84.12         | 0.95         | ● | 70   | Qatar                    | 0.60   | 45.98         | 0.37         |   |
| 7    | Cambodia                   | 4.99  | 83.60         | 0.95         | ● | 71   | Belgium                  | 0.46   | 44.73         | 0.36         | ○ |
| 8    | Romania                    | 4.68  | 80.93         | 0.94         | ● | 72   | Jordan                   | 0.44   | 44.61         | 0.35         |   |
| 9    | Indonesia                  | 4.62  | 80.44         | 0.93         | ● | 73   | Montenegro               | 0.41   | 44.31         | 0.35         |   |
| 10   | Mozambique                 | 4.42  | 78.71         | 0.92         | ● | 74   | Serbia                   | 0.41   | 44.31         | 0.34         |   |
| 11   | Sri Lanka                  | 4.33  | 77.98         | 0.91         | ● | 75   | Canada                   | 0.32   | 43.54         | 0.33         | ○ |
| 12   | Zambia                     | 4.31  | 77.77         | 0.90         | ● | 76   | Lithuania                | 0.31   | 43.43         | 0.32         |   |
| 13   | Dominican Republic         | 4.29  | 77.64         | 0.89         | ● | 77   | Chile                    | 0.29   | 43.27         | 0.31         | ○ |
| 14   | Tanzania, United Rep.      | 4.07  | 75.75         | 0.88         | ● | 78   | Spain                    | 0.27   | 43.11         | 0.30         | ○ |
| 15   | Philippines                | 4.03  | 75.40         | 0.87         | ● | 79   | Austria                  | 0.23   | 42.78         | 0.29         | ○ |
| 16   | Bangladesh                 | 3.85  | 73.82         | 0.86         | ● | 80   | Italy                    | 0.20   | 42.56         | 0.28         | ○ |
| 17   | Tajikistan                 | 3.77  | 73.10         | 0.85         | ● | 81   | Iceland                  | 0.18   | 42.33         | 0.27         | ○ |
| 18   | Iran, Islamic Rep.         | 3.57  | 71.46         | 0.85         | ● | 82   | Israel                   | 0.15   | 42.12         | 0.26         | ○ |
| 19   | Thailand                   | 2.98  | 66.41         | 0.84         | ● | 83   | Mexico                   | 0.12   | 41.87         | 0.25         |   |
| 20   | Czech Republic             | 2.97  | 66.26         | 0.83         |   | 84   | Hungary                  | 0.10   | 41.69         | 0.25         | ○ |
| 21   | Niger                      | 2.87  | 65.40         | 0.82         | ● | 85   | Japan                    | 0.07   | 41.43         | 0.24         | ○ |
| 22   | Kenya                      | 2.83  | 65.06         | 0.81         | ● | 86   | Portugal                 | 0.07   | 41.39         | 0.23         | ○ |
| 23   | Bolivia, Plurinational St. | 2.82  | 65.03         | 0.80         | ● | 87   | Denmark                  | 0.06   | 41.30         | 0.22         | ○ |
| 24   | Mali                       | 2.75  | 64.36         | 0.79         | ● | 88   | Costa Rica               | -0.02  | 40.64         | 0.21         |   |
| 25   | Malta                      | 2.73  | 64.25         | 0.78         |   | 89   | Croatia                  | -0.04  | 40.43         | 0.20         | ○ |
| 26   | Morocco                    | 2.71  | 64.08         | 0.77         | ● | 90   | Argentina                | -0.16  | 39.40         | 0.19         |   |
| 27   | Bulgaria                   | 2.61  | 63.19         | 0.76         |   | 91   | Singapore                | -0.21  | 39.01         | 0.18         | ○ |
| 28   | Sweden                     | 2.57  | 62.85         | 0.75         |   | 92   | Tunisia                  | -0.43  | 37.08         | 0.17         | ○ |
| 29   | Kyrgyzstan                 | 2.55  | 62.71         | 0.75         | ● | 93   | Jamaica                  | -0.46  | 36.89         | 0.16         |   |
| 30   | Pakistan                   | 2.52  | 62.44         | 0.74         | ● | 94   | Switzerland              | -0.63  | 35.44         | 0.15         | ○ |
| 31   | Armenia                    | 2.40  | 61.37         | 0.73         |   | 95   | Azerbaijan               | -0.66  | 35.12         | 0.15         |   |
| 32   | Georgia                    | 2.38  | 61.24         | 0.72         |   | 96   | Oman                     | -0.74  | 34.47         | 0.14         |   |
| 33   | Cameroon                   | 2.37  | 61.14         | 0.71         | ● | 97   | Ukraine                  | -0.93  | 32.80         | 0.13         | ○ |
| 34   | Luxembourg                 | 2.27  | 60.30         | 0.70         |   | 98   | Trinidad and Tobago      | -0.98  | 32.40         | 0.12         |   |
| 35   | Poland                     | 2.20  | 59.70         | 0.69         |   | 99   | Ecuador                  | -1.10  | 31.42         | 0.11         |   |
| 36   | Uganda                     | 2.19  | 59.56         | 0.68         | ● | 100  | Kuwait                   | -1.28  | 29.82         | 0.10         | ○ |
| 37   | Algeria                    | 2.01  | 58.05         | 0.67         | ● | 101  | Estonia                  | -1.76  | 25.76         | 0.09         | ○ |
| 38   | Burkina Faso               | 1.90  | 57.10         | 0.66         | ● | 102  | Greece                   | -2.11  | 22.71         | 0.08         | ○ |
| 39   | Peru                       | 1.83  | 56.50         | 0.65         |   | 103  | Zimbabwe                 | -2.42  | 20.08         | 0.07         |   |
| 40   | Malawi                     | 1.76  | 55.88         | 0.65         | ● | 104  | Belarus                  | -2.43  | 19.95         | 0.06         | ○ |
| 41   | Slovakia                   | 1.59  | 54.42         | 0.64         |   | 105  | South Africa             | -2.54  | 19.04         | 0.05         | ○ |
| 42   | Slovenia                   | 1.43  | 53.04         | 0.63         |   | 106  | Albania                  | -2.68  | 17.82         | 0.05         | ○ |
| 43   | Turkey                     | 1.42  | 52.98         | 0.62         |   | 107  | Nigeria                  | -2.69  | 17.73         | 0.04         | ○ |
| 44   | Latvia                     | 1.37  | 52.55         | 0.61         |   | 108  | Moldova, Rep.            | -3.52  | 10.60         | 0.03         | ○ |
| 45   | TFYR of Macedonia          | 1.34  | 52.35         | 0.60         |   | 109  | Brazil                   | -4.07  | 5.91          | 0.02         | ○ |
| 46   | Bosnia and Herzegovina     | 1.30  | 51.98         | 0.59         |   | 110  | Russian Federation       | -4.76  | 0.00          | 0.00         | ○ |
| 47   | United Arab Emirates       | 1.29  | 51.85         | 0.58         |   | 110  | Yemen                    | -31.13 | 0.00          | 0.00         | ○ |
| 48   | Korea, Rep.                | 1.28  | 51.79         | 0.57         |   | n/a  | Benin                    | n/a    | n/a           | n/a          |   |
| 49   | Senegal                    | 1.28  | 51.79         | 0.56         |   | n/a  | Botswana                 | n/a    | n/a           | n/a          |   |
| 50   | Uruguay                    | 1.24  | 51.47         | 0.55         |   | n/a  | Brunei Darussalam        | n/a    | n/a           | n/a          |   |
| 51   | Madagascar                 | 1.13  | 50.53         | 0.55         |   | n/a  | Burundi                  | n/a    | n/a           | n/a          |   |
| 52   | Netherlands                | 1.08  | 50.05         | 0.54         | ○ | n/a  | El Salvador              | n/a    | n/a           | n/a          |   |
| 53   | Saudi Arabia               | 1.04  | 49.70         | 0.53         |   | n/a  | Guinea                   | n/a    | n/a           | n/a          |   |
| 54   | Norway                     | 1.01  | 49.50         | 0.52         | ○ | n/a  | Honduras                 | n/a    | n/a           | n/a          |   |
| 55   | Hong Kong (China)          | 1.00  | 49.37         | 0.51         |   | n/a  | Lebanon                  | n/a    | n/a           | n/a          |   |
| 56   | Guatemala                  | 1.00  | 49.36         | 0.50         |   | n/a  | Mauritius                | n/a    | n/a           | n/a          |   |
| 57   | Kazakhstan                 | 0.99  | 49.33         | 0.49         |   | n/a  | Mongolia                 | n/a    | n/a           | n/a          |   |
| 58   | Malaysia                   | 0.92  | 48.70         | 0.48         |   | n/a  | Namibia                  | n/a    | n/a           | n/a          |   |
| 59   | New Zealand                | 0.91  | 48.59         | 0.47         | ○ | n/a  | Nepal                    | n/a    | n/a           | n/a          |   |
| 60   | Finland                    | 0.90  | 48.51         | 0.46         | ○ | n/a  | Panama                   | n/a    | n/a           | n/a          |   |
| 61   | Germany                    | 0.85  | 48.14         | 0.45         | ○ | n/a  | Paraguay                 | n/a    | n/a           | n/a          |   |
| 62   | Australia                  | 0.85  | 48.07         | 0.45         | ○ | n/a  | Rwanda                   | n/a    | n/a           | n/a          |   |
| 63   | France                     | 0.81  | 47.73         | 0.44         | ○ | n/a  | Togo                     | n/a    | n/a           | n/a          |   |
| 64   | Bahrain                    | 0.80  | 47.67         | 0.43         |   |      |                          |        |               |              |   |

SOURCE: The Conference Board Total Economy Database™ Output, Labor and Labor Productivity, 1950–2016, May 2016

NOTE: ● Indicates a strength; ○ a weakness

## 6.2.2 New business density

### New business density (new registrations per thousand population 15–64 years old) | 2014

| Rank | Country/Economy             | Value | Score (0–100) | Percent rank |   | Rank | Country/Economy            | Value | Score (0–100) | Percent rank |   |
|------|-----------------------------|-------|---------------|--------------|---|------|----------------------------|-------|---------------|--------------|---|
| 1    | Hong Kong (China)           | 31.30 | 100.00        | 0.99         | ● | 65   | Albania (2013)             | 1.11  | 6.41          | 0.38         |   |
| 1    | Malta                       | 17.26 | 100.00        | 0.99         | ● | 66   | Costa Rica                 | 1.10  | 6.36          | 0.38         |   |
| 3    | New Zealand                 | 16.63 | 96.35         | 0.98         | ● | 67   | Kyrgyzstan                 | 1.08  | 6.24          | 0.37         |   |
| 4    | Estonia                     | 16.05 | 92.99         | 0.97         | ● | 68   | Belarus                    | 1.05  | 6.07          | 0.36         |   |
| 5    | Australia                   | 14.91 | 86.38         | 0.96         | ● | 69   | Oman (2013)                | 1.02  | 5.89          | 0.35         |   |
| 6    | Panama (2012)               | 14.10 | 81.69         | 0.95         | ● | 70   | Jamaica                    | 1.00  | 5.78          | 0.34         |   |
| 7    | Cyprus                      | 13.70 | 79.37         | 0.94         | ● | 71   | Azerbaijan                 | 0.99  | 5.72          | 0.32         |   |
| 8    | Botswana                    | 13.11 | 75.95         | 0.93         | ● | 71   | Jordan                     | 0.99  | 5.72          | 0.32         |   |
| 9    | United Kingdom (2012)       | 12.90 | 74.73         | 0.92         |   | 73   | Mexico                     | 0.94  | 5.43          | 0.31         |   |
| 10   | Latvia                      | 10.61 | 61.46         | 0.91         | ● | 74   | Ukraine (2012)             | 0.92  | 5.31          | 0.30         |   |
| 11   | Singapore                   | 9.51  | 55.09         | 0.90         |   | 75   | Thailand                   | 0.90  | 5.20          | 0.29         |   |
| 12   | Iceland                     | 9.48  | 54.92         | 0.89         |   | 76   | Namibia (2012)             | 0.85  | 4.91          | 0.28         |   |
| 13   | Bulgaria                    | 8.86  | 51.32         | 0.88         | ● | 77   | Bosnia and Herzegovina     | 0.83  | 4.79          | 0.27         |   |
| 14   | Chile                       | 8.03  | 46.51         | 0.88         | ● | 78   | Greece (2010)              | 0.77  | 4.42          | 0.26         | ○ |
| 15   | Norway                      | 7.72  | 44.72         | 0.87         |   | 79   | Nigeria                    | 0.76  | 4.39          | 0.25         |   |
| 16   | Sweden                      | 6.87  | 39.79         | 0.86         |   | 80   | Austria                    | 0.73  | 4.21          | 0.24         | ○ |
| 17   | Montenegro                  | 6.85  | 39.68         | 0.85         | ● | 81   | Madagascar                 | 0.70  | 4.04          | 0.23         |   |
| 18   | South Africa (2012)         | 6.54  | 37.86         | 0.84         | ● | 82   | Nepal                      | 0.69  | 3.98          | 0.22         |   |
| 19   | Mongolia                    | 6.31  | 36.55         | 0.83         | ● | 83   | Algeria                    | 0.58  | 3.34          | 0.21         |   |
| 20   | Luxembourg (2012)           | 6.10  | 35.33         | 0.82         |   | 84   | Bolivia, Plurinational St. | 0.57  | 3.28          | 0.20         |   |
| 21   | Ireland                     | 5.78  | 33.48         | 0.81         |   | 85   | Poland (2009)              | 0.53  | 3.05          | 0.19         | ○ |
| 22   | Georgia                     | 5.65  | 32.72         | 0.80         |   | 86   | El Salvador                | 0.52  | 2.99          | 0.17         |   |
| 23   | Netherlands                 | 5.34  | 30.93         | 0.79         |   | 86   | Guatemala (2012)           | 0.52  | 2.99          | 0.17         |   |
| 24   | Mauritius                   | 5.14  | 29.77         | 0.78         | ● | 88   | Sri Lanka (2012)           | 0.51  | 2.94          | 0.16         |   |
| 25   | Croatia                     | 4.63  | 26.81         | 0.77         |   | 89   | Argentina                  | 0.43  | 2.47          | 0.15         |   |
| 26   | Portugal                    | 4.62  | 26.75         | 0.76         |   | 90   | Senegal                    | 0.30  | 1.72          | 0.14         |   |
| 27   | Slovenia                    | 4.44  | 25.71         | 0.75         |   | 91   | Indonesia (2012)           | 0.29  | 1.66          | 0.13         |   |
| 28   | Denmark                     | 4.36  | 25.25         | 0.74         |   | 92   | Philippines (2012)         | 0.27  | 1.55          | 0.13         | ○ |
| 29   | Russian Federation          | 4.20  | 24.32         | 0.73         |   | 93   | Tajikistan (2012)          | 0.26  | 1.49          | 0.11         |   |
| 30   | Lithuania                   | 4.19  | 24.26         | 0.72         |   | 93   | Togo                       | 0.26  | 1.49          | 0.11         |   |
| 31   | Romania                     | 4.07  | 23.57         | 0.71         |   | 95   | Cambodia (2009)            | 0.22  | 1.24          | 0.10         |   |
| 32   | TFYR of Macedonia           | 3.70  | 21.42         | 0.70         |   | 96   | Burkina Faso (2012)        | 0.15  | 0.85          | 0.08         |   |
| 33   | Hungary                     | 3.66  | 21.19         | 0.69         |   | 96   | Japan                      | 0.15  | 0.85          | 0.08         | ○ |
| 34   | Finland                     | 3.43  | 19.86         | 0.68         |   | 98   | Guinea                     | 0.13  | 0.73          | 0.07         |   |
| 35   | Czech Republic              | 3.42  | 19.80         | 0.67         |   | 99   | Egypt (2009)               | 0.13  | 0.72          | 0.06         | ○ |
| 36   | Israel                      | 3.11  | 18.00         | 0.66         |   | 100  | India                      | 0.12  | 0.68          | 0.05         | ○ |
| 37   | Slovakia                    | 3.10  | 17.94         | 0.65         |   | 101  | Bangladesh (2012)          | 0.09  | 0.50          | 0.04         | ○ |
| 38   | Spain                       | 2.97  | 17.19         | 0.64         |   | 102  | Malawi (2009)              | 0.08  | 0.44          | 0.03         | ○ |
| 39   | Brazil                      | 2.88  | 16.67         | 0.63         |   | 103  | Pakistan                   | 0.04  | 0.21          | 0.02         | ○ |
| 40   | Switzerland (2012)          | 2.53  | 14.64         | 0.63         |   | 104  | Ethiopia (2009)            | 0.03  | 0.15          | 0.01         | ○ |
| 41   | Uruguay (2012)              | 2.49  | 14.41         | 0.62         |   | 105  | Niger (2009)               | 0.00  | 0.00          | 0.00         | ○ |
| 42   | Peru                        | 2.44  | 14.12         | 0.61         |   | n/a  | Bahrain                    | n/a   | n/a           | n/a          |   |
| 43   | Malaysia                    | 2.37  | 13.71         | 0.60         |   | n/a  | Benin                      | n/a   | n/a           | n/a          |   |
| 44   | Italy                       | 2.32  | 13.42         | 0.59         |   | n/a  | Brunei Darussalam          | n/a   | n/a           | n/a          |   |
| 45   | Korea, Rep.                 | 2.30  | 13.31         | 0.58         |   | n/a  | Burundi                    | n/a   | n/a           | n/a          |   |
| 46   | France                      | 2.26  | 13.08         | 0.57         | ○ | n/a  | Cameroon                   | n/a   | n/a           | n/a          |   |
| 47   | Belgium (2013)              | 2.05  | 11.86         | 0.56         |   | n/a  | China                      | n/a   | n/a           | n/a          |   |
| 48   | Colombia (2012)             | 2.00  | 11.57         | 0.55         |   | n/a  | Côte d'Ivoire              | n/a   | n/a           | n/a          |   |
| 49   | Kenya                       | 1.80  | 10.41         | 0.54         |   | n/a  | Ecuador                    | n/a   | n/a           | n/a          |   |
| 50   | Kazakhstan (2012)           | 1.71  | 9.89          | 0.53         |   | n/a  | Honduras                   | n/a   | n/a           | n/a          |   |
| 51   | Qatar                       | 1.70  | 9.83          | 0.52         |   | n/a  | Iran, Islamic Rep.         | n/a   | n/a           | n/a          |   |
| 52   | Moldova, Rep. (2009)        | 1.63  | 9.43          | 0.51         |   | n/a  | Kuwait                     | n/a   | n/a           | n/a          |   |
| 53   | Serbia                      | 1.62  | 9.37          | 0.50         |   | n/a  | Lebanon                    | n/a   | n/a           | n/a          |   |
| 54   | Morocco                     | 1.54  | 8.91          | 0.49         |   | n/a  | Mali                       | n/a   | n/a           | n/a          |   |
| 55   | Armenia                     | 1.52  | 8.79          | 0.47         |   | n/a  | Mozambique                 | n/a   | n/a           | n/a          |   |
| 55   | Tunisia (2013)              | 1.52  | 8.79          | 0.47         |   | n/a  | Paraguay                   | n/a   | n/a           | n/a          |   |
| 57   | Rwanda                      | 1.49  | 8.62          | 0.46         |   | n/a  | Saudi Arabia               | n/a   | n/a           | n/a          |   |
| 58   | United Arab Emirates (2012) | 1.38  | 7.98          | 0.45         |   | n/a  | Tanzania, United Rep.      | n/a   | n/a           | n/a          |   |
| 59   | Zambia                      | 1.33  | 7.69          | 0.44         | ● | n/a  | Trinidad and Tobago        | n/a   | n/a           | n/a          |   |
| 60   | Germany (2013)              | 1.29  | 7.46          | 0.43         | ○ | n/a  | United States of America   | n/a   | n/a           | n/a          |   |
| 61   | Canada                      | 1.28  | 7.40          | 0.42         | ○ | n/a  | Viet Nam                   | n/a   | n/a           | n/a          |   |
| 62   | Dominican Republic          | 1.20  | 6.93          | 0.41         |   | n/a  | Yemen                      | n/a   | n/a           | n/a          |   |
| 63   | Uganda (2012)               | 1.17  | 6.76          | 0.40         |   | n/a  | Zimbabwe                   | n/a   | n/a           | n/a          |   |
| 64   | Turkey                      | 1.13  | 6.53          | 0.39         |   |      |                            |       |               |              |   |

SOURCE: World Bank, *Doing Business 2016, Entrepreneurship*

NOTE: ● indicates a strength; ○ a weakness

## 6.2.3 Total computer software spending

### Total computer software spending (% of GDP) | 2016

| Rank | Country/Economy          | Value | Score (0–100) | Percent rank |   | Rank | Country/Economy            | Value | Score (0–100) | Percent rank |   |
|------|--------------------------|-------|---------------|--------------|---|------|----------------------------|-------|---------------|--------------|---|
| 1    | United States of America | 1.09  | 100.00        | 1.00         | ● | 65   | Uruguay                    | 0.24  | 21.47         | 0.48         |   |
| 2    | Ireland                  | 0.83  | 75.82         | 0.99         | ● | 66   | India                      | 0.24  | 21.33         | 0.48         |   |
| 3    | Canada                   | 0.80  | 72.98         | 0.98         | ● | 67   | Iran, Islamic Rep.         | 0.24  | 21.20         | 0.47         |   |
| 4    | United Kingdom           | 0.77  | 70.23         | 0.98         | ● | 68   | Argentina                  | 0.23  | 20.45         | 0.46         |   |
| 5    | Switzerland              | 0.74  | 67.71         | 0.97         |   | 69   | Colombia                   | 0.21  | 18.80         | 0.45         |   |
| 6    | Ukraine                  | 0.70  | 63.48         | 0.96         | ● | 70   | Panama                     | 0.21  | 18.51         | 0.44         |   |
| 7    | Spain                    | 0.66  | 59.88         | 0.95         | ● | 71   | Bolivia, Plurinational St. | 0.21  | 18.31         | 0.44         |   |
| 8    | Belgium                  | 0.65  | 59.24         | 0.94         | ● | 72   | Brazil                     | 0.20  | 18.17         | 0.43         |   |
| 9    | Norway                   | 0.64  | 58.20         | 0.94         |   | 73   | Luxembourg                 | 0.19  | 16.74         | 0.42         |   |
| 10   | Netherlands              | 0.63  | 57.77         | 0.93         |   | 74   | Kenya                      | 0.17  | 15.45         | 0.41         |   |
| 11   | Portugal                 | 0.62  | 56.77         | 0.92         | ● | 75   | Mauritius                  | 0.17  | 15.44         | 0.40         |   |
| 12   | Denmark                  | 0.62  | 56.35         | 0.91         |   | 76   | Cameroon                   | 0.17  | 15.12         | 0.40         |   |
| 13   | France                   | 0.60  | 54.54         | 0.90         |   | 77   | Bangladesh                 | 0.17  | 14.95         | 0.39         |   |
| 14   | Austria                  | 0.59  | 54.12         | 0.90         |   | 78   | Cyprus                     | 0.17  | 14.80         | 0.38         |   |
| 15   | Italy                    | 0.58  | 53.07         | 0.89         | ● | 79   | Estonia                    | 0.16  | 13.73         | 0.37         | ○ |
| 16   | Sweden                   | 0.58  | 52.80         | 0.88         |   | 80   | TFYR of Macedonia          | 0.15  | 12.97         | 0.36         |   |
| 17   | Greece                   | 0.58  | 52.41         | 0.87         | ● | 81   | Nigeria                    | 0.13  | 11.19         | 0.35         |   |
| 18   | Turkey                   | 0.55  | 49.68         | 0.86         | ● | 82   | Mongolia                   | 0.13  | 11.16         | 0.35         |   |
| 19   | Finland                  | 0.55  | 49.67         | 0.85         |   | 83   | Moldova, Rep.              | 0.12  | 10.88         | 0.34         |   |
| 20   | Germany                  | 0.55  | 49.65         | 0.85         |   | 84   | Namibia                    | 0.12  | 10.38         | 0.33         |   |
| 21   | Kuwait                   | 0.44  | 40.24         | 0.84         | ● | 85   | Botswana                   | 0.12  | 10.23         | 0.32         |   |
| 22   | Montenegro               | 0.43  | 38.54         | 0.83         | ● | 86   | Albania                    | 0.12  | 10.13         | 0.31         |   |
| 23   | Saudi Arabia             | 0.41  | 37.25         | 0.82         | ● | 87   | Latvia                     | 0.11  | 9.90          | 0.31         | ○ |
| 24   | Zimbabwe                 | 0.41  | 36.75         | 0.81         | ● | 88   | Armenia                    | 0.11  | 9.26          | 0.30         |   |
| 25   | Malta                    | 0.40  | 36.40         | 0.81         |   | 89   | Bosnia and Herzegovina     | 0.10  | 8.81          | 0.29         |   |
| 26   | China                    | 0.40  | 36.39         | 0.80         |   | 90   | Kyrgyzstan                 | 0.10  | 8.28          | 0.28         |   |
| 27   | Bahrain                  | 0.39  | 35.74         | 0.79         |   | 91   | Georgia                    | 0.10  | 8.16          | 0.27         |   |
| 28   | Hong Kong (China)        | 0.38  | 34.46         | 0.78         |   | 92   | Slovenia                   | 0.09  | 8.07          | 0.27         | ○ |
| 29   | Malaysia                 | 0.37  | 33.91         | 0.77         |   | 93   | Togo                       | 0.08  | 7.14          | 0.26         |   |
| 30   | South Africa             | 0.37  | 33.45         | 0.77         |   | 94   | Burundi                    | 0.08  | 6.95          | 0.25         |   |
| 31   | Qatar                    | 0.35  | 31.68         | 0.76         |   | 95   | Tajikistan                 | 0.08  | 6.47          | 0.24         |   |
| 32   | Iceland                  | 0.34  | 31.07         | 0.75         |   | 96   | Lithuania                  | 0.08  | 6.45          | 0.23         | ○ |
| 33   | Sri Lanka                | 0.34  | 30.48         | 0.74         | ● | 97   | Azerbaijan                 | 0.06  | 4.98          | 0.23         |   |
| 34   | Singapore                | 0.34  | 30.46         | 0.73         |   | 98   | Croatia                    | 0.06  | 4.64          | 0.22         | ○ |
| 35   | Russian Federation       | 0.33  | 30.06         | 0.73         |   | 99   | Oman                       | 0.05  | 4.21          | 0.21         |   |
| 36   | Indonesia                | 0.33  | 29.80         | 0.72         | ● | 100  | Rwanda                     | 0.05  | 4.12          | 0.20         |   |
| 37   | United Arab Emirates     | 0.33  | 29.42         | 0.71         |   | 101  | Benin                      | 0.05  | 4.07          | 0.19         |   |
| 38   | Jamaica                  | 0.32  | 28.59         | 0.70         | ● | 102  | Malawi                     | 0.05  | 4.03          | 0.19         |   |
| 39   | Viet Nam                 | 0.32  | 28.57         | 0.69         |   | 103  | Serbia                     | 0.05  | 3.62          | 0.18         | ○ |
| 40   | Tunisia                  | 0.31  | 28.05         | 0.69         | ● | 104  | Lebanon                    | 0.05  | 3.57          | 0.17         |   |
| 41   | Czech Republic           | 0.31  | 27.93         | 0.68         |   | 105  | El Salvador                | 0.05  | 3.56          | 0.16         |   |
| 42   | Hungary                  | 0.31  | 27.75         | 0.67         |   | 106  | Paraguay                   | 0.04  | 3.50          | 0.15         |   |
| 43   | Slovakia                 | 0.30  | 27.24         | 0.66         |   | 107  | Guinea                     | 0.04  | 3.49          | 0.15         |   |
| 44   | Poland                   | 0.30  | 26.96         | 0.65         |   | 108  | Belarus                    | 0.04  | 3.11          | 0.14         | ○ |
| 45   | Romania                  | 0.30  | 26.76         | 0.65         |   | 109  | Niger                      | 0.04  | 2.82          | 0.13         |   |
| 46   | Egypt                    | 0.30  | 26.63         | 0.64         | ● | 110  | Burkina Faso               | 0.03  | 2.56          | 0.12         |   |
| 47   | Thailand                 | 0.29  | 26.05         | 0.63         |   | 111  | Mali                       | 0.03  | 2.56          | 0.11         |   |
| 48   | Bulgaria                 | 0.28  | 25.57         | 0.62         |   | 112  | Cambodia                   | 0.03  | 2.51          | 0.10         |   |
| 49   | Chile                    | 0.28  | 25.39         | 0.61         |   | 113  | Mozambique                 | 0.03  | 2.31          | 0.10         |   |
| 50   | Korea, Rep.              | 0.28  | 25.37         | 0.60         |   | 114  | Zambia                     | 0.03  | 2.24          | 0.09         |   |
| 51   | Australia                | 0.28  | 25.20         | 0.60         |   | 115  | Madagascar                 | 0.03  | 2.12          | 0.08         |   |
| 52   | Costa Rica               | 0.28  | 24.97         | 0.59         |   | 116  | Nepal                      | 0.02  | 1.59          | 0.07         |   |
| 53   | Israel                   | 0.28  | 24.92         | 0.58         |   | 117  | Dominican Republic         | 0.02  | 1.56          | 0.06         | ○ |
| 54   | Jordan                   | 0.28  | 24.88         | 0.57         |   | 118  | Yemen                      | 0.02  | 1.55          | 0.06         |   |
| 55   | Honduras                 | 0.27  | 24.45         | 0.56         | ● | 119  | Kazakhstan                 | 0.02  | 1.39          | 0.05         | ○ |
| 56   | Senegal                  | 0.27  | 24.44         | 0.56         |   | 120  | Côte d'Ivoire              | 0.02  | 1.24          | 0.04         | ○ |
| 57   | Mexico                   | 0.26  | 23.66         | 0.55         |   | 121  | Guatemala                  | 0.02  | 1.01          | 0.03         | ○ |
| 58   | New Zealand              | 0.26  | 23.61         | 0.54         |   | 122  | Uganda                     | 0.02  | 0.83          | 0.02         | ○ |
| 59   | Pakistan                 | 0.26  | 23.60         | 0.53         | ● | 123  | Tanzania, United Rep.      | 0.01  | 0.44          | 0.02         | ○ |
| 60   | Japan                    | 0.26  | 23.11         | 0.52         |   | 124  | Algeria                    | 0.01  | 0.41          | 0.01         | ○ |
| 61   | Philippines              | 0.25  | 22.83         | 0.52         |   | 125  | Ethiopia                   | 0.01  | 0.00          | 0.00         | ○ |
| 62   | Morocco                  | 0.25  | 22.47         | 0.51         |   | n/a  | Brunei Darussalam          | n/a   | n/a           | n/a          |   |
| 63   | Ecuador                  | 0.25  | 22.39         | 0.50         |   | n/a  | Trinidad and Tobago        | n/a   | n/a           | n/a          |   |
| 64   | Peru                     | 0.24  | 21.79         | 0.49         |   |      |                            |       |               |              |   |

SOURCE: IHS Global Insight, *Information and Communication Technology Database*

NOTE: ● indicates a strength; ○ a weakness



# 6.2.4 ISO 9001 quality certificates

ISO 9001 Quality management systems—Requirements: Number of certificates issued (per billion PPP\$ GDP) | 2015

| Rank | Country/Economy        | Value | Score (0–100) | Percent rank |   | Rank | Country/Economy            | Value | Score (0–100) | Percent rank |   |
|------|------------------------|-------|---------------|--------------|---|------|----------------------------|-------|---------------|--------------|---|
| 1    | Italy                  | 61.08 | 100.00        | 1.00         | ● | 65   | India                      | 4.54  | 7.43          | 0.49         |   |
| 2    | Romania                | 49.49 | 81.02         | 0.99         | ● | 66   | Luxembourg                 | 4.50  | 7.37          | 0.48         |   |
| 3    | Bulgaria               | 39.68 | 64.96         | 0.98         | ● | 67   | Honduras                   | 4.18  | 6.84          | 0.48         |   |
| 4    | Slovakia               | 35.23 | 57.67         | 0.98         | ● | 68   | El Salvador                | 4.17  | 6.82          | 0.47         |   |
| 5    | Malta                  | 32.76 | 53.64         | 0.97         | ● | 69   | Jordan                     | 4.09  | 6.70          | 0.46         |   |
| 6    | Israel                 | 31.85 | 52.14         | 0.96         |   | 70   | Canada                     | 3.93  | 6.43          | 0.45         | ○ |
| 7    | Czech Republic         | 31.50 | 51.57         | 0.95         | ● | 71   | Costa Rica                 | 3.74  | 6.13          | 0.44         |   |
| 8    | Estonia                | 30.06 | 49.21         | 0.94         | ● | 72   | Sri Lanka                  | 3.58  | 5.87          | 0.44         |   |
| 9    | Cyprus                 | 29.25 | 47.88         | 0.94         | ● | 73   | Morocco                    | 3.54  | 5.79          | 0.43         |   |
| 10   | Croatia                | 27.71 | 45.36         | 0.93         | ● | 74   | Mexico                     | 3.33  | 5.45          | 0.42         |   |
| 11   | Portugal               | 25.83 | 42.28         | 0.92         | ● | 75   | Peru                       | 3.31  | 5.42          | 0.41         |   |
| 12   | Serbia                 | 25.71 | 42.09         | 0.91         | ● | 76   | Oman                       | 3.21  | 5.25          | 0.40         |   |
| 13   | Switzerland            | 25.29 | 41.40         | 0.90         |   | 77   | Bolivia, Plurinational St. | 3.10  | 5.07          | 0.40         |   |
| 14   | Slovenia               | 23.22 | 38.02         | 0.90         | ● | 78   | Ukraine                    | 3.09  | 5.06          | 0.39         |   |
| 15   | Latvia                 | 22.77 | 37.28         | 0.89         |   | 79   | Brunei Darussalam          | 3.07  | 5.03          | 0.38         |   |
| 16   | Hungary                | 22.35 | 36.60         | 0.88         | ● | 80   | Indonesia                  | 3.02  | 4.95          | 0.37         |   |
| 17   | Belarus                | 21.73 | 35.58         | 0.87         | ● | 81   | Philippines                | 2.96  | 4.84          | 0.37         |   |
| 18   | Greece                 | 21.59 | 35.35         | 0.87         | ● | 82   | Madagascar                 | 2.70  | 4.42          | 0.36         |   |
| 19   | Spain                  | 20.22 | 33.11         | 0.86         |   | 83   | Pakistan                   | 2.67  | 4.37          | 0.35         |   |
| 20   | Bosnia and Herzegovina | 19.38 | 31.74         | 0.85         | ● | 84   | Trinidad and Tobago        | 2.65  | 4.33          | 0.34         |   |
| 21   | Colombia               | 18.48 | 30.25         | 0.84         | ● | 85   | Russian Federation         | 2.44  | 3.99          | 0.33         |   |
| 22   | Uruguay                | 18.04 | 29.53         | 0.83         | ● | 86   | Georgia                    | 2.38  | 3.90          | 0.33         |   |
| 23   | Lithuania              | 15.00 | 24.56         | 0.83         | ● | 87   | Egypt                      | 2.36  | 3.87          | 0.32         |   |
| 24   | United Kingdom         | 14.86 | 24.33         | 0.82         |   | 88   | Panama                     | 2.25  | 3.69          | 0.31         |   |
| 25   | China                  | 14.85 | 24.32         | 0.81         |   | 89   | Benin                      | 2.18  | 3.57          | 0.30         |   |
| 26   | Malaysia               | 14.63 | 23.96         | 0.80         |   | 90   | Qatar                      | 2.12  | 3.47          | 0.29         |   |
| 27   | Germany                | 13.73 | 22.48         | 0.79         |   | 91   | Côte d'Ivoire              | 2.03  | 3.33          | 0.29         |   |
| 28   | Chile                  | 12.48 | 20.43         | 0.79         |   | 92   | Togo                       | 2.02  | 3.31          | 0.28         |   |
| 29   | TFYR of Macedonia      | 12.48 | 20.43         | 0.78         | ● | 93   | Iran, Islamic Rep.         | 1.91  | 3.13          | 0.27         |   |
| 30   | Netherlands            | 12.35 | 20.22         | 0.77         |   | 94   | United States of America   | 1.84  | 3.00          | 0.26         | ○ |
| 31   | Singapore              | 12.24 | 20.04         | 0.76         |   | 95   | Saudi Arabia               | 1.79  | 2.93          | 0.25         |   |
| 32   | Australia              | 11.95 | 19.57         | 0.75         |   | 96   | Guatemala                  | 1.78  | 2.92          | 0.25         |   |
| 33   | Finland                | 11.54 | 18.89         | 0.75         |   | 97   | Namibia                    | 1.76  | 2.88          | 0.24         |   |
| 34   | Austria                | 11.04 | 18.07         | 0.74         |   | 98   | Mozambique                 | 1.71  | 2.80          | 0.23         |   |
| 35   | Poland                 | 10.61 | 17.36         | 0.73         |   | 99   | Senegal                    | 1.66  | 2.72          | 0.22         |   |
| 36   | France                 | 10.44 | 17.10         | 0.72         |   | 100  | Burkina Faso               | 1.62  | 2.65          | 0.21         |   |
| 37   | Japan                  | 9.73  | 15.92         | 0.71         |   | 101  | Azerbaijan                 | 1.43  | 2.34          | 0.21         |   |
| 38   | Mauritius              | 9.70  | 15.88         | 0.71         |   | 102  | Nepal                      | 1.40  | 2.29          | 0.20         |   |
| 39   | Sweden                 | 9.09  | 14.88         | 0.70         |   | 103  | Dominican Republic         | 1.29  | 2.11          | 0.19         |   |
| 40   | Albania                | 8.54  | 13.99         | 0.69         | ● | 104  | Kuwait                     | 1.19  | 1.94          | 0.18         |   |
| 41   | Montenegro             | 8.43  | 13.80         | 0.68         |   | 105  | Uganda                     | 1.10  | 1.80          | 0.17         |   |
| 42   | Argentina              | 8.04  | 13.17         | 0.67         |   | 106  | Kazakhstan                 | 1.07  | 1.75          | 0.17         |   |
| 43   | Tunisia                | 7.84  | 12.84         | 0.67         |   | 107  | Armenia                    | 1.06  | 1.74          | 0.16         |   |
| 44   | Thailand               | 7.82  | 12.81         | 0.66         |   | 108  | Jamaica                    | 1.05  | 1.72          | 0.15         |   |
| 45   | United Arab Emirates   | 7.68  | 12.57         | 0.65         |   | 109  | Algeria                    | 0.98  | 1.60          | 0.14         |   |
| 46   | Ireland                | 7.62  | 12.47         | 0.64         |   | 110  | Cameroon                   | 0.95  | 1.55          | 0.13         |   |
| 47   | Lebanon                | 7.58  | 12.41         | 0.63         |   | 111  | Malawi                     | 0.83  | 1.36          | 0.13         |   |
| 48   | Viet Nam               | 7.50  | 12.27         | 0.63         |   | 112  | Zambia                     | 0.80  | 1.31          | 0.12         |   |
| 49   | Moldova, Rep.          | 7.25  | 11.86         | 0.62         |   | 113  | Tanzania, United Rep.      | 0.79  | 1.29          | 0.11         |   |
| 50   | Denmark                | 7.21  | 11.80         | 0.61         |   | 114  | Bangladesh                 | 0.78  | 1.28          | 0.10         |   |
| 51   | Belgium                | 7.20  | 11.78         | 0.60         |   | 115  | Cambodia                   | 0.74  | 1.20          | 0.10         |   |
| 52   | New Zealand            | 7.16  | 11.73         | 0.60         |   | 116  | Ethiopia                   | 0.61  | 1.00          | 0.09         |   |
| 53   | Norway                 | 6.91  | 11.31         | 0.59         |   | 117  | Guinea                     | 0.59  | 0.96          | 0.08         |   |
| 54   | Ecuador                | 6.89  | 11.29         | 0.58         | ● | 118  | Mongolia                   | 0.50  | 0.81          | 0.07         | ○ |
| 55   | Korea, Rep.            | 6.47  | 10.59         | 0.57         |   | 119  | Botswana                   | 0.43  | 0.70          | 0.06         | ○ |
| 56   | Hong Kong (China)      | 6.06  | 9.92          | 0.56         |   | 120  | Niger                      | 0.42  | 0.69          | 0.06         |   |
| 57   | South Africa           | 5.99  | 9.80          | 0.56         |   | 121  | Yemen                      | 0.29  | 0.48          | 0.05         |   |
| 58   | Bahrain                | 5.84  | 9.57          | 0.55         |   | 122  | Nigeria                    | 0.18  | 0.30          | 0.04         | ○ |
| 59   | Paraguay               | 5.51  | 9.02          | 0.54         | ● | 123  | Mali                       | 0.17  | 0.28          | 0.03         | ○ |
| 60   | Brazil                 | 5.48  | 8.97          | 0.53         |   | 124  | Tajikistan                 | 0.17  | 0.27          | 0.02         | ○ |
| 61   | Turkey                 | 5.35  | 8.76          | 0.52         |   | 125  | Rwanda                     | 0.15  | 0.24          | 0.02         | ○ |
| 62   | Iceland                | 4.94  | 8.09          | 0.52         |   | 126  | Kyrgyzstan                 | 0.05  | 0.08          | 0.01         | ○ |
| 63   | Zimbabwe               | 4.64  | 7.59          | 0.51         | ● | 127  | Burundi                    | 0.00  | 0.00          | 0.00         | ○ |
| 64   | Kenya                  | 4.61  | 7.55          | 0.50         |   |      |                            |       |               |              |   |

SOURCE: International Organization for Standardization, *The ISO Survey 2015*; International Monetary Fund, *World Economic Outlook Database*, October 2016 (PPP\$ GDP)

NOTE: ● indicates a strength; ○ a weakness

# 6.2.5 High-tech and medium-high-tech output

## High-tech and medium-high-tech output (% of total manufactures output) | 2014

| Rank | Country/Economy                 | Value | Score (0–100) | Percent rank |   | Rank | Country/Economy                   | Value | Score (0–100) | Percent rank |   |
|------|---------------------------------|-------|---------------|--------------|---|------|-----------------------------------|-------|---------------|--------------|---|
| 1    | Switzerland                     | 0.65  | 100.00        | 1.00         | ● | 65   | Latvia (2013)                     | 0.16  | 21.59         | 0.37         |   |
| 2    | Singapore                       | 0.65  | 99.72         | 0.99         | ● | 66   | Cyprus                            | 0.15  | 20.36         | 0.36         |   |
| 3    | Hungary                         | 0.58  | 88.97         | 0.98         | ● | 67   | Kazakhstan (2013)                 | 0.15  | 19.68         | 0.35         |   |
| 4    | Slovakia                        | 0.58  | 88.38         | 0.97         | ● | 68   | Uruguay (2011)                    | 0.14  | 19.62         | 0.34         |   |
| 5    | Ireland (2013)                  | 0.55  | 84.74         | 0.96         | ● | 69   | Kuwait (2013)                     | 0.14  | 18.94         | 0.33         |   |
| 6    | Germany                         | 0.54  | 83.01         | 0.95         | ● | 70   | Ecuador (2008)                    | 0.14  | 18.80         | 0.32         |   |
| 7    | Czech Republic                  | 0.52  | 79.97         | 0.94         | ● | 71   | Ethiopia                          | 0.14  | 18.11         | 0.31         |   |
| 8    | Korea, Rep.                     | 0.52  | 79.79         | 0.93         | ● | 72   | Paraguay (2010)                   | 0.13  | 17.83         | 0.30         |   |
| 9    | Japan (2012)                    | 0.50  | 76.49         | 0.92         | ● | 73   | New Zealand (2012)                | 0.13  | 17.50         | 0.29         | ○ |
| 10   | Slovenia                        | 0.47  | 71.88         | 0.91         | ● | 74   | Azerbaijan (2013)                 | 0.13  | 17.19         | 0.28         |   |
| 11   | Sweden                          | 0.46  | 69.58         | 0.90         | ● | 75   | Greece                            | 0.13  | 17.13         | 0.27         | ○ |
| 12   | Qatar (2013)                    | 0.44  | 66.55         | 0.89         | ● | 76   | Georgia (2013)                    | 0.13  | 16.82         | 0.26         |   |
| 13   | United States of America (2008) | 0.43  | 65.58         | 0.88         | ● | 77   | Costa Rica (2013)                 | 0.12  | 15.67         | 0.25         |   |
| 14   | China (2011)                    | 0.43  | 65.36         | 0.87         | ● | 78   | Kenya (2013)                      | 0.11  | 14.24         | 0.24         |   |
| 15   | Austria                         | 0.43  | 65.07         | 0.86         | ● | 79   | Bosnia and Herzegovina (2011)     | 0.11  | 14.16         | 0.23         |   |
| 16   | Mexico (2013)                   | 0.42  | 63.52         | 0.85         | ● | 80   | Moldova, Rep. (2013)              | 0.10  | 12.77         | 0.22         |   |
| 17   | Denmark                         | 0.42  | 62.85         | 0.84         | ● | 81   | Bahrain (2013)                    | 0.10  | 12.75         | 0.21         |   |
| 18   | Philippines (2012)              | 0.41  | 61.98         | 0.83         | ● | 82   | Tanzania, United Rep. (2010)      | 0.10  | 12.46         | 0.20         |   |
| 19   | Thailand (2011)                 | 0.41  | 61.60         | 0.82         | ● | 83   | Peru (2011)                       | 0.09  | 11.27         | 0.19         | ○ |
| 20   | Netherlands                     | 0.39  | 58.47         | 0.81         | ● | 84   | Bangladesh (2011)                 | 0.09  | 10.98         | 0.18         |   |
| 21   | Brazil (2013)                   | 0.38  | 57.40         | 0.80         | ● | 85   | Bolivia, Plurinational St. (2010) | 0.09  | 10.45         | 0.17         |   |
| 22   | Finland                         | 0.38  | 56.54         | 0.79         | ● | 86   | Malawi (2012)                     | 0.09  | 10.28         | 0.16         |   |
| 23   | France                          | 0.37  | 55.87         | 0.78         | ● | 87   | Mauritius (2012)                  | 0.08  | 9.54          | 0.15         | ○ |
| 24   | Oman                            | 0.37  | 55.05         | 0.77         | ● | 88   | Albania (2013)                    | 0.08  | 8.98          | 0.14         |   |
| 25   | United Kingdom                  | 0.36  | 54.58         | 0.76         | ● | 89   | Panama (2013)                     | 0.08  | 8.81          | 0.13         |   |
| 26   | Italy                           | 0.36  | 54.41         | 0.75         | ● | 90   | Iceland (2006)                    | 0.07  | 7.90          | 0.12         | ○ |
| 27   | Romania (2013)                  | 0.36  | 54.14         | 0.74         | ● | 91   | Nepal (2011)                      | 0.07  | 7.23          | 0.11         |   |
| 28   | Malaysia (2012)                 | 0.36  | 53.58         | 0.73         | ● | 92   | Sri Lanka (2012)                  | 0.06  | 6.35          | 0.10         | ○ |
| 29   | Saudi Arabia (2009)             | 0.36  | 53.41         | 0.72         | ● | 93   | Mongolia (2011)                   | 0.06  | 5.34          | 0.09         | ○ |
| 30   | Estonia                         | 0.35  | 52.82         | 0.71         | ● | 94   | Namibia (2013)                    | 0.05  | 4.01          | 0.08         | ○ |
| 31   | Belgium                         | 0.35  | 51.90         | 0.70         | ● | 95   | Kyrgyzstan (2013)                 | 0.04  | 3.39          | 0.07         |   |
| 32   | Norway                          | 0.34  | 51.45         | 0.69         | ● | 96   | Cameroon (2008)                   | 0.04  | 3.37          | 0.06         | ○ |
| 33   | Spain                           | 0.33  | 49.71         | 0.68         | ● | 97   | Armenia (2013)                    | 0.04  | 2.94          | 0.05         | ○ |
| 34   | Tunisia (2007)                  | 0.32  | 47.75         | 0.67         | ● | 98   | Burundi (2012)                    | 0.04  | 2.52          | 0.04         |   |
| 35   | Poland                          | 0.32  | 47.19         | 0.66         | ● | 99   | Brunei Darussalam (2010)          | 0.03  | 0.82          | 0.03         | ○ |
| 36   | Iran, Islamic Rep.              | 0.31  | 45.50         | 0.65         | ● | 100  | Tajikistan (2013)                 | 0.02  | 0.49          | 0.02         | ○ |
| 37   | Israel                          | 0.30  | 44.06         | 0.64         | ● | 101  | Madagascar (2006)                 | 0.02  | 0.37          | 0.01         | ○ |
| 38   | Canada                          | 0.29  | 43.52         | 0.63         | ● | 102  | Yemen (2012)                      | 0.02  | 0.00          | 0.00         | ○ |
| 39   | Algeria (2010)                  | 0.29  | 42.91         | 0.62         | ● | n/a  | Argentina                         | n/a   | n/a           | n/a          |   |
| 40   | India                           | 0.29  | 42.82         | 0.61         | ● | n/a  | Benin                             | n/a   | n/a           | n/a          |   |
| 41   | Belarus                         | 0.29  | 42.02         | 0.60         | ● | n/a  | Botswana                          | n/a   | n/a           | n/a          |   |
| 42   | Morocco (2013)                  | 0.28  | 41.86         | 0.59         | ● | n/a  | Burkina Faso                      | n/a   | n/a           | n/a          |   |
| 43   | Indonesia (2013)                | 0.28  | 41.69         | 0.58         | ● | n/a  | Cambodia                          | n/a   | n/a           | n/a          |   |
| 44   | South Africa (2010)             | 0.27  | 40.07         | 0.57         | ● | n/a  | Côte d'Ivoire                     | n/a   | n/a           | n/a          |   |
| 45   | Serbia                          | 0.27  | 38.87         | 0.56         | ● | n/a  | Croatia                           | n/a   | n/a           | n/a          |   |
| 46   | Viet Nam (2012)                 | 0.26  | 38.22         | 0.55         | ● | n/a  | Dominican Republic                | n/a   | n/a           | n/a          |   |
| 47   | Portugal                        | 0.26  | 37.95         | 0.54         | ● | n/a  | El Salvador                       | n/a   | n/a           | n/a          |   |
| 48   | Turkey                          | 0.25  | 36.70         | 0.53         | ● | n/a  | Guatemala                         | n/a   | n/a           | n/a          |   |
| 49   | Australia (2013)                | 0.25  | 36.59         | 0.52         | ● | n/a  | Guinea                            | n/a   | n/a           | n/a          |   |
| 50   | Malta (2010)                    | 0.24  | 35.60         | 0.51         | ● | n/a  | Honduras                          | n/a   | n/a           | n/a          |   |
| 51   | Russian Federation              | 0.24  | 35.52         | 0.50         | ● | n/a  | Jamaica                           | n/a   | n/a           | n/a          |   |
| 52   | Pakistan (2006)                 | 0.24  | 34.36         | 0.50         | ● | n/a  | Mali                              | n/a   | n/a           | n/a          |   |
| 53   | Hong Kong (China)               | 0.23  | 32.67         | 0.49         | ● | n/a  | Montenegro                        | n/a   | n/a           | n/a          |   |
| 54   | Lebanon (2007)                  | 0.22  | 31.63         | 0.48         | ● | n/a  | Mozambique                        | n/a   | n/a           | n/a          |   |
| 55   | Jordan (2013)                   | 0.21  | 30.81         | 0.47         | ● | n/a  | Niger                             | n/a   | n/a           | n/a          |   |
| 56   | Ukraine                         | 0.20  | 29.23         | 0.46         | ● | n/a  | Nigeria                           | n/a   | n/a           | n/a          |   |
| 57   | Bulgaria                        | 0.20  | 28.58         | 0.45         | ● | n/a  | Rwanda                            | n/a   | n/a           | n/a          |   |
| 58   | Colombia (2012)                 | 0.20  | 28.49         | 0.44         | ● | n/a  | Togo                              | n/a   | n/a           | n/a          |   |
| 59   | TFYR of Macedonia (2011)        | 0.20  | 27.77         | 0.43         | ● | n/a  | Trinidad and Tobago               | n/a   | n/a           | n/a          |   |
| 60   | Egypt (2012)                    | 0.19  | 27.45         | 0.42         | ● | n/a  | Uganda                            | n/a   | n/a           | n/a          |   |
| 61   | Lithuania                       | 0.19  | 26.21         | 0.41         | ● | n/a  | United Arab Emirates              | n/a   | n/a           | n/a          |   |
| 62   | Luxembourg                      | 0.18  | 25.40         | 0.40         | ● | n/a  | Zambia                            | n/a   | n/a           | n/a          |   |
| 63   | Chile (2013)                    | 0.17  | 23.85         | 0.39         | ● | n/a  | Zimbabwe                          | n/a   | n/a           | n/a          |   |
| 64   | Senegal (2012)                  | 0.16  | 21.60         | 0.38         | ● |      |                                   |       |               |              |   |

**SOURCE:** United Nations Industrial Development Organization (UNIDO), *Industrial Statistics Database*, 3- and 4-digit level of International Standard Industrial Classification ISIC Revision 3 (INDSTAT4 2016); OECD, Directorate for Science, Technology and Industry, Economic Analysis and Statistics Division, 'ISIC REV.3 Technology Intensity Definition: Classification of Manufacturing Industries into Categories Based on R&D Intensities', 7 July 2011

**NOTE:** ● Indicates a strength; ○ a weakness

# 6.3.1

## Intellectual property receipts

Charges for use of intellectual property n.i.e., receipts (% of total trade) | 2015

| Rank | Country/Economy            | Value | Score (0–100) | Percent rank |   | Rank | Country/Economy              | Value | Score (0–100) | Percent rank |   |
|------|----------------------------|-------|---------------|--------------|---|------|------------------------------|-------|---------------|--------------|---|
| 1    | United States of America   | 5.09  | 100.00        | 1.00         | ● | 65   | Estonia                      | 0.07  | 3.16          | 0.40         | ○ |
| 2    | Japan                      | 4.71  | 96.20         | 0.99         | ● | 66   | Peru                         | 0.05  | 2.48          | 0.39         |   |
| 3    | Sweden                     | 4.21  | 90.88         | 0.98         | ● | 67   | China                        | 0.05  | 2.35          | 0.38         |   |
| 4    | Switzerland                | 3.82  | 86.32         | 0.97         |   | 68   | Mongolia                     | 0.05  | 2.30          | 0.37         |   |
| 5    | Netherlands                | 3.71  | 84.98         | 0.96         | ● | 69   | Albania                      | 0.05  | 2.29          | 0.36         |   |
| 6    | Finland                    | 2.90  | 74.02         | 0.95         |   | 70   | Latvia                       | 0.04  | 2.01          | 0.36         |   |
| 7    | Iceland                    | 2.82  | 72.79         | 0.94         |   | 71   | Pakistan                     | 0.04  | 2.00          | 0.35         |   |
| 8    | Ireland                    | 2.39  | 65.92         | 0.93         |   | 72   | Mauritius (2014)             | 0.04  | 1.99          | 0.34         |   |
| 9    | Malta                      | 2.13  | 61.41         | 0.93         |   | 73   | Malaysia                     | 0.04  | 1.98          | 0.33         |   |
| 10   | United Kingdom             | 1.98  | 58.58         | 0.92         |   | 74   | Montenegro                   | 0.04  | 1.80          | 0.32         |   |
| 11   | France                     | 1.88  | 56.50         | 0.91         |   | 75   | Slovakia                     | 0.03  | 1.61          | 0.31         | ○ |
| 12   | Denmark                    | 1.41  | 46.66         | 0.90         |   | 76   | Indonesia                    | 0.03  | 1.57          | 0.30         |   |
| 13   | Hungary                    | 1.41  | 46.56         | 0.89         | ● | 77   | Kyrgyzstan (2014)            | 0.03  | 1.48          | 0.29         |   |
| 14   | Korea, Rep.                | 1.04  | 37.47         | 0.88         |   | 78   | Zimbabwe (2012)              | 0.03  | 1.28          | 0.28         |   |
| 15   | Luxembourg                 | 0.98  | 35.71         | 0.87         |   | 79   | Costa Rica (2014)            | 0.02  | 1.19          | 0.27         |   |
| 16   | Germany                    | 0.94  | 34.54         | 0.86         |   | 80   | Burkina Faso (2014)          | 0.02  | 1.10          | 0.26         |   |
| 17   | Israel                     | 0.87  | 32.65         | 0.85         |   | 81   | Panama                       | 0.02  | 1.07          | 0.25         |   |
| 18   | Canada                     | 0.83  | 31.30         | 0.84         |   | 82   | Iran, Islamic Rep. (2014)    | 0.01  | 0.72          | 0.24         |   |
| 19   | Belgium                    | 0.78  | 30.02         | 0.83         |   | 83   | Rwanda (2009)                | 0.01  | 0.71          | 0.23         |   |
| 20   | Singapore                  | 0.69  | 27.18         | 0.82         |   | 84   | Philippines                  | 0.01  | 0.69          | 0.22         |   |
| 21   | New Zealand                | 0.63  | 25.29         | 0.81         |   | 85   | Honduras                     | 0.01  | 0.53          | 0.21         |   |
| 22   | Italy                      | 0.58  | 23.39         | 0.80         |   | 86   | Cyprus (2014)                | 0.01  | 0.48          | 0.21         | ○ |
| 23   | United Arab Emirates       | 0.50  | 20.92         | 0.79         |   | 87   | Burundi (2013)               | 0.01  | 0.44          | 0.20         |   |
| 24   | Madagascar (2013)          | 0.46  | 19.17         | 0.79         | ● | 88   | Georgia                      | 0.01  | 0.37          | 0.19         |   |
| 25   | Austria                    | 0.45  | 18.86         | 0.78         |   | 89   | Tajikistan (2013)            | 0.01  | 0.35          | 0.18         |   |
| 26   | Spain                      | 0.43  | 18.12         | 0.77         |   | 90   | Guinea (2008)                | 0.01  | 0.31          | 0.17         |   |
| 27   | Yemen (2009)               | 0.40  | 17.00         | 0.76         | ● | 91   | Côte d'Ivoire (2013)         | 0.01  | 0.28          | 0.16         |   |
| 28   | Kenya (2014)               | 0.39  | 16.80         | 0.75         | ● | 92   | Cambodia                     | 0.00  | 0.20          | 0.15         |   |
| 29   | Norway                     | 0.38  | 16.48         | 0.74         |   | 93   | Ethiopia (2010)              | 0.00  | 0.17          | 0.14         |   |
| 30   | El Salvador                | 0.33  | 14.61         | 0.73         | ● | 94   | Mali (2012)                  | 0.00  | 0.16          | 0.13         |   |
| 31   | Australia                  | 0.32  | 13.89         | 0.72         |   | 95   | Morocco (2013)               | 0.00  | 0.13          | 0.12         | ○ |
| 32   | Czech Republic             | 0.31  | 13.69         | 0.71         |   | 96   | Cameroon (2013)              | 0.00  | 0.12          | 0.11         |   |
| 33   | Egypt (2007)               | 0.25  | 11.36         | 0.70         | ● | 97   | Uruguay                      | 0.00  | 0.11          | 0.10         | ○ |
| 34   | Brazil                     | 0.25  | 11.26         | 0.69         |   | 98   | Bangladesh (2014)            | 0.00  | 0.11          | 0.09         |   |
| 35   | Argentina                  | 0.24  | 10.64         | 0.68         |   | 99   | Botswana (2014)              | 0.00  | 0.10          | 0.08         | ○ |
| 36   | Bolivia, Plurinational St. | 0.23  | 10.46         | 0.67         | ● | 100  | Namibia (2014)               | 0.00  | 0.10          | 0.07         | ○ |
| 37   | Russian Federation         | 0.22  | 9.86          | 0.66         |   | 101  | Kazakhstan                   | 0.00  | 0.09          | 0.07         | ○ |
| 38   | Croatia                    | 0.20  | 9.13          | 0.65         |   | 102  | Mozambique (2012)            | 0.00  | 0.07          | 0.06         |   |
| 39   | Serbia                     | 0.20  | 9.03          | 0.64         |   | 103  | Togo (2010)                  | 0.00  | 0.04          | 0.05         |   |
| 40   | Slovenia                   | 0.19  | 8.62          | 0.64         |   | 104  | Algeria (2014)               | 0.00  | 0.03          | 0.04         |   |
| 41   | Poland                     | 0.18  | 8.47          | 0.63         |   | 105  | Benin (2014)                 | 0.00  | 0.01          | 0.03         | ○ |
| 42   | Bosnia and Herzegovina     | 0.18  | 8.35          | 0.62         |   | 106  | Niger (2007)                 | 0.00  | 0.01          | 0.02         |   |
| 43   | Ukraine                    | 0.18  | 8.17          | 0.61         |   | 107  | Azerbaijan (2012)            | 0.00  | 0.01          | 0.01         | ○ |
| 44   | TFYR of Macedonia          | 0.16  | 7.45          | 0.60         |   | 108  | Tanzania, United Rep. (2007) | 0.00  | 0.00          | 0.00         | ○ |
| 45   | Bulgaria                   | 0.13  | 6.32          | 0.59         |   | n/a  | Armenia                      | n/a   | n/a           | n/a          |   |
| 46   | Moldova, Rep.              | 0.13  | 6.15          | 0.58         |   | n/a  | Bahrain                      | n/a   | n/a           | n/a          |   |
| 47   | Romania                    | 0.12  | 5.75          | 0.57         |   | n/a  | Brunei Darussalam            | n/a   | n/a           | n/a          |   |
| 48   | Tunisia (2014)             | 0.12  | 5.52          | 0.56         |   | n/a  | Dominican Republic           | n/a   | n/a           | n/a          |   |
| 49   | Portugal                   | 0.11  | 5.01          | 0.55         |   | n/a  | Ecuador                      | n/a   | n/a           | n/a          |   |
| 50   | South Africa               | 0.11  | 4.98          | 0.54         |   | n/a  | Jordan                       | n/a   | n/a           | n/a          |   |
| 51   | Jamaica                    | 0.10  | 4.91          | 0.53         |   | n/a  | Kuwait                       | n/a   | n/a           | n/a          |   |
| 52   | Chile (2014)               | 0.10  | 4.85          | 0.52         |   | n/a  | Malawi                       | n/a   | n/a           | n/a          |   |
| 53   | India                      | 0.10  | 4.82          | 0.51         |   | n/a  | Nepal                        | n/a   | n/a           | n/a          |   |
| 54   | Hong Kong (China) (2014)   | 0.10  | 4.75          | 0.50         |   | n/a  | Nigeria                      | n/a   | n/a           | n/a          |   |
| 55   | Guatemala                  | 0.10  | 4.74          | 0.50         |   | n/a  | Oman                         | n/a   | n/a           | n/a          |   |
| 56   | Colombia                   | 0.10  | 4.63          | 0.49         |   | n/a  | Paraguay                     | n/a   | n/a           | n/a          |   |
| 57   | Greece                     | 0.09  | 4.32          | 0.48         |   | n/a  | Qatar                        | n/a   | n/a           | n/a          |   |
| 58   | Mexico                     | 0.07  | 3.56          | 0.47         |   | n/a  | Saudi Arabia                 | n/a   | n/a           | n/a          |   |
| 59   | Lebanon (2014)             | 0.07  | 3.56          | 0.46         |   | n/a  | Sri Lanka                    | n/a   | n/a           | n/a          |   |
| 60   | Thailand                   | 0.07  | 3.45          | 0.45         |   | n/a  | Trinidad and Tobago          | n/a   | n/a           | n/a          |   |
| 61   | Belarus                    | 0.07  | 3.40          | 0.44         |   | n/a  | Turkey                       | n/a   | n/a           | n/a          |   |
| 62   | Lithuania                  | 0.07  | 3.38          | 0.43         |   | n/a  | Viet Nam                     | n/a   | n/a           | n/a          |   |
| 63   | Senegal (2014)             | 0.07  | 3.28          | 0.42         |   | n/a  | Zambia                       | n/a   | n/a           | n/a          |   |
| 64   | Uganda                     | 0.07  | 3.20          | 0.41         |   |      |                              |       |               |              |   |

SOURCE: World Trade Organization, *Trade in Commercial Services* database, based on the sixth (2009) edition of the International Monetary Fund's *Balance of Payments Manual* and *Balance of Payments* database

NOTE: ● indicates a strength; ○ a weakness

## 6.3.2 High-tech exports

### High-tech net exports (% of total trade) | 2015

| Rank | Country/Economy          | Value | Score (0–100) | Percent rank |   | Rank | Country/Economy            | Value | Score (0–100) | Percent rank |   |
|------|--------------------------|-------|---------------|--------------|---|------|----------------------------|-------|---------------|--------------|---|
| 1    | China                    | 29.38 | 100.00        | 0.99         | ● | 65   | Iceland                    | 1.34  | 4.55          | 0.48         |   |
| 1    | Malaysia                 | 32.31 | 100.00        | 0.99         | ● | 66   | Turkey                     | 1.32  | 4.48          | 0.48         |   |
| 3    | Singapore                | 29.08 | 98.97         | 0.98         | ● | 67   | Kyrgyzstan                 | 1.20  | 4.07          | 0.47         |   |
| 4    | Viet Nam                 | 26.83 | 91.32         | 0.98         | ● | 68   | Dominican Republic         | 1.13  | 3.82          | 0.46         |   |
| 5    | Korea, Rep.              | 24.79 | 84.36         | 0.97         |   | 69   | Cambodia                   | 0.93  | 3.15          | 0.45         |   |
| 6    | Panama (2011)            | 17.12 | 58.25         | 0.96         | ● | 70   | Chile                      | 0.81  | 2.73          | 0.44         |   |
| 7    | Czech Republic           | 16.72 | 56.90         | 0.95         | ● | 71   | Pakistan                   | 0.73  | 2.47          | 0.44         |   |
| 8    | Israel                   | 15.76 | 53.62         | 0.94         |   | 72   | Luxembourg                 | 0.68  | 2.31          | 0.43         |   |
| 9    | Thailand                 | 15.23 | 51.82         | 0.94         | ● | 73   | Jordan                     | 0.67  | 2.27          | 0.42         |   |
| 10   | Mexico                   | 14.79 | 50.32         | 0.93         | ● | 74   | Moldova, Rep.              | 0.62  | 2.08          | 0.41         |   |
| 11   | France                   | 14.45 | 49.17         | 0.92         | ● | 75   | Zambia                     | 0.61  | 2.06          | 0.40         |   |
| 12   | Switzerland              | 14.43 | 49.11         | 0.91         |   | 76   | Côte d'Ivoire              | 0.58  | 1.95          | 0.40         |   |
| 13   | Germany                  | 13.93 | 47.41         | 0.90         |   | 77   | Montenegro                 | 0.57  | 1.93          | 0.39         |   |
| 14   | Hungary                  | 13.89 | 47.28         | 0.90         | ● | 78   | Senegal                    | 0.56  | 1.90          | 0.38         |   |
| 15   | Netherlands              | 13.00 | 44.22         | 0.89         |   | 79   | Kenya (2013)               | 0.56  | 1.88          | 0.37         |   |
| 16   | Japan                    | 12.82 | 43.62         | 0.88         |   | 80   | Honduras (2014)            | 0.53  | 1.79          | 0.36         |   |
| 17   | Estonia                  | 11.66 | 39.68         | 0.87         |   | 81   | Iran, Islamic Rep. (2011)  | 0.53  | 1.78          | 0.35         |   |
| 18   | Ireland                  | 11.66 | 39.66         | 0.86         |   | 82   | Botswana                   | 0.51  | 1.73          | 0.35         |   |
| 19   | Belgium                  | 11.07 | 37.68         | 0.85         |   | 83   | Georgia                    | 0.51  | 1.72          | 0.34         |   |
| 20   | Slovakia                 | 9.32  | 31.72         | 0.85         | ● | 84   | Peru                       | 0.51  | 1.72          | 0.33         |   |
| 21   | United Kingdom           | 9.23  | 31.39         | 0.84         |   | 85   | Oman (2014)                | 0.49  | 1.65          | 0.32         |   |
| 22   | Austria                  | 9.18  | 31.22         | 0.83         |   | 86   | Cyprus                     | 0.48  | 1.61          | 0.31         |   |
| 23   | Sweden                   | 9.04  | 30.75         | 0.82         |   | 87   | Ecuador                    | 0.46  | 1.54          | 0.31         |   |
| 24   | Latvia                   | 8.05  | 27.37         | 0.81         |   | 88   | Paraguay                   | 0.45  | 1.53          | 0.30         |   |
| 25   | Poland                   | 7.25  | 24.67         | 0.81         |   | 89   | Rwanda                     | 0.45  | 1.52          | 0.29         |   |
| 26   | United States of America | 7.10  | 24.16         | 0.80         |   | 90   | Mozambique                 | 0.42  | 1.40          | 0.28         |   |
| 27   | Denmark                  | 6.83  | 23.25         | 0.79         |   | 91   | Albania                    | 0.41  | 1.38          | 0.27         |   |
| 28   | Lithuania                | 6.10  | 20.75         | 0.78         |   | 92   | Sri Lanka                  | 0.32  | 1.07          | 0.27         |   |
| 29   | Romania                  | 6.04  | 20.53         | 0.77         |   | 93   | Armenia                    | 0.32  | 1.07          | 0.26         |   |
| 30   | Kazakhstan               | 5.91  | 20.12         | 0.77         | ● | 94   | Qatar                      | 0.27  | 0.91          | 0.25         |   |
| 31   | Italy                    | 5.65  | 19.22         | 0.76         |   | 95   | United Arab Emirates       | 0.27  | 0.90          | 0.24         | ○ |
| 32   | Canada                   | 5.63  | 19.15         | 0.75         |   | 96   | Kuwait                     | 0.27  | 0.89          | 0.23         |   |
| 33   | Costa Rica               | 5.12  | 17.42         | 0.74         |   | 97   | Bolivia, Plurinational St. | 0.24  | 0.79          | 0.23         |   |
| 34   | Finland                  | 5.03  | 17.11         | 0.73         |   | 98   | Zimbabwe (2014)            | 0.22  | 0.72          | 0.22         |   |
| 35   | Slovenia                 | 4.97  | 16.91         | 0.73         |   | 99   | Malawi                     | 0.19  | 0.64          | 0.21         |   |
| 36   | Malta                    | 4.71  | 16.01         | 0.72         |   | 100  | Lebanon (2014)             | 0.19  | 0.62          | 0.20         |   |
| 37   | Tunisia                  | 4.34  | 14.76         | 0.71         | ● | 101  | Burkina Faso               | 0.17  | 0.58          | 0.19         |   |
| 38   | Brazil                   | 4.06  | 13.81         | 0.70         |   | 102  | Cameroon                   | 0.17  | 0.57          | 0.19         |   |
| 39   | Spain                    | 3.98  | 13.52         | 0.69         |   | 103  | Nigeria (2014)             | 0.17  | 0.55          | 0.18         |   |
| 40   | Croatia                  | 3.86  | 13.11         | 0.69         |   | 104  | Egypt                      | 0.16  | 0.54          | 0.17         |   |
| 41   | Norway                   | 3.85  | 13.11         | 0.68         |   | 105  | Uganda                     | 0.16  | 0.52          | 0.16         |   |
| 42   | Bulgaria                 | 3.70  | 12.57         | 0.67         |   | 106  | Guinea (2014)              | 0.15  | 0.48          | 0.15         |   |
| 43   | Indonesia                | 3.49  | 11.87         | 0.66         |   | 107  | Bangladesh (2011)          | 0.14  | 0.45          | 0.15         |   |
| 44   | Russian Federation       | 3.41  | 11.60         | 0.65         |   | 108  | Ethiopia                   | 0.13  | 0.43          | 0.14         |   |
| 45   | India                    | 3.19  | 10.86         | 0.65         |   | 109  | Saudi Arabia               | 0.13  | 0.42          | 0.13         | ○ |
| 46   | Ukraine                  | 3.11  | 10.57         | 0.64         |   | 110  | Bahrain                    | 0.12  | 0.40          | 0.12         |   |
| 47   | Niger (2014)             | 2.95  | 10.02         | 0.63         |   | 111  | Mali (2012)                | 0.11  | 0.36          | 0.11         |   |
| 48   | Portugal                 | 2.62  | 8.89          | 0.62         |   | 112  | Tanzania, United Rep.      | 0.09  | 0.27          | 0.10         |   |
| 49   | El Salvador              | 2.40  | 8.16          | 0.61         | ● | 113  | Hong Kong (China)          | 0.08  | 0.26          | 0.10         | ○ |
| 50   | Uruguay                  | 2.28  | 7.76          | 0.60         |   | 114  | Burundi (2014)             | 0.07  | 0.23          | 0.09         |   |
| 51   | Greece                   | 2.27  | 7.72          | 0.60         |   | 115  | Azerbaijan                 | 0.07  | 0.23          | 0.08         | ○ |
| 52   | South Africa             | 2.27  | 7.70          | 0.59         |   | 116  | Mongolia                   | 0.07  | 0.22          | 0.07         | ○ |
| 53   | Serbia                   | 2.19  | 7.44          | 0.58         |   | 117  | Nepal                      | 0.06  | 0.18          | 0.06         | ○ |
| 54   | TFYR of Macedonia        | 2.16  | 7.33          | 0.57         |   | 118  | Benin                      | 0.05  | 0.16          | 0.06         | ○ |
| 55   | Australia                | 2.04  | 6.93          | 0.56         |   | 119  | Madagascar                 | 0.05  | 0.14          | 0.05         |   |
| 56   | Argentina                | 2.03  | 6.91          | 0.56         |   | 120  | Trinidad and Tobago (2010) | 0.03  | 0.10          | 0.04         | ○ |
| 57   | Belarus                  | 1.76  | 5.98          | 0.55         |   | 121  | Togo (2014)                | 0.02  | 0.06          | 0.03         | ○ |
| 58   | Namibia (2014)           | 1.61  | 5.46          | 0.54         |   | 122  | Mauritius                  | 0.02  | 0.06          | 0.02         | ○ |
| 59   | Morocco                  | 1.53  | 5.19          | 0.53         |   | 123  | Yemen (2014)               | 0.01  | 0.02          | 0.02         |   |
| 60   | Colombia                 | 1.52  | 5.15          | 0.52         |   | 124  | Jamaica                    | 0.01  | 0.02          | 0.01         | ○ |
| 61   | Guatemala                | 1.52  | 5.14          | 0.52         |   | 125  | Algeria                    | 0.01  | 0.00          | 0.00         | ○ |
| 62   | Brunei Darussalam        | 1.39  | 4.72          | 0.51         |   | n/a  | Philippines                | n/a   | n/a           | n/a          |   |
| 63   | Bosnia and Herzegovina   | 1.38  | 4.70          | 0.50         |   | n/a  | Tajikistan                 | n/a   | n/a           | n/a          |   |
| 64   | New Zealand              | 1.37  | 4.66          | 0.49         |   |      |                            |       |               |              |   |

SOURCE: United Nations, COMTRADE database; Eurostat, Annex 5: High-tech aggregation by SITC Rev. 4, April 2009

NOTE: ● indicates a strength; ○ a weakness

# 6.3.3

## ICT services exports

Telecommunications, computers, and information services exports (% of total trade) | 2015

| Rank | Country/Economy        | Value | Score (0–100) | Percent rank |   | Rank | Country/Economy              | Value | Score (0–100) | Percent rank |   |
|------|------------------------|-------|---------------|--------------|---|------|------------------------------|-------|---------------|--------------|---|
| 1    | Costa Rica             | 14.62 | 100.00        | 0.98         | ● | 65   | Norway                       | 1.55  | 14.30         | 0.49         | ○ |
| 1    | India                  | 12.63 | 100.00        | 0.98         | ● | 66   | Greece                       | 1.53  | 14.09         | 0.48         |   |
| 1    | Ireland                | 24.01 | 100.00        | 0.98         | ● | 67   | Italy                        | 1.49  | 13.74         | 0.47         |   |
| 1    | Israel                 | 10.63 | 100.00        | 0.98         | ● | 68   | United States of America     | 1.49  | 13.72         | 0.46         |   |
| 5    | Finland                | 9.88  | 93.00         | 0.97         | ● | 69   | Canada                       | 1.47  | 13.54         | 0.46         |   |
| 6    | Cyprus (2014)          | 9.59  | 90.18         | 0.96         | ● | 70   | Portugal                     | 1.40  | 12.85         | 0.45         | ○ |
| 7    | Netherlands            | 7.15  | 67.22         | 0.95         |   | 71   | Malaysia                     | 1.34  | 12.28         | 0.44         |   |
| 8    | Sweden                 | 7.10  | 66.70         | 0.94         |   | 72   | Burkina Faso (2014)          | 1.32  | 12.13         | 0.43         |   |
| 9    | Nepal (2014)           | 6.61  | 62.04         | 0.94         | ● | 73   | Togo (2014)                  | 1.31  | 12.05         | 0.42         | ● |
| 10   | Niger (2014)           | 6.00  | 56.34         | 0.93         | ● | 74   | Cameroon (2013)              | 1.25  | 11.47         | 0.42         | ● |
| 11   | Senegal (2014)         | 5.23  | 49.03         | 0.92         | ● | 75   | New Zealand                  | 1.24  | 11.33         | 0.41         | ○ |
| 12   | Kuwait                 | 4.86  | 45.53         | 0.91         | ● | 76   | Russian Federation           | 1.18  | 10.82         | 0.40         |   |
| 13   | Moldova, Rep.          | 4.74  | 44.40         | 0.90         | ● | 77   | China                        | 1.10  | 10.01         | 0.39         |   |
| 14   | Mali (2014)            | 4.69  | 43.91         | 0.90         | ● | 78   | Bangladesh (2014)            | 1.09  | 9.96          | 0.38         |   |
| 15   | Ukraine                | 4.38  | 41.03         | 0.89         | ● | 79   | Panama                       | 1.09  | 9.94          | 0.38         |   |
| 16   | Philippines            | 4.33  | 40.50         | 0.88         | ● | 80   | Slovakia                     | 1.07  | 9.71          | 0.37         |   |
| 17   | Kenya (2014)           | 4.27  | 39.96         | 0.87         | ● | 81   | Dominican Republic (2014)    | 1.05  | 9.59          | 0.36         |   |
| 18   | Romania                | 4.09  | 38.31         | 0.86         | ● | 82   | Malta                        | 1.03  | 9.37          | 0.35         | ○ |
| 19   | Sri Lanka              | 4.02  | 37.63         | 0.86         | ● | 83   | Uganda                       | 1.03  | 9.34          | 0.34         |   |
| 20   | Luxembourg             | 3.90  | 36.44         | 0.85         |   | 84   | Singapore                    | 1.01  | 9.20          | 0.34         | ○ |
| 21   | Switzerland            | 3.68  | 34.39         | 0.84         |   | 85   | Bolivia, Plurinational St.   | 0.96  | 8.71          | 0.33         |   |
| 22   | Armenia                | 3.51  | 32.78         | 0.83         | ● | 86   | Rwanda (2014)                | 0.92  | 8.36          | 0.32         |   |
| 23   | Serbia                 | 3.38  | 31.54         | 0.82         | ● | 87   | Malawi (2014)                | 0.92  | 8.32          | 0.31         |   |
| 24   | United Kingdom         | 3.34  | 31.19         | 0.82         |   | 88   | Lithuania                    | 0.85  | 7.64          | 0.30         | ○ |
| 25   | Bahrain (2014)         | 3.34  | 31.18         | 0.81         | ● | 89   | Australia                    | 0.81  | 7.25          | 0.30         | ○ |
| 26   | Montenegro             | 3.18  | 29.72         | 0.80         |   | 90   | Côte d'Ivoire (2013)         | 0.74  | 6.58          | 0.29         |   |
| 27   | Burundi (2014)         | 3.18  | 29.68         | 0.79         | ● | 91   | Qatar                        | 0.73  | 6.55          | 0.28         |   |
| 28   | Estonia                | 3.18  | 29.65         | 0.78         |   | 92   | Brazil                       | 0.68  | 6.03          | 0.27         |   |
| 29   | Belarus                | 3.08  | 28.73         | 0.78         | ● | 93   | Kyrgyzstan                   | 0.65  | 5.82          | 0.26         |   |
| 30   | Belgium                | 2.96  | 27.63         | 0.77         |   | 94   | Korea, Rep.                  | 0.61  | 5.44          | 0.26         | ○ |
| 31   | Morocco (2013)         | 2.91  | 27.14         | 0.76         | ● | 95   | Indonesia                    | 0.61  | 5.36          | 0.25         |   |
| 32   | Austria                | 2.91  | 27.13         | 0.75         |   | 96   | Georgia                      | 0.60  | 5.27          | 0.24         |   |
| 33   | Guatemala              | 2.90  | 27.07         | 0.74         | ● | 97   | South Africa                 | 0.58  | 5.14          | 0.23         | ○ |
| 34   | Honduras               | 2.87  | 26.79         | 0.74         | ● | 98   | Tajikistan                   | 0.57  | 5.04          | 0.22         |   |
| 35   | Spain                  | 2.86  | 26.63         | 0.73         |   | 99   | Chile (2014)                 | 0.54  | 4.73          | 0.22         | ○ |
| 36   | Lebanon (2014)         | 2.79  | 25.96         | 0.72         | ● | 100  | Colombia                     | 0.53  | 4.60          | 0.21         | ○ |
| 37   | Albania                | 2.77  | 25.78         | 0.71         | ● | 101  | Hong Kong (China) (2014)     | 0.45  | 3.92          | 0.20         | ○ |
| 38   | Iceland                | 2.76  | 25.69         | 0.70         |   | 102  | Azerbaijan                   | 0.45  | 3.91          | 0.19         |   |
| 39   | Bulgaria               | 2.69  | 25.06         | 0.70         |   | 103  | Cambodia                     | 0.44  | 3.78          | 0.18         |   |
| 40   | Guinea (2013)          | 2.68  | 24.98         | 0.69         | ● | 104  | Tanzania, United Rep. (2014) | 0.43  | 3.66          | 0.18         |   |
| 41   | Mauritius (2014)       | 2.64  | 24.54         | 0.68         |   | 105  | Japan                        | 0.42  | 3.59          | 0.17         | ○ |
| 42   | Uruguay                | 2.57  | 23.95         | 0.67         |   | 106  | Ecuador                      | 0.39  | 3.34          | 0.16         |   |
| 43   | TFYR of Macedonia      | 2.52  | 23.48         | 0.66         |   | 107  | Brunei Darussalam (2009)     | 0.37  | 3.17          | 0.15         | ○ |
| 44   | Latvia                 | 2.50  | 23.23         | 0.66         |   | 108  | Peru                         | 0.34  | 2.83          | 0.14         | ○ |
| 45   | Croatia                | 2.50  | 23.21         | 0.65         |   | 109  | Kazakhstan                   | 0.30  | 2.48          | 0.14         | ○ |
| 46   | Denmark                | 2.48  | 23.03         | 0.64         |   | 110  | Zambia (2014)                | 0.29  | 2.40          | 0.13         |   |
| 47   | Jamaica                | 2.29  | 21.28         | 0.63         |   | 111  | Botswana (2014)              | 0.29  | 2.34          | 0.12         | ○ |
| 48   | Argentina              | 2.29  | 21.27         | 0.62         |   | 112  | Algeria (2014)               | 0.29  | 2.33          | 0.11         |   |
| 49   | France                 | 2.18  | 20.23         | 0.62         |   | 113  | Mongolia                     | 0.22  | 1.70          | 0.10         |   |
| 50   | Pakistan               | 2.16  | 20.02         | 0.61         | ● | 114  | Mozambique                   | 0.22  | 1.69          | 0.10         |   |
| 51   | El Salvador            | 2.10  | 19.46         | 0.60         |   | 115  | Oman (2014)                  | 0.20  | 1.56          | 0.09         | ○ |
| 52   | Germany                | 1.99  | 18.44         | 0.59         |   | 116  | Iran, Islamic Rep. (2014)    | 0.19  | 1.40          | 0.08         | ○ |
| 53   | Yemen (2014)           | 1.95  | 18.06         | 0.58         | ● | 117  | Thailand                     | 0.18  | 1.32          | 0.07         | ○ |
| 54   | Poland                 | 1.91  | 17.66         | 0.58         |   | 118  | Paraguay                     | 0.14  | 0.93          | 0.06         | ○ |
| 55   | Benin (2014)           | 1.84  | 16.97         | 0.57         | ● | 119  | Nigeria                      | 0.12  | 0.81          | 0.06         |   |
| 56   | Slovenia               | 1.82  | 16.82         | 0.56         |   | 120  | Saudi Arabia                 | 0.12  | 0.75          | 0.05         | ○ |
| 57   | Czech Republic         | 1.76  | 16.30         | 0.55         |   | 121  | Turkey                       | 0.10  | 0.58          | 0.04         | ○ |
| 58   | Hungary                | 1.74  | 16.08         | 0.54         |   | 122  | Viet Nam (2014)              | 0.09  | 0.48          | 0.03         | ○ |
| 59   | Egypt (2014)           | 1.71  | 15.79         | 0.54         |   | 123  | Trinidad and Tobago (2011)   | 0.08  | 0.42          | 0.02         | ○ |
| 60   | Bosnia and Herzegovina | 1.66  | 15.32         | 0.53         |   | 124  | Namibia (2014)               | 0.05  | 0.10          | 0.02         | ○ |
| 61   | United Arab Emirates   | 1.66  | 15.31         | 0.52         |   | 125  | Zimbabwe (2012)              | 0.05  | 0.07          | 0.01         | ○ |
| 62   | Madagascar (2013)      | 1.65  | 15.26         | 0.51         |   | 126  | Mexico                       | 0.04  | 0.00          | 0.00         | ○ |
| 63   | Ethiopia (2012)        | 1.65  | 15.22         | 0.50         | ● | n/a  | Jordan                       | n/a   | n/a           | n/a          |   |
| 64   | Tunisia (2014)         | 1.57  | 14.48         | 0.50         |   |      |                              |       |               |              |   |

SOURCE: World Trade Organization, *Trade in Commercial Services* database, based on the sixth (2009) edition of the International Monetary Fund's *Balance of Payments Manual* and *Balance of Payments* database

NOTE: ● indicates a strength; ○ a weakness

## 6.3.4 Foreign direct investment net outflows

Foreign direct investment (FDI), net outflows (% of GDP, three-year average) | 2015

| Rank | Country/Economy          | Value | Score (0–100) | Percent rank |   | Rank | Country/Economy            | Value  | Score (0–100) | Percent rank |   |
|------|--------------------------|-------|---------------|--------------|---|------|----------------------------|--------|---------------|--------------|---|
| 1    | Cyprus                   | 17.24 | 100.00        | 0.95         | ● | 65   | Botswana                   | 0.62   | 35.33         | 0.48         |   |
| 1    | Hong Kong (China)        | 32.79 | 100.00        | 0.95         | ● | 66   | Albania                    | 0.50   | 34.16         | 0.48         |   |
| 1    | Ireland                  | 39.57 | 100.00        | 0.95         | ● | 67   | Poland                     | 0.50   | 34.16         | 0.47         |   |
| 1    | Kuwait                   | 7.46  | 100.00        | 0.95         | ● | 68   | Morocco                    | 0.49   | 34.08         | 0.46         |   |
| 1    | Luxembourg               | 48.39 | 100.00        | 0.95         | ● | 69   | El Salvador                | 0.47   | 33.91         | 0.45         |   |
| 1    | Netherlands              | 23.13 | 100.00        | 0.95         | ● | 70   | Mongolia                   | 0.44   | 33.63         | 0.44         |   |
| 1    | Singapore                | 12.69 | 100.00        | 0.95         | ● | 71   | Burkina Faso               | 0.44   | 33.62         | 0.44         |   |
| 8    | Switzerland              | 7.01  | 95.76         | 0.94         |   | 72   | Montenegro                 | 0.44   | 33.61         | 0.43         |   |
| 9    | Trinidad and Tobago      | 5.57  | 82.14         | 0.94         | ● | 73   | Slovenia                   | 0.41   | 33.32         | 0.42         |   |
| 10   | Chile                    | 5.04  | 77.08         | 0.93         | ● | 74   | Benin                      | 0.38   | 33.05         | 0.41         |   |
| 11   | Togo                     | 4.11  | 68.36         | 0.92         | ● | 75   | Moldova, Rep.              | 0.35   | 32.83         | 0.40         |   |
| 12   | Malaysia                 | 4.08  | 68.02         | 0.91         | ● | 76   | India                      | 0.34   | 32.71         | 0.40         |   |
| 13   | Canada                   | 3.85  | 65.85         | 0.90         |   | 77   | Zimbabwe                   | 0.29   | 32.18         | 0.39         |   |
| 14   | Norway                   | 3.66  | 64.04         | 0.90         |   | 78   | Nigeria                    | 0.27   | 32.07         | 0.38         |   |
| 15   | Brunei Darussalam        | 3.64  | 63.83         | 0.89         | ● | 79   | Bosnia and Herzegovina     | 0.27   | 32.04         | 0.37         |   |
| 16   | Azerbaijan               | 3.57  | 63.19         | 0.88         | ● | 80   | Cambodia                   | 0.25   | 31.85         | 0.36         |   |
| 17   | Spain                    | 3.37  | 61.33         | 0.87         |   | 81   | Ukraine                    | 0.23   | 31.64         | 0.35         |   |
| 18   | Sweden                   | 3.35  | 61.14         | 0.86         |   | 82   | Romania                    | 0.23   | 31.62         | 0.35         |   |
| 19   | Qatar                    | 3.25  | 60.20         | 0.85         |   | 83   | Argentina                  | 0.22   | 31.60         | 0.34         |   |
| 20   | Denmark                  | 3.00  | 57.82         | 0.85         |   | 84   | Belarus                    | 0.22   | 31.52         | 0.33         |   |
| 21   | Japan                    | 2.94  | 57.23         | 0.84         |   | 85   | Senegal                    | 0.20   | 31.37         | 0.32         |   |
| 22   | Germany                  | 2.87  | 56.63         | 0.83         |   | 86   | Paraguay                   | 0.19   | 31.31         | 0.31         |   |
| 23   | Lebanon                  | 2.80  | 55.94         | 0.82         | ● | 87   | Uruguay                    | 0.19   | 31.30         | 0.31         |   |
| 24   | Russian Federation       | 2.77  | 55.69         | 0.81         |   | 88   | Armenia                    | 0.16   | 30.98         | 0.30         |   |
| 25   | Czech Republic           | 2.53  | 53.35         | 0.81         |   | 89   | Namibia                    | 0.16   | 30.96         | 0.29         |   |
| 26   | United Arab Emirates     | 2.34  | 51.58         | 0.80         |   | 90   | Bangladesh                 | 0.14   | 30.78         | 0.28         |   |
| 27   | Portugal                 | 2.31  | 51.33         | 0.79         |   | 91   | Australia                  | 0.12   | 30.64         | 0.27         | ○ |
| 28   | Israel                   | 2.12  | 49.52         | 0.78         |   | 92   | Jordan                     | 0.09   | 30.36         | 0.27         |   |
| 29   | United States of America | 2.09  | 49.23         | 0.77         |   | 93   | Rwanda                     | 0.09   | 30.32         | 0.26         |   |
| 30   | Korea, Rep.              | 2.05  | 48.89         | 0.77         |   | 94   | Egypt                      | 0.08   | 30.24         | 0.25         |   |
| 31   | Iceland                  | 2.04  | 48.79         | 0.76         |   | 95   | Sri Lanka                  | 0.08   | 30.22         | 0.24         |   |
| 32   | Estonia                  | 1.93  | 47.76         | 0.75         |   | 96   | Madagascar                 | 0.07   | 30.17         | 0.23         |   |
| 33   | Philippines              | 1.89  | 47.31         | 0.74         | ● | 97   | Ecuador                    | 0.07   | 30.11         | 0.23         |   |
| 34   | South Africa             | 1.86  | 47.09         | 0.73         |   | 98   | Peru                       | 0.06   | 30.05         | 0.22         |   |
| 35   | Thailand                 | 1.86  | 47.02         | 0.73         |   | 99   | Tunisia                    | 0.06   | 30.01         | 0.21         |   |
| 36   | Georgia                  | 1.84  | 46.84         | 0.72         |   | 100  | Pakistan                   | 0.05   | 29.95         | 0.20         |   |
| 37   | Panama                   | 1.82  | 46.66         | 0.71         |   | 101  | Iran, Islamic Rep.         | 0.03   | 29.73         | 0.19         |   |
| 38   | Austria                  | 1.81  | 46.60         | 0.70         |   | 102  | Yemen                      | 0.02   | 29.67         | 0.19         |   |
| 39   | Bahrain                  | 1.53  | 43.95         | 0.69         |   | 103  | Côte d'Ivoire              | 0.02   | 29.64         | 0.18         |   |
| 40   | Colombia                 | 1.50  | 43.61         | 0.69         |   | 104  | Mali                       | 0.01   | 29.59         | 0.17         |   |
| 41   | Latvia                   | 1.33  | 42.04         | 0.68         |   | 105  | Guinea                     | 0.01   | 29.55         | 0.16         |   |
| 42   | Mozambique               | 1.28  | 41.58         | 0.67         | ● | 106  | Guatemala                  | 0.01   | 29.54         | 0.15         |   |
| 43   | France                   | 1.22  | 40.98         | 0.66         |   | 107  | New Zealand                | 0.01   | 29.53         | 0.15         | ○ |
| 44   | Kyrgyzstan               | 1.22  | 40.97         | 0.65         |   | 108  | Burundi                    | 0.00   | 29.51         | 0.14         |   |
| 45   | China                    | 1.21  | 40.94         | 0.65         |   | 109  | Bolivia, Plurinational St. | 0.00   | 29.48         | 0.12         |   |
| 46   | Kazakhstan               | 1.21  | 40.87         | 0.64         |   | 109  | Tanzania, United Rep.      | 0.00   | 29.48         | 0.12         |   |
| 47   | Croatia                  | 1.19  | 40.72         | 0.63         |   | 111  | Kenya                      | -0.01  | 29.37         | 0.11         | ○ |
| 48   | Indonesia                | 1.16  | 40.43         | 0.62         |   | 112  | Algeria                    | -0.03  | 29.22         | 0.10         |   |
| 49   | Oman                     | 1.09  | 39.80         | 0.61         |   | 113  | Uganda                     | -0.03  | 29.19         | 0.10         |   |
| 50   | Costa Rica               | 1.09  | 39.79         | 0.60         |   | 114  | Hungary                    | -0.05  | 29.01         | 0.09         | ○ |
| 51   | Niger                    | 1.04  | 39.30         | 0.60         |   | 115  | TFYR of Macedonia          | -0.07  | 28.80         | 0.08         | ○ |
| 52   | Slovakia                 | 0.99  | 38.83         | 0.59         |   | 116  | Malawi                     | -0.08  | 28.73         | 0.07         |   |
| 53   | Mexico                   | 0.89  | 37.90         | 0.58         |   | 117  | Dominican Republic         | -0.11  | 28.45         | 0.06         | ○ |
| 54   | Italy                    | 0.89  | 37.90         | 0.57         |   | 118  | Jamaica                    | -0.20  | 27.63         | 0.06         | ○ |
| 55   | Mauritius                | 0.85  | 37.52         | 0.56         |   | 119  | Cameroon                   | -0.41  | 25.59         | 0.05         | ○ |
| 56   | Serbia                   | 0.82  | 37.19         | 0.56         |   | 120  | Finland                    | -0.99  | 20.14         | 0.04         | ○ |
| 57   | Brazil                   | 0.81  | 37.17         | 0.55         |   | 121  | Zambia                     | -1.16  | 18.54         | 0.03         | ○ |
| 58   | Lithuania                | 0.79  | 36.93         | 0.54         |   | 122  | United Kingdom             | -1.51  | 15.23         | 0.02         | ○ |
| 59   | Viet Nam                 | 0.78  | 36.81         | 0.53         |   | 123  | Tajikistan                 | -1.87  | 11.81         | 0.02         | ○ |
| 60   | Honduras                 | 0.77  | 36.78         | 0.52         |   | 124  | Belgium                    | -3.12  | 0.00          | 0.00         | ○ |
| 61   | Bulgaria                 | 0.77  | 36.75         | 0.52         |   | 124  | Malta                      | -81.54 | 0.00          | 0.00         | ○ |
| 62   | Saudi Arabia             | 0.74  | 36.51         | 0.51         |   | n/a  | Ethiopia                   | n/a    | n/a           | n/a          |   |
| 63   | Greece                   | 0.69  | 36.03         | 0.50         |   | n/a  | Nepal                      | n/a    | n/a           | n/a          |   |
| 64   | Turkey                   | 0.68  | 35.88         | 0.49         |   |      |                            |        |               |              |   |

**SOURCE:** International Monetary Fund, Balance of Payments database, supplemented by data from the United Nations Conference on Trade and Development and official national sources; extracted from the World Bank's *World Development Indicators* database

**NOTE:** ● Indicates a strength; ○ a weakness



# 7.1.1

## Trademark application class count by origin

Number of trademark applications issued to residents at a given national or regional office (per billion PPP\$ GDP) | 2015

| Rank | Country/Economy    | Value  | Score (0–100) | Percent rank |   | Rank | Country/Economy                   | Value | Score (0–100) | Percent rank |   |
|------|--------------------|--------|---------------|--------------|---|------|-----------------------------------|-------|---------------|--------------|---|
| 1    | Mongolia           | 194.51 | 100.00        | 0.99         | ● | 65   | Bolivia, Plurinational St. (2014) | 35.06 | 17.60         | 0.44         |   |
| 1    | Paraguay (2010)    | 296.27 | 100.00        | 0.99         | ● | 66   | Mozambique                        | 34.69 | 17.41         | 0.43         | ● |
| 3    | Moldova, Rep.      | 149.83 | 76.91         | 0.98         | ● | 67   | Kenya                             | 32.93 | 16.50         | 0.43         |   |
| 4    | China              | 134.99 | 69.24         | 0.97         | ● | 68   | Jordan                            | 32.91 | 16.49         | 0.42         |   |
| 5    | Luxembourg         | 131.62 | 67.50         | 0.97         | ● | 69   | Norway                            | 32.04 | 16.04         | 0.41         | ○ |
| 6    | Jamaica            | 126.41 | 64.81         | 0.96         | ● | 70   | Serbia                            | 32.01 | 16.02         | 0.40         |   |
| 7    | Turkey             | 122.04 | 62.55         | 0.95         | ● | 71   | India                             | 31.33 | 15.67         | 0.39         |   |
| 8    | Bulgaria           | 113.56 | 58.17         | 0.94         | ● | 72   | Thailand                          | 30.03 | 15.00         | 0.38         |   |
| 9    | Slovenia (2010)    | 111.20 | 56.95         | 0.93         | ● | 73   | South Africa                      | 29.68 | 14.82         | 0.37         |   |
| 10   | France             | 108.98 | 55.80         | 0.92         | ● | 74   | Philippines                       | 28.22 | 14.07         | 0.37         |   |
| 11   | Armenia            | 107.42 | 55.00         | 0.91         | ● | 75   | Sri Lanka                         | 26.77 | 13.32         | 0.36         |   |
| 12   | Ukraine            | 106.83 | 54.69         | 0.90         | ● | 76   | Belarus                           | 26.68 | 13.27         | 0.35         |   |
| 13   | Malta              | 104.63 | 53.55         | 0.90         |   | 77   | Albania                           | 26.52 | 13.19         | 0.34         |   |
| 14   | Korea, Rep.        | 103.32 | 52.88         | 0.89         |   | 78   | Pakistan                          | 25.27 | 12.54         | 0.33         |   |
| 15   | Portugal           | 95.36  | 48.77         | 0.88         | ● | 79   | Algeria                           | 24.94 | 12.37         | 0.32         |   |
| 16   | New Zealand        | 93.90  | 48.01         | 0.87         |   | 80   | Cambodia (2014)                   | 23.52 | 11.64         | 0.31         |   |
| 17   | Iceland            | 87.72  | 44.81         | 0.86         |   | 81   | United States of America          | 21.52 | 10.60         | 0.30         | ○ |
| 18   | El Salvador        | 83.68  | 42.73         | 0.85         | ● | 82   | Malawi                            | 20.98 | 10.33         | 0.30         |   |
| 19   | Estonia            | 82.92  | 42.34         | 0.84         |   | 83   | Nigeria (2013)                    | 19.84 | 9.74          | 0.29         |   |
| 20   | Viet Nam           | 81.73  | 41.72         | 0.83         | ● | 84   | Malaysia                          | 19.50 | 9.56          | 0.28         | ○ |
| 21   | Switzerland        | 79.82  | 40.73         | 0.83         |   | 85   | Singapore                         | 17.90 | 8.73          | 0.27         | ○ |
| 22   | Costa Rica         | 79.76  | 40.70         | 0.82         | ● | 86   | Yemen                             | 17.48 | 8.52          | 0.26         | ● |
| 23   | Cyprus             | 75.36  | 38.43         | 0.81         |   | 87   | Trinidad and Tobago               | 17.34 | 8.45          | 0.25         |   |
| 24   | Latvia             | 72.77  | 37.09         | 0.80         |   | 88   | Bosnia and Herzegovina            | 16.91 | 8.22          | 0.24         |   |
| 25   | Australia          | 70.83  | 36.09         | 0.79         |   | 89   | Kyrgyzstan                        | 16.81 | 8.17          | 0.23         |   |
| 26   | Hong Kong (China)  | 69.53  | 35.42         | 0.78         |   | 90   | Kazakhstan (2013)                 | 16.70 | 8.11          | 0.23         |   |
| 27   | Chile              | 68.28  | 34.77         | 0.77         |   | 91   | Azerbaijan                        | 16.50 | 8.01          | 0.22         |   |
| 28   | Germany            | 66.92  | 34.06         | 0.77         |   | 92   | Bangladesh                        | 16.07 | 7.79          | 0.21         |   |
| 29   | Czech Republic     | 66.17  | 33.68         | 0.76         |   | 93   | Lebanon                           | 15.06 | 7.26          | 0.20         |   |
| 30   | Slovakia           | 65.95  | 33.57         | 0.75         |   | 94   | Guinea                            | 13.80 | 6.62          | 0.19         |   |
| 31   | Ecuador (2010)     | 63.94  | 32.53         | 0.74         | ● | 95   | Indonesia                         | 13.22 | 6.32          | 0.18         |   |
| 32   | Namibia            | 62.93  | 32.00         | 0.73         | ● | 96   | Uganda                            | 13.10 | 6.25          | 0.17         |   |
| 33   | Netherlands        | 61.08  | 31.05         | 0.72         |   | 97   | Israel                            | 13.00 | 6.20          | 0.17         | ○ |
| 34   | Austria            | 61.06  | 31.04         | 0.71         |   | 98   | Rwanda                            | 12.03 | 5.70          | 0.16         |   |
| 35   | Japan              | 59.93  | 30.45         | 0.70         |   | 99   | Egypt                             | 11.73 | 5.55          | 0.15         |   |
| 36   | Spain              | 59.20  | 30.08         | 0.70         |   | 100  | Senegal                           | 11.48 | 5.42          | 0.14         |   |
| 37   | Argentina          | 59.05  | 30.00         | 0.69         |   | 101  | United Arab Emirates (2014)       | 11.41 | 5.38          | 0.13         | ○ |
| 38   | Madagascar         | 56.99  | 28.93         | 0.68         | ● | 102  | Botswana (2014)                   | 10.36 | 4.84          | 0.12         | ○ |
| 39   | Panama             | 56.36  | 28.61         | 0.67         |   | 103  | Zimbabwe                          | 10.16 | 4.74          | 0.11         |   |
| 40   | Sweden             | 55.75  | 28.29         | 0.66         | ○ | 104  | Côte d'Ivoire                     | 9.47  | 4.38          | 0.10         |   |
| 41   | Georgia            | 53.67  | 27.22         | 0.65         |   | 105  | Tajikistan                        | 9.15  | 4.21          | 0.10         |   |
| 42   | Romania            | 52.73  | 26.73         | 0.64         |   | 106  | Zambia (2014)                     | 8.79  | 4.02          | 0.09         |   |
| 43   | United Kingdom     | 52.69  | 26.71         | 0.63         | ○ | 107  | Togo                              | 8.73  | 4.00          | 0.08         |   |
| 44   | Finland            | 51.52  | 26.11         | 0.63         |   | 108  | Benin                             | 7.50  | 3.36          | 0.07         |   |
| 45   | Canada             | 51.11  | 25.90         | 0.62         |   | 109  | Cameroon                          | 7.26  | 3.23          | 0.06         | ○ |
| 46   | Peru               | 51.05  | 25.87         | 0.61         |   | 110  | Bahrain                           | 5.92  | 2.54          | 0.05         | ○ |
| 47   | Croatia            | 50.65  | 25.66         | 0.60         |   | 111  | Mali                              | 5.43  | 2.29          | 0.04         |   |
| 48   | Lithuania          | 50.63  | 25.65         | 0.59         |   | 112  | Qatar (2014)                      | 4.58  | 1.85          | 0.03         | ○ |
| 49   | Uruguay            | 50.14  | 25.39         | 0.58         |   | 113  | Saudi Arabia                      | 4.40  | 1.76          | 0.03         | ○ |
| 50   | Italy (2014)       | 49.87  | 25.25         | 0.57         |   | 114  | Burkina Faso                      | 3.17  | 1.12          | 0.02         | ○ |
| 51   | Honduras           | 49.65  | 25.14         | 0.57         | ● | 115  | Brunei Darussalam (2012)          | 2.55  | 0.80          | 0.01         | ○ |
| 52   | Morocco            | 49.38  | 25.00         | 0.56         |   | 116  | Niger                             | 1.00  | 0.00          | 0.00         | ○ |
| 53   | Belgium            | 49.34  | 24.98         | 0.55         | ○ | n/a  | Burundi                           | n/a   | n/a           | n/a          |   |
| 54   | Dominican Republic | 45.63  | 23.07         | 0.54         |   | n/a  | Ethiopia                          | n/a   | n/a           | n/a          |   |
| 55   | Poland             | 45.03  | 22.75         | 0.53         |   | n/a  | Greece                            | n/a   | n/a           | n/a          |   |
| 56   | Russian Federation | 43.41  | 21.92         | 0.52         |   | n/a  | Iran, Islamic Rep.                | n/a   | n/a           | n/a          |   |
| 57   | Brazil             | 40.86  | 20.60         | 0.51         |   | n/a  | Ireland                           | n/a   | n/a           | n/a          |   |
| 58   | Mexico             | 40.66  | 20.50         | 0.50         |   | n/a  | Kuwait                            | n/a   | n/a           | n/a          |   |
| 59   | Mauritius          | 40.21  | 20.26         | 0.50         |   | n/a  | Montenegro                        | n/a   | n/a           | n/a          |   |
| 60   | Guatemala (2010)   | 39.25  | 19.77         | 0.49         |   | n/a  | Oman                              | n/a   | n/a           | n/a          |   |
| 61   | Denmark            | 36.59  | 18.39         | 0.48         | ○ | n/a  | Tanzania, United Rep.             | n/a   | n/a           | n/a          |   |
| 62   | Colombia           | 36.16  | 18.17         | 0.47         |   | n/a  | TFYR of Macedonia                 | n/a   | n/a           | n/a          |   |
| 63   | Hungary            | 35.79  | 17.98         | 0.46         |   | n/a  | Tunisia                           | n/a   | n/a           | n/a          |   |
| 64   | Nepal              | 35.10  | 17.62         | 0.45         | ● |      |                                   |       |               |              |   |

SOURCE: World Intellectual Property Organization, *Intellectual Property Statistics*; International Monetary Fund, *World Economic Outlook Database*, October 2016 (PPPS GDP)

NOTE: ● indicates a strength; ○ a weakness

## 7.1.2

## Industrial designs by origin

Number of designs contained in industrial design applications filed at a given national or regional office (per billion PPP\$ GDP) | 2015

| Rank | Country/Economy           | Value | Score (0–100) | Percent rank |   | Rank | Country/Economy                   | Value | Score (0–100) | Percent rank |   |
|------|---------------------------|-------|---------------|--------------|---|------|-----------------------------------|-------|---------------|--------------|---|
| 1    | China                     | 28.00 | 100.00        | 0.96         | ● | 65   | Mozambique                        | 0.90  | 4.71          | 0.43         |   |
| 1    | Italy (2014)              | 18.51 | 100.00        | 0.96         | ● | 66   | India                             | 0.85  | 4.46          | 0.42         |   |
| 1    | Korea, Rep.               | 35.56 | 100.00        | 0.96         | ● | 67   | Nigeria (2013)                    | 0.85  | 4.44          | 0.41         |   |
| 1    | Moldova, Rep.             | 67.28 | 100.00        | 0.96         | ● | 68   | Montenegro                        | 0.80  | 4.18          | 0.40         |   |
| 1    | Turkey                    | 24.26 | 100.00        | 0.96         | ● | 69   | Mexico                            | 0.78  | 4.03          | 0.39         |   |
| 6    | Germany                   | 16.48 | 89.00         | 0.96         | ● | 70   | Malaysia                          | 0.77  | 3.99          | 0.38         |   |
| 7    | Luxembourg                | 13.82 | 74.60         | 0.95         |   | 71   | Philippines                       | 0.72  | 3.76          | 0.38         |   |
| 8    | Morocco                   | 13.60 | 73.44         | 0.94         | ● | 72   | Russian Federation                | 0.70  | 3.64          | 0.37         |   |
| 9    | Malta (2014)              | 12.97 | 70.00         | 0.93         |   | 73   | Jordan                            | 0.66  | 3.43          | 0.36         |   |
| 10   | Spain                     | 12.79 | 69.04         | 0.92         | ● | 74   | Senegal                           | 0.63  | 3.22          | 0.35         |   |
| 11   | Ukraine                   | 12.61 | 68.06         | 0.91         | ● | 75   | Bosnia and Herzegovina            | 0.59  | 3.03          | 0.34         |   |
| 12   | Bulgaria                  | 10.84 | 58.47         | 0.90         | ● | 76   | Colombia                          | 0.54  | 2.74          | 0.33         |   |
| 13   | Switzerland               | 10.06 | 54.25         | 0.89         |   | 77   | Mali                              | 0.53  | 2.72          | 0.32         |   |
| 14   | Portugal                  | 9.66  | 52.10         | 0.88         | ● | 78   | Kenya                             | 0.51  | 2.62          | 0.31         |   |
| 15   | Austria                   | 7.91  | 42.62         | 0.88         |   | 79   | Canada                            | 0.49  | 2.48          | 0.30         | ○ |
| 16   | Denmark                   | 7.61  | 41.01         | 0.87         |   | 80   | Zambia (2014)                     | 0.48  | 2.45          | 0.29         |   |
| 17   | France                    | 7.46  | 40.21         | 0.86         |   | 81   | Mauritius (2013)                  | 0.45  | 2.26          | 0.29         |   |
| 18   | Mongolia (2014)           | 7.35  | 39.62         | 0.85         | ● | 82   | Albania (2014)                    | 0.45  | 2.25          | 0.28         |   |
| 19   | Iran, Islamic Rep. (2014) | 6.46  | 34.77         | 0.84         | ● | 83   | Trinidad and Tobago               | 0.41  | 2.04          | 0.27         |   |
| 20   | Madagascar                | 5.77  | 31.05         | 0.83         | ● | 84   | Pakistan                          | 0.39  | 1.95          | 0.26         |   |
| 21   | Croatia                   | 5.53  | 29.77         | 0.82         | ● | 85   | Bolivia, Plurinational St. (2014) | 0.37  | 1.84          | 0.25         |   |
| 22   | Cyprus                    | 5.41  | 29.10         | 0.81         |   | 86   | Togo                              | 0.37  | 1.83          | 0.24         |   |
| 23   | Finland                   | 5.33  | 28.68         | 0.80         |   | 87   | Cameroon                          | 0.36  | 1.77          | 0.23         |   |
| 24   | Japan                     | 5.12  | 27.57         | 0.79         |   | 88   | Benin                             | 0.35  | 1.73          | 0.22         |   |
| 25   | Czech Republic            | 5.12  | 27.53         | 0.79         |   | 89   | Botswana (2014)                   | 0.35  | 1.71          | 0.21         |   |
| 26   | Sweden                    | 5.03  | 27.03         | 0.78         |   | 90   | Peru                              | 0.34  | 1.66          | 0.21         |   |
| 27   | Georgia                   | 4.90  | 26.38         | 0.77         |   | 91   | Dominican Republic                | 0.32  | 1.57          | 0.20         |   |
| 28   | Guinea                    | 4.64  | 24.97         | 0.76         | ● | 92   | Rwanda                            | 0.24  | 1.16          | 0.19         |   |
| 29   | Estonia                   | 4.25  | 22.85         | 0.75         |   | 93   | Nepal                             | 0.23  | 1.07          | 0.18         |   |
| 30   | Greece                    | 4.21  | 22.63         | 0.74         |   | 94   | Panama                            | 0.22  | 1.02          | 0.17         |   |
| 31   | Latvia                    | 3.90  | 20.95         | 0.73         |   | 95   | El Salvador                       | 0.21  | 0.97          | 0.16         |   |
| 32   | Israel                    | 3.68  | 19.74         | 0.72         |   | 96   | Kazakhstan                        | 0.21  | 0.95          | 0.15         |   |
| 33   | Viet Nam                  | 3.32  | 17.82         | 0.71         |   | 97   | Saudi Arabia                      | 0.19  | 0.87          | 0.14         | ○ |
| 34   | Hungary                   | 3.26  | 17.49         | 0.71         |   | 98   | Honduras                          | 0.17  | 0.76          | 0.13         |   |
| 35   | Hong Kong (China)         | 3.21  | 17.21         | 0.70         |   | 99   | Cambodia                          | 0.17  | 0.73          | 0.13         |   |
| 36   | Netherlands               | 3.13  | 16.76         | 0.69         |   | 100  | Burkina Faso                      | 0.16  | 0.71          | 0.12         |   |
| 37   | Thailand                  | 3.05  | 16.32         | 0.68         |   | 101  | Guatemala                         | 0.16  | 0.70          | 0.11         |   |
| 38   | Belgium                   | 2.91  | 15.57         | 0.67         |   | 102  | United Arab Emirates (2014)       | 0.15  | 0.64          | 0.10         | ○ |
| 39   | Jamaica                   | 2.63  | 14.09         | 0.66         |   | 103  | Costa Rica                        | 0.13  | 0.56          | 0.09         | ○ |
| 40   | Romania                   | 2.52  | 13.47         | 0.65         |   | 104  | Brunei Darussalam (2014)          | 0.12  | 0.49          | 0.08         | ○ |
| 41   | Australia                 | 2.47  | 13.22         | 0.64         |   | 105  | Uruguay                           | 0.11  | 0.43          | 0.07         | ○ |
| 42   | Bangladesh                | 2.21  | 11.82         | 0.63         | ● | 106  | Chile                             | 0.10  | 0.39          | 0.06         | ○ |
| 43   | Slovakia                  | 2.09  | 11.14         | 0.63         |   | 107  | Azerbaijan                        | 0.06  | 0.19          | 0.05         | ○ |
| 44   | New Zealand               | 2.05  | 10.95         | 0.62         |   | 108  | Niger (2014)                      | 0.06  | 0.14          | 0.04         |   |
| 45   | Lithuania                 | 1.95  | 10.39         | 0.61         |   | 109  | Yemen                             | 0.05  | 0.12          | 0.04         |   |
| 46   | Sri Lanka                 | 1.74  | 9.28          | 0.60         |   | 110  | Tajikistan (2013)                 | 0.05  | 0.10          | 0.03         | ○ |
| 47   | Norway                    | 1.72  | 9.16          | 0.59         |   | 111  | Bahrain                           | 0.05  | 0.09          | 0.02         | ○ |
| 48   | Singapore                 | 1.68  | 8.93          | 0.58         | ○ | 112  | Namibia                           | 0.04  | 0.05          | 0.01         | ○ |
| 49   | TFYR of Macedonia         | 1.65  | 8.77          | 0.57         |   | 113  | Oman                              | 0.03  | 0.00          | 0.00         | ○ |
| 50   | Côte d'Ivoire             | 1.64  | 8.74          | 0.56         | ● | n/a  | Burundi                           | n/a   | n/a           | n/a          |   |
| 51   | Egypt                     | 1.55  | 8.21          | 0.55         |   | n/a  | Ecuador                           | n/a   | n/a           | n/a          |   |
| 52   | Algeria (2014)            | 1.49  | 7.91          | 0.54         | ● | n/a  | Ethiopia                          | n/a   | n/a           | n/a          |   |
| 53   | Ireland                   | 1.32  | 7.01          | 0.54         | ○ | n/a  | Kuwait                            | n/a   | n/a           | n/a          |   |
| 54   | United States of America  | 1.25  | 6.63          | 0.53         |   | n/a  | Lebanon                           | n/a   | n/a           | n/a          |   |
| 55   | Serbia                    | 1.25  | 6.60          | 0.52         |   | n/a  | Malawi                            | n/a   | n/a           | n/a          |   |
| 56   | Armenia                   | 1.22  | 6.44          | 0.51         |   | n/a  | Paraguay                          | n/a   | n/a           | n/a          |   |
| 57   | Belarus                   | 1.20  | 6.33          | 0.50         |   | n/a  | Poland                            | n/a   | n/a           | n/a          |   |
| 58   | Argentina                 | 1.15  | 6.06          | 0.49         |   | n/a  | Qatar                             | n/a   | n/a           | n/a          |   |
| 59   | Iceland                   | 1.05  | 5.54          | 0.48         |   | n/a  | Slovenia                          | n/a   | n/a           | n/a          |   |
| 60   | Kyrgyzstan                | 1.04  | 5.44          | 0.47         |   | n/a  | Tanzania, United Rep.             | n/a   | n/a           | n/a          |   |
| 61   | Brazil                    | 1.03  | 5.40          | 0.46         |   | n/a  | Uganda                            | n/a   | n/a           | n/a          |   |
| 62   | Tunisia                   | 1.01  | 5.33          | 0.46         |   | n/a  | United Kingdom                    | n/a   | n/a           | n/a          |   |
| 63   | South Africa              | 1.00  | 5.23          | 0.45         |   | n/a  | Zimbabwe                          | n/a   | n/a           | n/a          |   |
| 64   | Indonesia                 | 0.93  | 4.88          | 0.44         |   |      |                                   |       |               |              |   |

SOURCE: World Intellectual Property Organization, *Intellectual Property Statistics*; International Monetary Fund, *World Economic Outlook Database*, October 2016 (PPPS GDP)

NOTE: ● Indicates a strength; ○ a weakness

# 7.1.3

## ICTs and business model creation

Average answer to the question: In your country, to what extent do ICTs enable new business models? [1 = not at all; 7 = to a great extent] | 2016

| Rank | Country/Economy          | Value | Score (0–100) | Percent rank |   | Rank | Country/Economy            | Value | Score (0–100) | Percent rank |   |
|------|--------------------------|-------|---------------|--------------|---|------|----------------------------|-------|---------------|--------------|---|
| 1    | United Kingdom           | 6.03  | 83.79         | 1.00         | ● | 65   | Peru                       | 4.59  | 59.79         | 0.48         |   |
| 2    | Switzerland              | 6.00  | 83.28         | 0.99         | ● | 66   | Senegal                    | 4.58  | 59.71         | 0.47         |   |
| 3    | Netherlands              | 5.99  | 83.17         | 0.98         | ● | 67   | Honduras                   | 4.57  | 59.44         | 0.46         |   |
| 4    | Finland                  | 5.98  | 83.07         | 0.98         | ● | 68   | Armenia                    | 4.54  | 59.00         | 0.45         |   |
| 5    | Sweden                   | 5.98  | 83.03         | 0.97         |   | 69   | Tunisia                    | 4.53  | 58.86         | 0.44         |   |
| 6    | Luxembourg               | 5.96  | 82.72         | 0.96         |   | 70   | Iran, Islamic Rep.         | 4.53  | 58.78         | 0.43         |   |
| 7    | Singapore                | 5.89  | 81.47         | 0.95         |   | 71   | Brazil                     | 4.49  | 58.19         | 0.43         |   |
| 8    | Israel                   | 5.85  | 80.87         | 0.94         |   | 72   | Namibia                    | 4.48  | 58.02         | 0.42         |   |
| 9    | Ireland                  | 5.83  | 80.44         | 0.93         |   | 73   | TFYR of Macedonia          | 4.48  | 57.93         | 0.41         |   |
| 10   | United Arab Emirates     | 5.79  | 79.92         | 0.93         | ● | 74   | Croatia                    | 4.47  | 57.76         | 0.40         |   |
| 11   | Qatar                    | 5.77  | 79.45         | 0.92         | ● | 75   | Nigeria                    | 4.45  | 57.47         | 0.39         |   |
| 12   | United States of America | 5.75  | 79.20         | 0.91         |   | 76   | Ecuador                    | 4.44  | 57.37         | 0.39         |   |
| 13   | Norway                   | 5.75  | 79.14         | 0.90         |   | 77   | Romania                    | 4.43  | 57.15         | 0.38         |   |
| 14   | Iceland                  | 5.72  | 78.62         | 0.89         |   | 78   | Viet Nam                   | 4.42  | 57.05         | 0.37         |   |
| 15   | Germany                  | 5.64  | 77.31         | 0.89         |   | 79   | Montenegro                 | 4.40  | 56.71         | 0.36         |   |
| 16   | Portugal                 | 5.61  | 76.79         | 0.88         | ● | 80   | India                      | 4.39  | 56.57         | 0.35         |   |
| 17   | France                   | 5.60  | 76.73         | 0.87         |   | 81   | Côte d'Ivoire              | 4.38  | 56.27         | 0.34         |   |
| 18   | Korea, Rep.              | 5.60  | 76.68         | 0.86         |   | 82   | Mongolia                   | 4.35  | 55.82         | 0.34         |   |
| 19   | Belgium                  | 5.59  | 76.42         | 0.85         |   | 83   | Oman                       | 4.32  | 55.30         | 0.33         |   |
| 20   | Malaysia                 | 5.57  | 76.19         | 0.84         |   | 84   | Uganda                     | 4.28  | 54.69         | 0.32         |   |
| 21   | New Zealand              | 5.57  | 76.10         | 0.84         |   | 85   | Kazakhstan                 | 4.26  | 54.39         | 0.31         |   |
| 22   | Estonia                  | 5.55  | 75.91         | 0.83         |   | 86   | Cyprus                     | 4.26  | 54.29         | 0.30         |   |
| 23   | Canada                   | 5.55  | 75.79         | 0.82         |   | 87   | Greece                     | 4.25  | 54.17         | 0.30         |   |
| 24   | Denmark                  | 5.52  | 75.31         | 0.81         |   | 88   | Madagascar                 | 4.20  | 53.37         | 0.29         |   |
| 25   | Spain                    | 5.42  | 73.68         | 0.80         |   | 89   | Kuwait                     | 4.20  | 53.36         | 0.28         |   |
| 26   | Austria                  | 5.37  | 72.86         | 0.80         |   | 90   | Trinidad and Tobago        | 4.19  | 53.15         | 0.27         |   |
| 27   | Panama                   | 5.31  | 71.78         | 0.79         | ● | 91   | Russian Federation         | 4.16  | 52.67         | 0.26         |   |
| 28   | Chile                    | 5.29  | 71.49         | 0.78         |   | 92   | Botswana                   | 4.15  | 52.51         | 0.25         |   |
| 29   | Japan                    | 5.28  | 71.34         | 0.77         |   | 93   | Brunei Darussalam          | 4.11  | 51.85         | 0.25         |   |
| 30   | Lithuania                | 5.25  | 70.89         | 0.76         |   | 94   | Tanzania, United Rep.      | 4.11  | 51.84         | 0.24         |   |
| 31   | Hong Kong (China)        | 5.24  | 70.69         | 0.75         |   | 95   | Cameroon                   | 4.08  | 51.35         | 0.23         |   |
| 32   | Malta                    | 5.19  | 69.90         | 0.75         |   | 96   | Pakistan                   | 4.08  | 51.27         | 0.22         |   |
| 33   | Saudi Arabia             | 5.13  | 68.83         | 0.74         |   | 97   | Egypt                      | 4.02  | 50.30         | 0.21         |   |
| 34   | Czech Republic           | 5.12  | 68.66         | 0.73         |   | 98   | Benin                      | 4.01  | 50.14         | 0.20         |   |
| 35   | Australia                | 5.11  | 68.54         | 0.72         |   | 99   | Georgia                    | 4.00  | 50.00         | 0.20         |   |
| 36   | Rwanda                   | 5.08  | 68.02         | 0.71         | ● | 100  | Paraguay                   | 4.00  | 49.93         | 0.19         |   |
| 37   | Kenya                    | 5.07  | 67.80         | 0.70         |   | 101  | Serbia                     | 3.98  | 49.65         | 0.18         | ○ |
| 38   | Uruguay                  | 5.06  | 67.59         | 0.70         |   | 102  | Albania                    | 3.97  | 49.58         | 0.17         |   |
| 39   | Thailand                 | 5.03  | 67.11         | 0.69         |   | 103  | Bangladesh                 | 3.97  | 49.55         | 0.16         |   |
| 40   | Slovakia                 | 5.02  | 67.06         | 0.68         |   | 104  | Moldova, Rep.              | 3.97  | 49.46         | 0.16         | ○ |
| 41   | Costa Rica               | 5.02  | 66.95         | 0.67         |   | 105  | Mozambique                 | 3.96  | 49.30         | 0.15         |   |
| 42   | Bahrain                  | 5.01  | 66.84         | 0.66         |   | 106  | El Salvador                | 3.94  | 49.07         | 0.14         |   |
| 43   | Mexico                   | 4.99  | 66.57         | 0.66         |   | 107  | Mali                       | 3.93  | 48.77         | 0.13         |   |
| 44   | Dominican Republic       | 4.93  | 65.56         | 0.65         | ● | 108  | Zambia                     | 3.92  | 48.61         | 0.12         |   |
| 45   | South Africa             | 4.93  | 65.46         | 0.64         |   | 109  | Lebanon                    | 3.91  | 48.48         | 0.11         | ○ |
| 46   | China                    | 4.92  | 65.36         | 0.63         |   | 110  | Bolivia, Plurinational St. | 3.85  | 47.44         | 0.11         |   |
| 47   | Guatemala                | 4.91  | 65.25         | 0.62         | ● | 111  | Tajikistan                 | 3.84  | 47.29         | 0.10         |   |
| 48   | Jordan                   | 4.87  | 64.58         | 0.61         |   | 112  | Ukraine                    | 3.82  | 46.97         | 0.09         | ○ |
| 49   | Hungary                  | 4.83  | 63.79         | 0.61         |   | 113  | Zimbabwe                   | 3.80  | 46.60         | 0.08         |   |
| 50   | Azerbaijan               | 4.83  | 63.78         | 0.60         |   | 114  | Argentina                  | 3.79  | 46.57         | 0.07         | ○ |
| 51   | Turkey                   | 4.79  | 63.16         | 0.59         |   | 115  | Algeria                    | 3.71  | 45.23         | 0.07         |   |
| 52   | Indonesia                | 4.77  | 62.91         | 0.58         |   | 116  | Bosnia and Herzegovina     | 3.68  | 44.73         | 0.06         | ○ |
| 53   | Morocco                  | 4.74  | 62.30         | 0.57         |   | 117  | Ethiopia                   | 3.66  | 44.36         | 0.05         |   |
| 54   | Slovenia                 | 4.73  | 62.11         | 0.57         |   | 118  | Kyrgyzstan                 | 3.47  | 41.12         | 0.04         | ○ |
| 55   | Jamaica                  | 4.72  | 62.05         | 0.56         |   | 119  | Nepal                      | 3.47  | 41.09         | 0.03         | ○ |
| 56   | Bulgaria                 | 4.72  | 62.02         | 0.55         |   | 120  | Malawi                     | 3.36  | 39.41         | 0.02         | ○ |
| 57   | Italy                    | 4.70  | 61.65         | 0.54         |   | 121  | Guinea (2015)              | 3.15  | 35.86         | 0.02         | ○ |
| 58   | Colombia                 | 4.69  | 61.50         | 0.53         |   | 122  | Burundi                    | 2.91  | 31.90         | 0.01         | ○ |
| 59   | Poland                   | 4.66  | 61.00         | 0.52         |   | 123  | Yemen                      | 2.79  | 29.90         | 0.00         | ○ |
| 60   | Philippines              | 4.65  | 60.88         | 0.52         |   | n/a  | Belarus                    | n/a   | n/a           | n/a          |   |
| 61   | Cambodia                 | 4.64  | 60.73         | 0.51         |   | n/a  | Burkina Faso               | n/a   | n/a           | n/a          |   |
| 62   | Sri Lanka                | 4.64  | 60.62         | 0.50         |   | n/a  | Niger                      | n/a   | n/a           | n/a          |   |
| 63   | Latvia                   | 4.63  | 60.45         | 0.49         |   | n/a  | Togo                       | n/a   | n/a           | n/a          |   |
| 64   | Mauritius                | 4.60  | 59.96         | 0.48         |   |      |                            |       |               |              |   |

SOURCE: World Economic Forum, *Executive Opinion Survey 2016–2017*

NOTE: ● indicates a strength; ○ a weakness

## 7.1.4

## ICTs and organizational model creation

Average answer to the question: In your country, to what extent do ICTs enable new organizational models (e.g., virtual teams, remote working, telecommuting) within companies? [1 = not at all; 7 = to a great extent] | 2016

| Rank | Country/Economy          | Value | Score (0–100) | Percent rank |   | Rank | Country/Economy            | Value | Score (0–100) | Percent rank |   |
|------|--------------------------|-------|---------------|--------------|---|------|----------------------------|-------|---------------|--------------|---|
| 1    | United States of America | 5.94  | 82.31         | 1.00         | ● | 65   | Senegal                    | 4.18  | 52.96         | 0.48         |   |
| 2    | United Kingdom           | 5.88  | 81.30         | 0.99         | ● | 66   | Ukraine                    | 4.13  | 52.25         | 0.47         |   |
| 3    | Norway                   | 5.84  | 80.65         | 0.98         | ● | 67   | Ecuador                    | 4.13  | 52.16         | 0.46         |   |
| 4    | Sweden                   | 5.83  | 80.50         | 0.98         | ● | 68   | Rwanda                     | 4.10  | 51.67         | 0.45         |   |
| 5    | Estonia                  | 5.80  | 79.94         | 0.97         | ● | 69   | Brazil                     | 4.08  | 51.33         | 0.44         |   |
| 6    | Netherlands              | 5.75  | 79.18         | 0.96         |   | 70   | TFYR of Macedonia          | 4.07  | 51.23         | 0.43         |   |
| 7    | Finland                  | 5.71  | 78.47         | 0.95         |   | 71   | Mauritius                  | 4.05  | 50.91         | 0.43         |   |
| 8    | Iceland                  | 5.67  | 77.84         | 0.94         |   | 72   | Côte d'Ivoire              | 4.05  | 50.81         | 0.42         | ● |
| 9    | Singapore                | 5.60  | 76.69         | 0.93         |   | 73   | Turkey                     | 4.05  | 50.75         | 0.41         |   |
| 10   | Switzerland              | 5.57  | 76.23         | 0.93         |   | 74   | Jamaica                    | 4.04  | 50.71         | 0.40         |   |
| 11   | Israel                   | 5.53  | 75.53         | 0.92         |   | 75   | Italy                      | 4.03  | 50.47         | 0.39         | ○ |
| 12   | Canada                   | 5.49  | 74.78         | 0.91         |   | 76   | Namibia                    | 4.01  | 50.13         | 0.39         |   |
| 13   | United Arab Emirates     | 5.47  | 74.45         | 0.90         | ● | 77   | Kazakhstan                 | 3.95  | 49.24         | 0.38         |   |
| 14   | Luxembourg               | 5.45  | 74.21         | 0.89         |   | 78   | Morocco                    | 3.93  | 48.84         | 0.37         |   |
| 15   | Denmark                  | 5.45  | 74.12         | 0.89         |   | 79   | Romania                    | 3.92  | 48.71         | 0.36         |   |
| 16   | Qatar                    | 5.45  | 74.10         | 0.88         | ● | 80   | Argentina                  | 3.91  | 48.50         | 0.35         |   |
| 17   | Germany                  | 5.44  | 73.97         | 0.87         |   | 81   | Brunei Darussalam          | 3.86  | 47.69         | 0.34         |   |
| 18   | Malaysia                 | 5.42  | 73.74         | 0.86         |   | 82   | Madagascar                 | 3.86  | 47.65         | 0.34         |   |
| 19   | Ireland                  | 5.33  | 72.23         | 0.85         |   | 83   | Oman                       | 3.82  | 47.04         | 0.33         |   |
| 20   | France                   | 5.28  | 71.35         | 0.84         |   | 84   | Peru                       | 3.82  | 46.97         | 0.32         |   |
| 21   | Hong Kong (China)        | 5.27  | 71.20         | 0.84         |   | 85   | Kuwait                     | 3.82  | 46.96         | 0.31         |   |
| 22   | Belgium                  | 5.22  | 70.36         | 0.83         |   | 86   | Cyprus                     | 3.80  | 46.64         | 0.30         |   |
| 23   | New Zealand              | 5.15  | 69.11         | 0.82         |   | 87   | Benin                      | 3.74  | 45.74         | 0.30         |   |
| 24   | Lithuania                | 5.14  | 68.94         | 0.81         |   | 88   | Egypt                      | 3.74  | 45.68         | 0.29         |   |
| 25   | Austria                  | 5.02  | 67.07         | 0.80         |   | 89   | Trinidad and Tobago        | 3.74  | 45.59         | 0.28         |   |
| 26   | Korea, Rep.              | 5.01  | 66.84         | 0.80         |   | 90   | Montenegro                 | 3.73  | 45.50         | 0.27         | ○ |
| 27   | Japan                    | 4.98  | 66.34         | 0.79         |   | 91   | Nigeria                    | 3.71  | 45.21         | 0.26         |   |
| 28   | Australia                | 4.89  | 64.80         | 0.78         |   | 92   | Moldova, Rep.              | 3.70  | 45.06         | 0.25         |   |
| 29   | China                    | 4.86  | 64.40         | 0.77         |   | 93   | Tanzania, United Rep.      | 3.68  | 44.69         | 0.25         |   |
| 30   | Czech Republic           | 4.82  | 63.65         | 0.76         |   | 94   | Greece                     | 3.68  | 44.68         | 0.24         | ○ |
| 31   | Slovakia                 | 4.76  | 62.72         | 0.75         |   | 95   | El Salvador                | 3.67  | 44.54         | 0.23         |   |
| 32   | Portugal                 | 4.76  | 62.64         | 0.75         |   | 96   | Ethiopia                   | 3.65  | 44.22         | 0.22         |   |
| 33   | Costa Rica               | 4.74  | 62.31         | 0.74         |   | 97   | Zambia                     | 3.64  | 44.01         | 0.21         |   |
| 34   | Panama                   | 4.72  | 62.07         | 0.73         |   | 98   | Cameroon                   | 3.62  | 43.74         | 0.20         |   |
| 35   | India                    | 4.71  | 61.88         | 0.72         |   | 99   | Tunisia                    | 3.62  | 43.73         | 0.20         |   |
| 36   | Malta                    | 4.67  | 61.23         | 0.71         |   | 100  | Iran, Islamic Rep.         | 3.61  | 43.44         | 0.19         |   |
| 37   | Azerbaijan               | 4.65  | 60.80         | 0.70         | ● | 101  | Uganda                     | 3.61  | 43.43         | 0.18         |   |
| 38   | Indonesia                | 4.59  | 59.75         | 0.70         | ● | 102  | Tajikistan                 | 3.53  | 42.14         | 0.17         |   |
| 39   | Spain                    | 4.56  | 59.35         | 0.69         |   | 103  | Serbia                     | 3.52  | 42.07         | 0.16         | ○ |
| 40   | Guatemala                | 4.55  | 59.21         | 0.68         | ● | 104  | Bangladesh                 | 3.52  | 42.03         | 0.16         |   |
| 41   | South Africa             | 4.54  | 59.03         | 0.67         |   | 105  | Lebanon                    | 3.48  | 41.36         | 0.15         | ○ |
| 42   | Slovenia                 | 4.54  | 58.94         | 0.66         |   | 106  | Botswana                   | 3.48  | 41.34         | 0.14         |   |
| 43   | Thailand                 | 4.53  | 58.87         | 0.66         |   | 107  | Georgia                    | 3.48  | 41.34         | 0.13         | ○ |
| 44   | Bulgaria                 | 4.51  | 58.57         | 0.65         |   | 108  | Mongolia                   | 3.47  | 41.23         | 0.12         |   |
| 45   | Bahrain                  | 4.49  | 58.22         | 0.64         |   | 109  | Mali                       | 3.34  | 38.93         | 0.11         |   |
| 46   | Kenya                    | 4.45  | 57.47         | 0.63         |   | 110  | Bosnia and Herzegovina     | 3.30  | 38.41         | 0.11         | ○ |
| 47   | Colombia                 | 4.43  | 57.18         | 0.62         |   | 111  | Kyrgyzstan                 | 3.28  | 37.97         | 0.10         |   |
| 48   | Uruguay                  | 4.42  | 56.98         | 0.61         |   | 112  | Pakistan                   | 3.28  | 37.96         | 0.09         |   |
| 49   | Mexico                   | 4.42  | 56.96         | 0.61         |   | 113  | Mozambique                 | 3.22  | 36.97         | 0.08         |   |
| 50   | Latvia                   | 4.40  | 56.59         | 0.60         |   | 114  | Paraguay                   | 3.17  | 36.20         | 0.07         |   |
| 51   | Saudi Arabia             | 4.39  | 56.49         | 0.59         |   | 115  | Bolivia, Plurinational St. | 3.17  | 36.11         | 0.07         |   |
| 52   | Cambodia                 | 4.34  | 55.59         | 0.58         | ● | 116  | Nepal                      | 3.04  | 34.03         | 0.06         | ○ |
| 53   | Dominican Republic       | 4.33  | 55.57         | 0.57         | ● | 117  | Zimbabwe                   | 2.99  | 33.20         | 0.05         |   |
| 54   | Chile                    | 4.33  | 55.45         | 0.57         |   | 118  | Albania                    | 2.96  | 32.61         | 0.04         | ○ |
| 55   | Russian Federation       | 4.31  | 55.13         | 0.56         |   | 119  | Malawi                     | 2.83  | 30.51         | 0.03         |   |
| 56   | Honduras                 | 4.30  | 54.94         | 0.55         | ● | 120  | Algeria                    | 2.77  | 29.55         | 0.02         |   |
| 57   | Philippines              | 4.29  | 54.82         | 0.54         |   | 121  | Guinea (2015)              | 2.71  | 28.57         | 0.02         | ○ |
| 58   | Armenia                  | 4.28  | 54.60         | 0.53         |   | 122  | Burundi                    | 2.59  | 26.47         | 0.01         | ○ |
| 59   | Hungary                  | 4.27  | 54.48         | 0.52         |   | 123  | Yemen                      | 2.54  | 25.68         | 0.00         | ○ |
| 60   | Croatia                  | 4.26  | 54.29         | 0.52         |   | n/a  | Belarus                    | n/a   | n/a           | n/a          |   |
| 61   | Viet Nam                 | 4.25  | 54.16         | 0.51         |   | n/a  | Burkina Faso               | n/a   | n/a           | n/a          |   |
| 62   | Poland                   | 4.24  | 54.00         | 0.50         |   | n/a  | Niger                      | n/a   | n/a           | n/a          |   |
| 63   | Sri Lanka                | 4.22  | 53.61         | 0.49         |   | n/a  | Togo                       | n/a   | n/a           | n/a          |   |
| 64   | Jordan                   | 4.20  | 53.25         | 0.48         |   |      |                            |       |               |              |   |

SOURCE: World Economic Forum, *Executive Opinion Survey 2016–2017*

NOTE: ● indicates a strength; ○ a weakness

| Rank | Country/Economy                 | Value | Score (0–100) | Percent rank |   | Rank | Country/Economy        | Value | Score (0–100) | Percent rank |   |
|------|---------------------------------|-------|---------------|--------------|---|------|------------------------|-------|---------------|--------------|---|
| 1    | Costa Rica                      | 10.05 | 100.00        | 0.98         | ● | 65   | Albania                | 0.05  | 2.42          | 0.30         |   |
| 1    | Luxembourg (2014)               | 5.02  | 100.00        | 0.98         | ● | 66   | Azerbaijan             | 0.05  | 2.29          | 0.29         |   |
| 1    | United States of America (2014) | 1.98  | 100.00        | 0.98         | ● | 67   | Belarus                | 0.05  | 2.29          | 0.27         |   |
| 4    | Belgium (2014)                  | 1.65  | 83.11         | 0.97         | ● | 68   | Malawi                 | 0.04  | 2.03          | 0.26         |   |
| 5    | Romania (2014)                  | 1.56  | 78.88         | 0.96         | ● | 69   | Mauritius              | 0.04  | 2.01          | 0.25         |   |
| 6    | Croatia (2014)                  | 1.55  | 77.97         | 0.95         | ● | 70   | China                  | 0.03  | 1.66          | 0.24         |   |
| 7    | Estonia (2014)                  | 1.51  | 76.37         | 0.93         | ● | 71   | Mozambique (2014)      | 0.03  | 1.55          | 0.23         |   |
| 8    | Israel (2014)                   | 1.26  | 63.52         | 0.92         | ● | 72   | Côte d'Ivoire          | 0.03  | 1.33          | 0.22         |   |
| 9    | Latvia (2014)                   | 1.21  | 60.82         | 0.91         | ● | 73   | Madagascar             | 0.03  | 1.29          | 0.21         |   |
| 10   | France (2014)                   | 1.17  | 58.83         | 0.90         | ● | 74   | Mali                   | 0.02  | 1.23          | 0.20         |   |
| 11   | Benin                           | 1.15  | 58.16         | 0.89         | ● | 75   | Mexico                 | 0.02  | 1.05          | 0.19         | ○ |
| 12   | Austria (2014)                  | 1.10  | 55.47         | 0.88         | ● | 76   | Guatemala              | 0.02  | 0.93          | 0.18         |   |
| 13   | Bulgaria (2014)                 | 1.10  | 55.26         | 0.87         | ● | 77   | Kazakhstan             | 0.01  | 0.74          | 0.16         |   |
| 14   | Netherlands (2014)              | 1.07  | 54.04         | 0.86         | ● | 78   | Pakistan (2012)        | 0.01  | 0.54          | 0.15         |   |
| 15   | United Kingdom                  | 1.03  | 52.16         | 0.85         | ● | 79   | Turkey                 | 0.01  | 0.32          | 0.14         | ○ |
| 16   | Poland (2014)                   | 1.00  | 50.45         | 0.84         | ● | 80   | Uganda                 | 0.01  | 0.26          | 0.13         |   |
| 17   | Russian Federation (2014)       | 0.94  | 47.51         | 0.82         | ● | 81   | Bosnia and Herzegovina | 0.00  | 0.26          | 0.12         | ○ |
| 18   | Slovenia (2014)                 | 0.89  | 44.76         | 0.81         | ● | 82   | Paraguay               | 0.00  | 0.20          | 0.11         |   |
| 19   | Sweden (2014)                   | 0.88  | 44.46         | 0.80         | ● | 83   | Bangladesh             | 0.00  | 0.17          | 0.10         |   |
| 20   | Niger (2014)                    | 0.74  | 37.24         | 0.79         | ● | 84   | Algeria                | 0.00  | 0.16          | 0.09         |   |
| 21   | Denmark (2014)                  | 0.68  | 34.08         | 0.78         | ● | 85   | Togo (2014)            | 0.00  | 0.15          | 0.08         |   |
| 22   | Germany (2014)                  | 0.66  | 33.33         | 0.77         | ● | 86   | Ethiopia               | 0.00  | 0.10          | 0.07         |   |
| 23   | Canada (2014)                   | 0.65  | 33.00         | 0.76         | ● | 87   | Rwanda (2014)          | 0.00  | 0.03          | 0.05         | ○ |
| 24   | Greece (2014)                   | 0.64  | 32.36         | 0.75         | ● | 88   | Kenya (2014)           | 0.00  | 0.01          | 0.04         | ○ |
| 25   | Hungary (2014)                  | 0.62  | 31.16         | 0.74         | ● | 89   | El Salvador (2013)     | 0.00  | 0.01          | 0.03         | ○ |
| 26   | Portugal (2014)                 | 0.60  | 30.52         | 0.73         | ● | 90   | Malta (2013)           | 0.00  | 0.01          | 0.02         | ○ |
| 27   | Czech Republic (2014)           | 0.50  | 25.46         | 0.71         | ● | 91   | Mongolia (2007)        | 0.00  | 0.01          | 0.01         | ○ |
| 28   | Cyprus (2014)                   | 0.49  | 24.83         | 0.70         | ● | 92   | Honduras (2014)        | 0.00  | 0.00          | 0.00         | ○ |
| 29   | Lithuania (2014)                | 0.44  | 22.45         | 0.69         | ● | n/a  | Bahrain                | n/a   | n/a           | n/a          |   |
| 30   | Guinea (2014)                   | 0.40  | 20.41         | 0.68         | ● | n/a  | Botswana               | n/a   | n/a           | n/a          |   |
| 31   | Argentina                       | 0.39  | 19.61         | 0.67         | ● | n/a  | Brunei Darussalam      | n/a   | n/a           | n/a          |   |
| 32   | Moldova, Rep.                   | 0.38  | 19.38         | 0.66         | ● | n/a  | Cambodia               | n/a   | n/a           | n/a          |   |
| 33   | Burundi (2014)                  | 0.34  | 17.08         | 0.65         | ● | n/a  | Chile                  | n/a   | n/a           | n/a          |   |
| 34   | Slovakia (2014)                 | 0.33  | 16.64         | 0.64         | ● | n/a  | Dominican Republic     | n/a   | n/a           | n/a          |   |
| 35   | Armenia                         | 0.33  | 16.60         | 0.63         | ● | n/a  | Egypt                  | n/a   | n/a           | n/a          |   |
| 36   | Iceland                         | 0.33  | 16.56         | 0.62         | ● | n/a  | Indonesia              | n/a   | n/a           | n/a          |   |
| 37   | Ecuador                         | 0.33  | 16.48         | 0.60         | ● | n/a  | Iran, Islamic Rep.     | n/a   | n/a           | n/a          |   |
| 38   | Australia (2014)                | 0.32  | 16.02         | 0.59         | ● | n/a  | Jordan                 | n/a   | n/a           | n/a          |   |
| 39   | Finland (2013)                  | 0.31  | 15.77         | 0.58         | ● | n/a  | Kuwait                 | n/a   | n/a           | n/a          |   |
| 40   | Burkina Faso                    | 0.30  | 14.94         | 0.57         | ● | n/a  | Kyrgyzstan             | n/a   | n/a           | n/a          |   |
| 41   | Italy (2014)                    | 0.29  | 14.76         | 0.56         | ● | n/a  | Malaysia               | n/a   | n/a           | n/a          |   |
| 42   | Korea, Rep. (2014)              | 0.29  | 14.75         | 0.55         | ● | n/a  | Namibia                | n/a   | n/a           | n/a          |   |
| 43   | TFYR of Macedonia               | 0.25  | 12.54         | 0.54         | ● | n/a  | Nepal                  | n/a   | n/a           | n/a          |   |
| 44   | Lebanon                         | 0.25  | 12.43         | 0.53         | ● | n/a  | New Zealand            | n/a   | n/a           | n/a          |   |
| 45   | Serbia                          | 0.23  | 11.48         | 0.52         | ● | n/a  | Nigeria                | n/a   | n/a           | n/a          |   |
| 46   | Ireland (2014)                  | 0.21  | 10.74         | 0.51         | ○ | n/a  | Oman                   | n/a   | n/a           | n/a          |   |
| 47   | Senegal                         | 0.21  | 10.51         | 0.49         | ○ | n/a  | Qatar                  | n/a   | n/a           | n/a          |   |
| 48   | South Africa                    | 0.16  | 7.94          | 0.48         | ○ | n/a  | Saudi Arabia           | n/a   | n/a           | n/a          |   |
| 49   | Hong Kong (China) (2014)        | 0.15  | 7.71          | 0.47         | ○ | n/a  | Singapore              | n/a   | n/a           | n/a          |   |
| 50   | Panama                          | 0.15  | 7.56          | 0.46         | ○ | n/a  | Spain                  | n/a   | n/a           | n/a          |   |
| 51   | Colombia (2014)                 | 0.13  | 6.62          | 0.45         | ○ | n/a  | Sri Lanka              | n/a   | n/a           | n/a          |   |
| 52   | India                           | 0.13  | 6.37          | 0.44         | ○ | n/a  | Switzerland            | n/a   | n/a           | n/a          |   |
| 53   | Ukraine                         | 0.12  | 5.89          | 0.43         | ○ | n/a  | Tajikistan             | n/a   | n/a           | n/a          |   |
| 54   | Peru                            | 0.10  | 5.04          | 0.42         | ○ | n/a  | Tanzania, United Rep.  | n/a   | n/a           | n/a          |   |
| 55   | Japan                           | 0.09  | 4.58          | 0.41         | ○ | n/a  | Thailand               | n/a   | n/a           | n/a          |   |
| 56   | Brazil                          | 0.09  | 4.53          | 0.40         | ○ | n/a  | Trinidad and Tobago    | n/a   | n/a           | n/a          |   |
| 57   | Montenegro                      | 0.09  | 4.47          | 0.38         | ○ | n/a  | Tunisia                | n/a   | n/a           | n/a          |   |
| 58   | Morocco                         | 0.08  | 4.09          | 0.37         | ○ | n/a  | United Arab Emirates   | n/a   | n/a           | n/a          |   |
| 59   | Georgia                         | 0.08  | 4.09          | 0.36         | ○ | n/a  | Uruguay                | n/a   | n/a           | n/a          |   |
| 60   | Jamaica                         | 0.07  | 3.70          | 0.35         | ○ | n/a  | Viet Nam               | n/a   | n/a           | n/a          |   |
| 61   | Bolivia, Plurinational St.      | 0.06  | 3.19          | 0.34         | ○ | n/a  | Yemen                  | n/a   | n/a           | n/a          |   |
| 62   | Norway                          | 0.06  | 2.97          | 0.33         | ○ | n/a  | Zambia                 | n/a   | n/a           | n/a          |   |
| 63   | Philippines                     | 0.06  | 2.94          | 0.32         | ○ | n/a  | Zimbabwe               | n/a   | n/a           | n/a          |   |
| 64   | Cameroon (2013)                 | 0.06  | 2.92          | 0.31         | ○ |      |                        |       |               |              |   |

SOURCE: World Trade Organization, *Trade in Commercial Services* database, based on the sixth (2009) edition of the International Monetary Fund's *Balance of Payments Manual* and *Balance of Payments* database; Bureau of Economic Analysis (BEA) released October 2016

NOTE: ● indicates a strength; ○ a weakness

## 7.2.2 National feature films produced

Number of national feature films produced (per million population 15–69 years old) | 2015

| Rank | Country/Economy          | Value | Score (0–100) | Percent rank |   | Rank | Country/Economy            | Value | Score (0–100) | Percent rank |   |
|------|--------------------------|-------|---------------|--------------|---|------|----------------------------|-------|---------------|--------------|---|
| 1    | Estonia                  | 27.16 | 100.00        | 0.98         | ● | 65   | Mozambique                 | 1.70  | 6.24          | 0.38         |   |
| 1    | Iceland                  | 55.95 | 100.00        | 0.98         | ● | 66   | Colombia                   | 1.63  | 5.99          | 0.38         |   |
| 1    | Luxembourg (2011)        | 42.41 | 100.00        | 0.98         | ● | 67   | Mexico                     | 1.62  | 5.96          | 0.37         |   |
| 4    | Malta                    | 22.84 | 84.10         | 0.97         | ● | 68   | Iran, Islamic Rep.         | 1.47  | 5.40          | 0.36         |   |
| 5    | Mongolia                 | 20.02 | 73.72         | 0.96         | ● | 69   | Poland                     | 1.45  | 5.35          | 0.35         | ○ |
| 6    | Denmark                  | 17.68 | 65.10         | 0.95         |   | 70   | Peru                       | 1.41  | 5.20          | 0.34         |   |
| 7    | Switzerland              | 16.94 | 62.38         | 0.94         |   | 71   | United Arab Emirates       | 1.40  | 5.17          | 0.33         |   |
| 8    | Armenia                  | 16.58 | 61.03         | 0.93         | ● | 72   | Tunisia                    | 1.37  | 5.03          | 0.32         |   |
| 9    | Slovenia                 | 13.40 | 49.35         | 0.92         | ● | 73   | Kazakhstan                 | 1.32  | 4.87          | 0.31         |   |
| 10   | Montenegro               | 13.29 | 48.92         | 0.91         | ● | 74   | Paraguay (2009)            | 1.29  | 4.74          | 0.30         |   |
| 11   | Latvia                   | 12.23 | 45.04         | 0.90         | ● | 75   | Guatemala (2010)           | 1.17  | 4.31          | 0.29         |   |
| 12   | Finland                  | 11.58 | 42.65         | 0.89         |   | 76   | Russian Federation         | 1.14  | 4.20          | 0.28         |   |
| 13   | Nigeria (2011)           | 11.16 | 41.09         | 0.88         | ● | 77   | Sri Lanka (2013)           | 1.04  | 3.84          | 0.27         |   |
| 14   | Hong Kong (China)        | 10.40 | 38.28         | 0.88         |   | 78   | Thailand (2010)            | 0.98  | 3.61          | 0.26         |   |
| 15   | Ireland                  | 10.11 | 37.22         | 0.87         |   | 79   | Dominican Republic (2009)  | 0.96  | 3.52          | 0.25         |   |
| 16   | Mauritius                | 9.42  | 34.68         | 0.86         | ● | 80   | Honduras                   | 0.95  | 3.50          | 0.24         |   |
| 17   | New Zealand              | 8.83  | 32.51         | 0.85         |   | 81   | Bolivia, Plurinational St. | 0.89  | 3.26          | 0.23         |   |
| 18   | Belgium                  | 8.69  | 31.99         | 0.84         |   | 82   | Brazil                     | 0.86  | 3.17          | 0.22         | ○ |
| 19   | Spain                    | 7.74  | 28.50         | 0.83         |   | 83   | Philippines (2013)         | 0.84  | 3.08          | 0.21         |   |
| 20   | Sweden                   | 7.38  | 27.16         | 0.82         |   | 84   | Guinea (2010)              | 0.83  | 3.04          | 0.20         |   |
| 21   | Azerbaijan               | 7.36  | 27.11         | 0.81         | ● | 85   | Morocco                    | 0.76  | 2.81          | 0.19         |   |
| 22   | Czech Republic           | 7.24  | 26.68         | 0.80         |   | 86   | Niger (2011)               | 0.73  | 2.69          | 0.18         |   |
| 23   | Netherlands              | 7.19  | 26.48         | 0.79         |   | 87   | Bangladesh (2009)          | 0.66  | 2.43          | 0.17         |   |
| 24   | Korea, Rep.              | 6.94  | 25.55         | 0.78         |   | 88   | China                      | 0.65  | 2.39          | 0.16         | ○ |
| 25   | France                   | 6.82  | 25.12         | 0.77         |   | 89   | South Africa               | 0.60  | 2.20          | 0.15         | ○ |
| 26   | Japan                    | 6.72  | 24.76         | 0.76         |   | 90   | Egypt                      | 0.58  | 2.14          | 0.14         | ○ |
| 27   | United Kingdom           | 6.57  | 24.18         | 0.75         |   | 91   | Kyrgyzstan (2013)          | 0.53  | 1.93          | 0.13         |   |
| 28   | Austria                  | 6.50  | 23.91         | 0.74         |   | 92   | Burkina Faso               | 0.52  | 1.92          | 0.13         |   |
| 29   | TFYR of Macedonia        | 6.41  | 23.61         | 0.73         |   | 93   | Indonesia (2012)           | 0.51  | 1.86          | 0.12         |   |
| 30   | Slovakia                 | 6.32  | 23.25         | 0.72         |   | 94   | Panama (2010)              | 0.41  | 1.52          | 0.11         |   |
| 31   | Argentina                | 6.22  | 22.91         | 0.71         |   | 95   | Senegal                    | 0.36  | 1.34          | 0.10         |   |
| 32   | Norway                   | 6.18  | 22.74         | 0.70         |   | 96   | Moldova, Rep.              | 0.32  | 1.17          | 0.09         | ○ |
| 33   | Israel                   | 6.13  | 22.55         | 0.69         |   | 97   | El Salvador (2008)         | 0.26  | 0.96          | 0.08         |   |
| 34   | Hungary                  | 5.69  | 20.96         | 0.68         |   | 98   | Viet Nam (2009)            | 0.19  | 0.71          | 0.07         | ○ |
| 35   | Georgia                  | 5.53  | 20.36         | 0.67         |   | 99   | Burundi                    | 0.17  | 0.61          | 0.06         |   |
| 36   | Greece                   | 5.48  | 20.17         | 0.66         |   | 100  | Belarus (2011)             | 0.14  | 0.52          | 0.05         | ○ |
| 37   | Serbia                   | 5.43  | 19.99         | 0.65         |   | 101  | Mali (2011)                | 0.12  | 0.46          | 0.04         | ○ |
| 38   | Singapore                | 4.84  | 17.83         | 0.64         |   | 102  | Ukraine                    | 0.09  | 0.33          | 0.03         | ○ |
| 39   | Bulgaria                 | 4.82  | 17.75         | 0.63         |   | 103  | Pakistan                   | 0.01  | 0.03          | 0.02         | ○ |
| 40   | Bosnia and Herzegovina   | 4.80  | 17.68         | 0.63         |   | 104  | Bahrain (2013)             | 0.00  | 0.00          | 0.00         | ○ |
| 41   | Uruguay                  | 4.70  | 17.30         | 0.62         |   | 104  | Oman (2009)                | 0.00  | 0.00          | 0.00         | ○ |
| 42   | Togo                     | 4.62  | 17.03         | 0.61         | ● | n/a  | Algeria                    | n/a   | n/a           | n/a          |   |
| 43   | Cyprus                   | 4.58  | 16.88         | 0.60         |   | n/a  | Benin                      | n/a   | n/a           | n/a          |   |
| 44   | Croatia                  | 4.58  | 16.87         | 0.59         |   | n/a  | Botswana                   | n/a   | n/a           | n/a          |   |
| 45   | Italy                    | 4.42  | 16.28         | 0.58         |   | n/a  | Brunei Darussalam          | n/a   | n/a           | n/a          |   |
| 46   | Lithuania                | 4.39  | 16.17         | 0.57         |   | n/a  | Côte d'Ivoire              | n/a   | n/a           | n/a          |   |
| 47   | Portugal                 | 4.22  | 15.55         | 0.56         |   | n/a  | Ethiopia                   | n/a   | n/a           | n/a          |   |
| 48   | Costa Rica               | 4.04  | 14.89         | 0.55         |   | n/a  | Jamaica                    | n/a   | n/a           | n/a          |   |
| 49   | Germany                  | 3.95  | 14.53         | 0.54         |   | n/a  | Jordan                     | n/a   | n/a           | n/a          |   |
| 50   | Canada                   | 3.91  | 14.40         | 0.53         |   | n/a  | Kenya                      | n/a   | n/a           | n/a          |   |
| 51   | Malaysia                 | 3.66  | 13.46         | 0.52         |   | n/a  | Kuwait                     | n/a   | n/a           | n/a          |   |
| 52   | Lebanon                  | 3.63  | 13.37         | 0.51         |   | n/a  | Malawi                     | n/a   | n/a           | n/a          |   |
| 53   | United States of America | 3.45  | 12.70         | 0.50         |   | n/a  | Namibia                    | n/a   | n/a           | n/a          |   |
| 54   | Albania                  | 3.30  | 12.17         | 0.49         |   | n/a  | Nepal                      | n/a   | n/a           | n/a          |   |
| 55   | Cambodia                 | 3.11  | 11.46         | 0.48         |   | n/a  | Qatar                      | n/a   | n/a           | n/a          |   |
| 56   | Chile                    | 2.92  | 10.76         | 0.47         |   | n/a  | Rwanda                     | n/a   | n/a           | n/a          |   |
| 57   | Madagascar               | 2.62  | 9.66          | 0.46         |   | n/a  | Saudi Arabia               | n/a   | n/a           | n/a          |   |
| 58   | Turkey                   | 2.51  | 9.24          | 0.45         |   | n/a  | Tanzania, United Rep.      | n/a   | n/a           | n/a          |   |
| 59   | India                    | 2.15  | 7.90          | 0.44         |   | n/a  | Trinidad and Tobago        | n/a   | n/a           | n/a          |   |
| 60   | Ecuador                  | 2.14  | 7.89          | 0.43         |   | n/a  | Uganda                     | n/a   | n/a           | n/a          |   |
| 61   | Australia                | 1.93  | 7.12          | 0.42         | ○ | n/a  | Yemen                      | n/a   | n/a           | n/a          |   |
| 62   | Romania                  | 1.83  | 6.75          | 0.41         |   | n/a  | Zambia                     | n/a   | n/a           | n/a          |   |
| 63   | Cameroon (2009)          | 1.83  | 6.74          | 0.40         | ● | n/a  | Zimbabwe                   | n/a   | n/a           | n/a          |   |
| 64   | Tajikistan (2013)        | 1.77  | 6.51          | 0.39         |   |      |                            |       |               |              |   |

SOURCE: UNESCO Institute for Statistics, *UIS online database*; United Nations, Department of Economic and Social Affairs, Population Division, *World Population Prospects: The 2015 Revision*

NOTE: ● indicates a strength; ○ a weakness



# 7.2.3

## Global entertainment and media market

Global entertainment and media market (per thousand population 15–69 years old) | 2015

| Rank | Country/Economy          | Value | Score (0–100) | Percent rank |   | Rank | Country/Economy            | Value | Score (0–100) | Percent rank |
|------|--------------------------|-------|---------------|--------------|---|------|----------------------------|-------|---------------|--------------|
| 1    | Norway                   | 2.87  | 100.00        | 1.00         | ● | n/a  | Armenia                    | n/a   | n/a           | n/a          |
| 2    | Switzerland              | 2.83  | 98.69         | 0.98         | ● | n/a  | Azerbaijan                 | n/a   | n/a           | n/a          |
| 3    | United States of America | 2.78  | 97.10         | 0.97         | ● | n/a  | Bangladesh                 | n/a   | n/a           | n/a          |
| 4    | Denmark                  | 2.18  | 75.97         | 0.95         |   | n/a  | Belarus                    | n/a   | n/a           | n/a          |
| 5    | United Kingdom           | 2.06  | 71.62         | 0.94         |   | n/a  | Benin                      | n/a   | n/a           | n/a          |
| 6    | Sweden                   | 2.05  | 71.47         | 0.92         |   | n/a  | Bolivia, Plurinational St. | n/a   | n/a           | n/a          |
| 7    | Austria                  | 1.88  | 65.32         | 0.90         |   | n/a  | Bosnia and Herzegovina     | n/a   | n/a           | n/a          |
| 8    | Australia                | 1.84  | 63.93         | 0.89         |   | n/a  | Botswana                   | n/a   | n/a           | n/a          |
| 9    | Finland                  | 1.80  | 62.57         | 0.87         |   | n/a  | Brunei Darussalam          | n/a   | n/a           | n/a          |
| 10   | Japan                    | 1.78  | 61.79         | 0.85         |   | n/a  | Bulgaria                   | n/a   | n/a           | n/a          |
| 11   | Germany                  | 1.67  | 57.82         | 0.84         |   | n/a  | Burkina Faso               | n/a   | n/a           | n/a          |
| 12   | New Zealand              | 1.64  | 56.78         | 0.82         |   | n/a  | Burundi                    | n/a   | n/a           | n/a          |
| 13   | Hong Kong (China)        | 1.62  | 56.17         | 0.81         |   | n/a  | Cambodia                   | n/a   | n/a           | n/a          |
| 14   | Canada                   | 1.60  | 55.57         | 0.79         |   | n/a  | Cameroon                   | n/a   | n/a           | n/a          |
| 15   | France                   | 1.53  | 53.11         | 0.77         |   | n/a  | Costa Rica                 | n/a   | n/a           | n/a          |
| 16   | Belgium                  | 1.52  | 52.84         | 0.76         |   | n/a  | Côte d'Ivoire              | n/a   | n/a           | n/a          |
| 17   | Netherlands              | 1.45  | 50.35         | 0.74         |   | n/a  | Croatia                    | n/a   | n/a           | n/a          |
| 18   | Ireland                  | 1.42  | 49.29         | 0.73         |   | n/a  | Cyprus                     | n/a   | n/a           | n/a          |
| 19   | Korea, Rep.              | 1.36  | 47.05         | 0.71         |   | n/a  | Dominican Republic         | n/a   | n/a           | n/a          |
| 20   | Singapore                | 1.22  | 42.16         | 0.69         |   | n/a  | Ecuador                    | n/a   | n/a           | n/a          |
| 21   | Israel                   | 1.04  | 35.90         | 0.68         |   | n/a  | El Salvador                | n/a   | n/a           | n/a          |
| 22   | Portugal                 | 0.94  | 32.24         | 0.66         |   | n/a  | Estonia                    | n/a   | n/a           | n/a          |
| 23   | Italy                    | 0.82  | 28.07         | 0.65         |   | n/a  | Ethiopia                   | n/a   | n/a           | n/a          |
| 24   | Spain                    | 0.76  | 25.99         | 0.63         |   | n/a  | Georgia                    | n/a   | n/a           | n/a          |
| 25   | Qatar                    | 0.76  | 25.94         | 0.61         |   | n/a  | Guatemala                  | n/a   | n/a           | n/a          |
| 26   | Czech Republic           | 0.60  | 20.30         | 0.60         |   | n/a  | Guinea                     | n/a   | n/a           | n/a          |
| 27   | Greece                   | 0.55  | 18.57         | 0.58         |   | n/a  | Honduras                   | n/a   | n/a           | n/a          |
| 28   | United Arab Emirates     | 0.49  | 16.46         | 0.56         |   | n/a  | Iceland                    | n/a   | n/a           | n/a          |
| 29   | Argentina                | 0.40  | 13.41         | 0.55         |   | n/a  | Jamaica                    | n/a   | n/a           | n/a          |
| 30   | Hungary                  | 0.38  | 12.62         | 0.53         |   | n/a  | Kazakhstan                 | n/a   | n/a           | n/a          |
| 31   | Saudi Arabia             | 0.34  | 11.31         | 0.52         |   | n/a  | Kyrgyzstan                 | n/a   | n/a           | n/a          |
| 32   | Malaysia                 | 0.34  | 11.19         | 0.50         |   | n/a  | Latvia                     | n/a   | n/a           | n/a          |
| 33   | Chile                    | 0.34  | 11.17         | 0.48         |   | n/a  | Lithuania                  | n/a   | n/a           | n/a          |
| 34   | Poland                   | 0.33  | 11.05         | 0.47         |   | n/a  | Luxembourg                 | n/a   | n/a           | n/a          |
| 35   | Kuwait                   | 0.33  | 10.71         | 0.45         |   | n/a  | Madagascar                 | n/a   | n/a           | n/a          |
| 36   | Malta                    | 0.27  | 8.79          | 0.44         |   | n/a  | Malawi                     | n/a   | n/a           | n/a          |
| 37   | South Africa             | 0.26  | 8.58          | 0.42         |   | n/a  | Mali                       | n/a   | n/a           | n/a          |
| 38   | Mexico                   | 0.26  | 8.27          | 0.40         |   | n/a  | Mauritius                  | n/a   | n/a           | n/a          |
| 39   | Bahrain                  | 0.25  | 8.04          | 0.39         |   | n/a  | Moldova, Rep.              | n/a   | n/a           | n/a          |
| 40   | Brazil                   | 0.25  | 7.89          | 0.37         |   | n/a  | Mongolia                   | n/a   | n/a           | n/a          |
| 41   | Turkey                   | 0.22  | 6.95          | 0.35         |   | n/a  | Montenegro                 | n/a   | n/a           | n/a          |
| 42   | Peru                     | 0.19  | 5.94          | 0.34         |   | n/a  | Mozambique                 | n/a   | n/a           | n/a          |
| 43   | Thailand                 | 0.18  | 5.52          | 0.32         |   | n/a  | Namibia                    | n/a   | n/a           | n/a          |
| 44   | China                    | 0.16  | 5.02          | 0.31         |   | n/a  | Nepal                      | n/a   | n/a           | n/a          |
| 45   | Romania                  | 0.16  | 4.89          | 0.29         |   | n/a  | Niger                      | n/a   | n/a           | n/a          |
| 46   | Oman                     | 0.16  | 4.76          | 0.27         |   | n/a  | Panama                     | n/a   | n/a           | n/a          |
| 47   | Colombia                 | 0.16  | 4.73          | 0.26         |   | n/a  | Paraguay                   | n/a   | n/a           | n/a          |
| 48   | Russian Federation       | 0.15  | 4.59          | 0.24         | ○ | n/a  | Rwanda                     | n/a   | n/a           | n/a          |
| 49   | Lebanon                  | 0.10  | 2.96          | 0.23         |   | n/a  | Senegal                    | n/a   | n/a           | n/a          |
| 50   | Kenya                    | 0.09  | 2.34          | 0.21         |   | n/a  | Serbia                     | n/a   | n/a           | n/a          |
| 51   | Philippines              | 0.09  | 2.33          | 0.19         |   | n/a  | Slovakia                   | n/a   | n/a           | n/a          |
| 52   | Indonesia                | 0.07  | 1.80          | 0.18         |   | n/a  | Slovenia                   | n/a   | n/a           | n/a          |
| 53   | Jordan                   | 0.07  | 1.66          | 0.16         | ○ | n/a  | Sri Lanka                  | n/a   | n/a           | n/a          |
| 54   | Iran, Islamic Rep.       | 0.06  | 1.29          | 0.15         |   | n/a  | Tajikistan                 | n/a   | n/a           | n/a          |
| 55   | Algeria                  | 0.05  | 1.14          | 0.13         |   | n/a  | Tanzania, United Rep.      | n/a   | n/a           | n/a          |
| 56   | Egypt                    | 0.05  | 1.01          | 0.11         |   | n/a  | TFYR of Macedonia          | n/a   | n/a           | n/a          |
| 57   | Viet Nam                 | 0.05  | 0.91          | 0.10         | ○ | n/a  | Togo                       | n/a   | n/a           | n/a          |
| 58   | Tunisia                  | 0.05  | 0.90          | 0.08         | ○ | n/a  | Trinidad and Tobago        | n/a   | n/a           | n/a          |
| 59   | Nigeria                  | 0.04  | 0.81          | 0.06         |   | n/a  | Uganda                     | n/a   | n/a           | n/a          |
| 60   | Morocco                  | 0.04  | 0.55          | 0.05         | ○ | n/a  | Ukraine                    | n/a   | n/a           | n/a          |
| 61   | India                    | 0.03  | 0.30          | 0.03         | ○ | n/a  | Uruguay                    | n/a   | n/a           | n/a          |
| 62   | Pakistan                 | 0.03  | 0.20          | 0.02         | ○ | n/a  | Zambia                     | n/a   | n/a           | n/a          |
| 63   | Yemen                    | 0.02  | 0.00          | 0.00         | ○ | n/a  | Zimbabwe                   | n/a   | n/a           | n/a          |
| n/a  | Albania                  | n/a   | n/a           | n/a          |   |      |                            |       |               |              |

SOURCE: PwC's *Global Entertainment and Media Outlook, 2016–2020*; United Nations, Department of Economic and Social Affairs, Population Division, *World Population Prospects: The 2015 Revision* (population); International Monetary Fund, *World Economic Outlook Database*, October 2016 (current US\$ GDP); Middle East & North Africa in World Bank's *DataBank*

NOTE: ● indicates a strength; ○ a weakness

# 7.2.4 Printing and publishing output

## Printing and publishing manufactures output (% of manufactures total output) | 2014

| Rank | Country/Economy                   | Value | Score (0–100) | Percent rank |   | Rank | Country/Economy          | Value | Score (0–100) | Percent rank |   |
|------|-----------------------------------|-------|---------------|--------------|---|------|--------------------------|-------|---------------|--------------|---|
| 1    | Iceland (2006)                    | 6.36  | 100.00        | 0.99         | ● | 65   | Czech Republic           | 1.01  | 13.20         | 0.35         | ○ |
| 1    | Malta (2009)                      | 36.18 | 100.00        | 0.99         | ● | 66   | Ukraine                  | 0.97  | 12.46         | 0.34         |   |
| 3    | Lebanon (2007)                    | 4.18  | 64.70         | 0.98         | ● | 67   | Turkey                   | 0.93  | 11.88         | 0.33         |   |
| 4    | Kenya (2013)                      | 3.82  | 58.79         | 0.97         | ● | 68   | Qatar (2013)             | 0.91  | 11.58         | 0.32         |   |
| 5    | Mauritius (2012)                  | 3.24  | 49.44         | 0.96         | ● | 69   | Greece                   | 0.91  | 11.57         | 0.31         |   |
| 6    | Panama (2013)                     | 3.20  | 48.80         | 0.95         | ● | 70   | Malaysia (2012)          | 0.86  | 10.71         | 0.30         |   |
| 7    | Georgia (2013)                    | 3.12  | 47.41         | 0.94         | ● | 71   | Ireland (2013)           | 0.83  | 10.16         | 0.29         | ○ |
| 8    | Latvia (2013)                     | 3.00  | 45.41         | 0.93         | ● | 72   | Senegal (2012)           | 0.82  | 10.14         | 0.28         |   |
| 9    | Mongolia (2011)                   | 2.94  | 44.52         | 0.92         | ● | 73   | Hungary                  | 0.81  | 9.88          | 0.27         | ○ |
| 10   | Tanzania, United Rep. (2010)      | 2.84  | 42.87         | 0.91         | ● | 74   | Morocco (2013)           | 0.80  | 9.81          | 0.26         |   |
| 11   | Peru (2011)                       | 2.66  | 39.93         | 0.90         | ● | 75   | Singapore                | 0.79  | 9.49          | 0.24         | ○ |
| 12   | TFYR of Macedonia (2011)          | 2.62  | 39.24         | 0.89         | ● | 76   | Thailand (2011)          | 0.77  | 9.17          | 0.23         |   |
| 13   | Cyprus                            | 2.60  | 39.05         | 0.88         |   | 77   | Brazil (2013)            | 0.76  | 9.14          | 0.22         |   |
| 14   | United Arab Emirates (2012)       | 2.50  | 37.35         | 0.87         |   | 78   | Oman                     | 0.73  | 8.65          | 0.21         |   |
| 15   | South Africa (2010)               | 2.44  | 36.30         | 0.86         | ● | 79   | Kazakhstan (2013)        | 0.73  | 8.53          | 0.20         |   |
| 16   | Costa Rica (2013)                 | 2.39  | 35.64         | 0.85         | ● | 80   | Tunisia (2007)           | 0.72  | 8.37          | 0.19         |   |
| 17   | Saudi Arabia (2009)               | 2.31  | 34.33         | 0.84         | ● | 81   | Viet Nam (2012)          | 0.70  | 8.06          | 0.18         |   |
| 18   | Colombia (2012)                   | 2.23  | 33.01         | 0.83         | ● | 82   | Azerbaijan (2013)        | 0.66  | 7.51          | 0.17         |   |
| 19   | Australia (2013)                  | 2.09  | 30.66         | 0.82         |   | 83   | Kyrgyzstan (2013)        | 0.66  | 7.43          | 0.16         |   |
| 20   | Japan (2012)                      | 2.09  | 30.64         | 0.81         |   | 84   | Kuwait (2013)            | 0.64  | 7.20          | 0.15         |   |
| 21   | Madagascar (2006)                 | 2.08  | 30.51         | 0.80         | ● | 85   | India                    | 0.60  | 6.48          | 0.14         |   |
| 22   | Estonia                           | 1.99  | 29.14         | 0.79         |   | 86   | Slovakia                 | 0.59  | 6.37          | 0.13         | ○ |
| 23   | United Kingdom                    | 1.95  | 28.36         | 0.78         |   | 87   | Mexico (2011)            | 0.57  | 5.99          | 0.12         | ○ |
| 24   | United States of America (2008)   | 1.88  | 27.35         | 0.77         |   | 88   | Indonesia (2013)         | 0.52  | 5.24          | 0.11         | ○ |
| 25   | Armenia (2013)                    | 1.82  | 26.38         | 0.76         |   | 89   | China (2011)             | 0.52  | 5.18          | 0.10         | ○ |
| 26   | Ethiopia                          | 1.79  | 25.78         | 0.74         | ● | 90   | Philippines (2012)       | 0.51  | 5.06          | 0.09         | ○ |
| 27   | New Zealand (2012)                | 1.75  | 25.20         | 0.73         |   | 91   | Brunei Darussalam (2010) | 0.48  | 4.58          | 0.08         | ○ |
| 28   | Slovenia                          | 1.75  | 25.19         | 0.72         |   | 92   | Nepal (2011)             | 0.43  | 3.80          | 0.07         |   |
| 29   | Moldova, Rep. (2013)              | 1.75  | 25.16         | 0.71         |   | 93   | Egypt (2012)             | 0.43  | 3.80          | 0.06         | ○ |
| 30   | Malawi (2012)                     | 1.74  | 24.95         | 0.70         | ● | 94   | Canada                   | 0.39  | 3.04          | 0.05         | ○ |
| 31   | Sri Lanka (2012)                  | 1.74  | 24.94         | 0.69         | ● | 95   | Yemen (2012)             | 0.36  | 2.60          | 0.04         |   |
| 32   | Serbia                            | 1.60  | 22.76         | 0.68         |   | 96   | Pakistan (2006)          | 0.33  | 2.12          | 0.03         | ○ |
| 33   | Ecuador (2008)                    | 1.55  | 21.95         | 0.67         | ● | 97   | Korea, Rep.              | 0.28  | 1.31          | 0.02         | ○ |
| 34   | Bahrain (2013)                    | 1.53  | 21.63         | 0.66         |   | 98   | Iran, Islamic Rep.       | 0.21  | 0.22          | 0.01         | ○ |
| 35   | Spain                             | 1.49  | 20.99         | 0.65         |   | 99   | Bangladesh (2011)        | 0.20  | 0.00          | 0.00         | ○ |
| 36   | Netherlands                       | 1.35  | 18.69         | 0.64         | ○ | n/a  | Albania                  | n/a   | n/a           | n/a          |   |
| 37   | Paraguay (2010)                   | 1.33  | 18.33         | 0.63         | ● | n/a  | Argentina                | n/a   | n/a           | n/a          |   |
| 38   | Bulgaria                          | 1.31  | 18.05         | 0.62         |   | n/a  | Belarus                  | n/a   | n/a           | n/a          |   |
| 39   | Norway                            | 1.29  | 17.77         | 0.61         |   | n/a  | Benin                    | n/a   | n/a           | n/a          |   |
| 40   | Sweden                            | 1.29  | 17.65         | 0.60         | ○ | n/a  | Botswana                 | n/a   | n/a           | n/a          |   |
| 41   | Cameroon (2008)                   | 1.28  | 17.60         | 0.59         | ● | n/a  | Burkina Faso             | n/a   | n/a           | n/a          |   |
| 42   | Austria                           | 1.28  | 17.58         | 0.58         | ○ | n/a  | Cambodia                 | n/a   | n/a           | n/a          |   |
| 43   | Portugal                          | 1.27  | 17.35         | 0.57         |   | n/a  | Côte d'Ivoire            | n/a   | n/a           | n/a          |   |
| 44   | Uruguay (2011)                    | 1.23  | 16.73         | 0.56         |   | n/a  | Croatia                  | n/a   | n/a           | n/a          |   |
| 45   | Belgium                           | 1.23  | 16.65         | 0.55         |   | n/a  | Dominican Republic       | n/a   | n/a           | n/a          |   |
| 46   | Israel                            | 1.22  | 16.62         | 0.54         |   | n/a  | El Salvador              | n/a   | n/a           | n/a          |   |
| 47   | Russian Federation                | 1.22  | 16.59         | 0.53         |   | n/a  | Guatemala                | n/a   | n/a           | n/a          |   |
| 48   | Italy                             | 1.21  | 16.37         | 0.52         |   | n/a  | Guinea                   | n/a   | n/a           | n/a          |   |
| 49   | Algeria (2008)                    | 1.21  | 16.33         | 0.51         | ● | n/a  | Honduras                 | n/a   | n/a           | n/a          |   |
| 50   | Finland                           | 1.20  | 16.21         | 0.50         | ○ | n/a  | Hong Kong (China)        | n/a   | n/a           | n/a          |   |
| 51   | Jordan (2013)                     | 1.19  | 16.11         | 0.49         |   | n/a  | Jamaica                  | n/a   | n/a           | n/a          |   |
| 52   | Burundi (2012)                    | 1.18  | 15.88         | 0.48         |   | n/a  | Mali                     | n/a   | n/a           | n/a          |   |
| 53   | Tajikistan (2013)                 | 1.17  | 15.73         | 0.47         |   | n/a  | Montenegro               | n/a   | n/a           | n/a          |   |
| 54   | Luxembourg                        | 1.17  | 15.68         | 0.46         |   | n/a  | Mozambique               | n/a   | n/a           | n/a          |   |
| 55   | France                            | 1.15  | 15.48         | 0.45         | ○ | n/a  | Namibia                  | n/a   | n/a           | n/a          |   |
| 56   | Bolivia, Plurinational St. (2010) | 1.14  | 15.23         | 0.44         |   | n/a  | Niger                    | n/a   | n/a           | n/a          |   |
| 57   | Poland                            | 1.14  | 15.20         | 0.43         |   | n/a  | Nigeria                  | n/a   | n/a           | n/a          |   |
| 58   | Switzerland                       | 1.12  | 14.94         | 0.42         | ○ | n/a  | Rwanda                   | n/a   | n/a           | n/a          |   |
| 59   | Germany                           | 1.12  | 14.86         | 0.41         | ○ | n/a  | Togo                     | n/a   | n/a           | n/a          |   |
| 60   | Lithuania                         | 1.09  | 14.38         | 0.40         |   | n/a  | Trinidad and Tobago      | n/a   | n/a           | n/a          |   |
| 61   | Chile (2013)                      | 1.06  | 13.98         | 0.39         |   | n/a  | Uganda                   | n/a   | n/a           | n/a          |   |
| 62   | Romania (2013)                    | 1.06  | 13.95         | 0.38         |   | n/a  | Zambia                   | n/a   | n/a           | n/a          |   |
| 63   | Bosnia and Herzegovina (2011)     | 1.06  | 13.94         | 0.37         |   | n/a  | Zimbabwe                 | n/a   | n/a           | n/a          |   |
| 64   | Denmark                           | 1.02  | 13.29         | 0.36         | ○ |      |                          |       |               |              |   |

SOURCE: United Nations Industrial Development Organization, *Industrial Statistics Database*; 2-digit level of International Standard Industrial Classification ISIC Revision 3 (INDSTAT2 2015)

NOTE: ● Indicates a strength; ○ a weakness

# 7.2.5 Creative goods exports

## Creative goods exports (% of total trade) | 2015

| Rank | Country/Economy            | Value | Score (0–100) | Percent rank |   | Rank | Country/Economy              | Value | Score (0–100) | Percent rank |   |
|------|----------------------------|-------|---------------|--------------|---|------|------------------------------|-------|---------------|--------------|---|
| 1    | China                      | 12.83 | 100.00        | 1.00         | ● | 65   | Bosnia and Herzegovina       | 0.34  | 10.63         | 0.48         |   |
| 2    | Malaysia                   | 10.27 | 92.06         | 0.99         | ● | 66   | New Zealand                  | 0.29  | 9.14          | 0.48         | ○ |
| 3    | Mexico                     | 9.98  | 91.02         | 0.98         | ● | 67   | Peru                         | 0.28  | 8.91          | 0.47         |   |
| 4    | Czech Republic             | 9.75  | 90.21         | 0.98         | ● | 68   | Kenya (2013)                 | 0.28  | 8.85          | 0.46         |   |
| 5    | Thailand                   | 9.53  | 89.39         | 0.97         | ● | 69   | Sri Lanka                    | 0.26  | 8.43          | 0.45         |   |
| 6    | Slovakia                   | 9.33  | 88.65         | 0.96         | ● | 70   | Zimbabwe (2014)              | 0.26  | 8.36          | 0.44         |   |
| 7    | Viet Nam                   | 5.98  | 73.44         | 0.95         | ● | 71   | Colombia                     | 0.24  | 7.73          | 0.44         |   |
| 8    | Hungary                    | 5.86  | 72.78         | 0.94         | ● | 72   | Brazil                       | 0.23  | 7.53          | 0.43         |   |
| 9    | Poland                     | 5.48  | 70.59         | 0.94         | ● | 73   | Nepal                        | 0.22  | 7.35          | 0.42         | ● |
| 10   | Singapore                  | 5.16  | 68.60         | 0.93         |   | 74   | Belarus                      | 0.21  | 6.98          | 0.41         |   |
| 11   | Netherlands                | 4.69  | 65.52         | 0.92         |   | 75   | Montenegro                   | 0.19  | 6.22          | 0.40         |   |
| 12   | Latvia                     | 4.17  | 61.80         | 0.91         | ● | 76   | Botswana                     | 0.18  | 6.14          | 0.40         |   |
| 13   | Indonesia                  | 3.89  | 59.72         | 0.90         | ● | 77   | Morocco                      | 0.18  | 6.09          | 0.39         |   |
| 14   | Switzerland                | 3.80  | 58.98         | 0.90         |   | 78   | Qatar                        | 0.18  | 5.92          | 0.38         |   |
| 15   | United Kingdom             | 3.60  | 57.37         | 0.89         |   | 79   | Hong Kong (China)            | 0.17  | 5.75          | 0.37         | ○ |
| 16   | Korea, Rep.                | 3.11  | 53.01         | 0.88         |   | 80   | Kazakhstan                   | 0.16  | 5.40          | 0.36         |   |
| 17   | Turkey                     | 3.05  | 52.48         | 0.87         | ● | 81   | TFYR of Macedonia            | 0.16  | 5.28          | 0.35         |   |
| 18   | India                      | 2.57  | 47.56         | 0.86         | ● | 82   | Chile                        | 0.16  | 5.23          | 0.35         |   |
| 19   | Italy                      | 2.28  | 44.42         | 0.85         |   | 83   | Paraguay                     | 0.15  | 4.98          | 0.34         |   |
| 20   | Japan                      | 2.24  | 43.89         | 0.85         |   | 84   | Rwanda                       | 0.15  | 4.97          | 0.33         |   |
| 21   | Dominican Republic         | 2.20  | 43.47         | 0.84         | ● | 85   | Brunei Darussalam            | 0.13  | 4.37          | 0.32         |   |
| 22   | Germany                    | 2.18  | 43.23         | 0.83         |   | 86   | Argentina                    | 0.12  | 4.23          | 0.31         |   |
| 23   | Lithuania                  | 2.12  | 42.48         | 0.82         |   | 87   | Madagascar                   | 0.12  | 4.20          | 0.31         |   |
| 24   | Tunisia                    | 2.06  | 41.75         | 0.81         | ● | 88   | Albania                      | 0.12  | 4.10          | 0.30         |   |
| 25   | Ireland                    | 1.95  | 40.26         | 0.81         |   | 89   | Luxembourg                   | 0.12  | 3.94          | 0.29         | ○ |
| 26   | Egypt                      | 1.94  | 40.22         | 0.80         | ● | 90   | Côte d'Ivoire                | 0.10  | 3.57          | 0.28         |   |
| 27   | Israel                     | 1.82  | 38.59         | 0.79         |   | 91   | Georgia                      | 0.10  | 3.45          | 0.27         |   |
| 28   | Belgium                    | 1.81  | 38.52         | 0.78         |   | 92   | Malawi                       | 0.10  | 3.35          | 0.27         |   |
| 29   | Denmark                    | 1.80  | 38.38         | 0.77         |   | 93   | Senegal                      | 0.10  | 3.35          | 0.26         |   |
| 30   | France                     | 1.69  | 36.85         | 0.77         |   | 94   | Honduras (2014)              | 0.10  | 3.34          | 0.25         |   |
| 31   | United States of America   | 1.67  | 36.57         | 0.76         |   | 95   | Iceland                      | 0.08  | 2.92          | 0.24         | ○ |
| 32   | Sweden                     | 1.65  | 36.17         | 0.75         |   | 96   | Saudi Arabia                 | 0.08  | 2.66          | 0.23         |   |
| 33   | United Arab Emirates       | 1.62  | 35.85         | 0.74         |   | 97   | Uruguay                      | 0.07  | 2.56          | 0.23         |   |
| 34   | Bahrain                    | 1.25  | 30.11         | 0.73         |   | 98   | Kyrgyzstan                   | 0.07  | 2.47          | 0.22         |   |
| 35   | Bolivia, Plurinational St. | 1.25  | 30.08         | 0.73         | ● | 99   | Pakistan                     | 0.07  | 2.32          | 0.21         |   |
| 36   | Greece                     | 1.25  | 29.97         | 0.72         |   | 100  | Bangladesh (2011)            | 0.06  | 2.14          | 0.20         |   |
| 37   | Portugal                   | 1.23  | 29.69         | 0.71         |   | 101  | Tanzania, United Rep. (2014) | 0.06  | 2.11          | 0.19         |   |
| 38   | Estonia                    | 1.20  | 29.19         | 0.70         |   | 102  | Moldova, Rep.                | 0.06  | 2.10          | 0.19         |   |
| 39   | Romania                    | 1.19  | 28.96         | 0.69         |   | 103  | Trinidad and Tobago (2010)   | 0.06  | 2.00          | 0.18         |   |
| 40   | Austria                    | 1.17  | 28.71         | 0.69         |   | 104  | Ecuador                      | 0.06  | 1.94          | 0.17         |   |
| 41   | Mauritius                  | 1.14  | 28.11         | 0.68         |   | 105  | Uganda                       | 0.06  | 1.93          | 0.16         |   |
| 42   | Jordan                     | 1.02  | 26.06         | 0.67         | ● | 106  | Zambia                       | 0.04  | 1.45          | 0.15         |   |
| 43   | Bulgaria                   | 0.96  | 24.92         | 0.66         |   | 107  | Cyprus                       | 0.04  | 1.44          | 0.15         | ○ |
| 44   | Croatia                    | 0.94  | 24.49         | 0.65         |   | 108  | Jamaica                      | 0.03  | 1.19          | 0.14         | ○ |
| 45   | Slovenia                   | 0.91  | 23.77         | 0.65         |   | 109  | Burkina Faso                 | 0.03  | 0.91          | 0.13         |   |
| 46   | Spain                      | 0.88  | 23.34         | 0.64         |   | 110  | Oman (2014)                  | 0.02  | 0.66          | 0.12         | ○ |
| 47   | Lebanon (2014)             | 0.81  | 21.80         | 0.63         |   | 111  | Ethiopia                     | 0.02  | 0.59          | 0.11         |   |
| 48   | Australia                  | 0.80  | 21.65         | 0.62         |   | 112  | Niger (2014)                 | 0.02  | 0.53          | 0.10         |   |
| 49   | Russian Federation         | 0.79  | 21.45         | 0.61         |   | 113  | Burundi (2014)               | 0.01  | 0.46          | 0.10         |   |
| 50   | Serbia                     | 0.76  | 20.81         | 0.60         |   | 114  | Guinea (2014)                | 0.01  | 0.45          | 0.09         |   |
| 51   | Namibia (2014)             | 0.67  | 18.85         | 0.60         |   | 115  | Nigeria (2014)               | 0.01  | 0.38          | 0.08         |   |
| 52   | El Salvador                | 0.66  | 18.61         | 0.59         |   | 116  | Panama                       | 0.01  | 0.36          | 0.07         | ○ |
| 53   | Finland                    | 0.64  | 18.24         | 0.58         |   | 117  | Benin                        | 0.01  | 0.31          | 0.06         |   |
| 54   | Canada                     | 0.63  | 18.04         | 0.57         |   | 118  | Cameroon                     | 0.01  | 0.29          | 0.06         | ○ |
| 55   | South Africa               | 0.59  | 17.04         | 0.56         |   | 119  | Azerbaijan                   | 0.01  | 0.27          | 0.05         | ○ |
| 56   | Cambodia                   | 0.56  | 16.27         | 0.56         | ● | 120  | Mongolia                     | 0.01  | 0.17          | 0.04         | ○ |
| 57   | Costa Rica                 | 0.55  | 15.98         | 0.55         |   | 121  | Mozambique                   | 0.01  | 0.17          | 0.03         | ○ |
| 58   | Iran, Islamic Rep. (2011)  | 0.53  | 15.60         | 0.54         |   | 122  | Mali (2012)                  | 0.00  | 0.13          | 0.02         | ○ |
| 59   | Norway                     | 0.52  | 15.27         | 0.53         |   | 123  | Togo (2014)                  | 0.00  | 0.11          | 0.02         | ○ |
| 60   | Armenia                    | 0.43  | 13.04         | 0.52         |   | 124  | Yemen (2014)                 | 0.00  | 0.02          | 0.01         |   |
| 61   | Guatemala                  | 0.43  | 12.96         | 0.52         |   | 125  | Algeria                      | 0.00  | 0.00          | 0.00         | ○ |
| 62   | Kuwait                     | 0.41  | 12.49         | 0.51         |   | n/a  | Philippines                  | n/a   | n/a           | n/a          |   |
| 63   | Ukraine                    | 0.40  | 12.21         | 0.50         |   | n/a  | Tajikistan                   | n/a   | n/a           | n/a          |   |
| 64   | Malta                      | 0.36  | 11.26         | 0.49         |   |      |                              |       |               |              |   |

**SOURCE:** United Nations, COMTRADE database; 2009 UNESCO Framework for Cultural Statistics, Table 3, *International trade of cultural goods and services based on the 2007 Harmonised System (HS 2007)*; World Trade Organization, *Trade in Commercial Services* database, itself based on the sixth (2009) edition of the International Monetary Fund's *Balance of Payments Manual* and *Balance of Payments* database

**NOTE:** ● indicates a strength; ○ a weakness

## 7.3.1

## Generic top-level domains (gTLDs)

Generic top-level domains (gTLDs) (per thousand population 15–69 years old) | 2016

| Rank | Country/Economy          | Value  | Score (0–100) | Percent rank |   | Rank | Country/Economy            | Value | Score (0–100) | Percent rank |   |
|------|--------------------------|--------|---------------|--------------|---|------|----------------------------|-------|---------------|--------------|---|
| 1    | Iceland                  | 100.00 | 100.00        | 0.99         | ● | 65   | Argentina                  | 3.07  | 3.07          | 0.49         |   |
| 1    | United States of America | 100.00 | 100.00        | 0.99         | ● | 66   | Dominican Republic         | 2.92  | 2.92          | 0.48         |   |
| 3    | Malta                    | 94.51  | 94.51         | 0.98         | ● | 67   | Colombia                   | 2.90  | 2.90          | 0.48         |   |
| 4    | Luxembourg               | 92.55  | 92.55         | 0.98         | ● | 68   | Armenia                    | 2.79  | 2.79          | 0.47         |   |
| 5    | Netherlands              | 77.94  | 77.94         | 0.97         | ● | 69   | Tunisia                    | 2.71  | 2.71          | 0.46         |   |
| 6    | Canada                   | 76.36  | 76.36         | 0.96         | ● | 70   | Viet Nam                   | 2.56  | 2.56          | 0.45         |   |
| 7    | Hong Kong (China)        | 70.80  | 70.80         | 0.95         |   | 71   | Mexico                     | 2.55  | 2.55          | 0.44         |   |
| 8    | Cyprus                   | 68.23  | 68.23         | 0.94         | ● | 72   | El Salvador                | 2.55  | 2.55          | 0.44         |   |
| 9    | Australia                | 63.61  | 63.61         | 0.94         |   | 73   | Bosnia and Herzegovina     | 2.44  | 2.44          | 0.43         |   |
| 10   | United Kingdom           | 61.89  | 61.89         | 0.93         |   | 74   | China                      | 2.36  | 2.36          | 0.42         |   |
| 11   | Ireland                  | 61.44  | 61.44         | 0.92         |   | 75   | Chile                      | 2.18  | 2.18          | 0.41         |   |
| 12   | Switzerland              | 60.48  | 60.48         | 0.91         |   | 76   | Ecuador                    | 2.13  | 2.13          | 0.40         |   |
| 13   | Germany                  | 55.34  | 55.34         | 0.90         |   | 77   | Moldova, Rep.              | 2.12  | 2.12          | 0.40         |   |
| 14   | Norway                   | 51.48  | 51.48         | 0.90         |   | 78   | Jamaica                    | 1.90  | 1.90          | 0.39         |   |
| 15   | Denmark                  | 48.45  | 48.45         | 0.89         |   | 79   | Iran, Islamic Rep.         | 1.84  | 1.84          | 0.38         |   |
| 16   | Panama                   | 44.64  | 44.64         | 0.88         | ● | 80   | Bolivia, Plurinational St. | 1.83  | 1.83          | 0.37         |   |
| 17   | Sweden                   | 43.00  | 43.00         | 0.87         |   | 81   | Oman                       | 1.81  | 1.81          | 0.37         |   |
| 18   | France                   | 41.31  | 41.31         | 0.87         |   | 82   | Belarus                    | 1.77  | 1.77          | 0.36         |   |
| 19   | Austria                  | 36.92  | 36.92         | 0.86         |   | 83   | Georgia                    | 1.76  | 1.76          | 0.35         |   |
| 20   | New Zealand              | 34.29  | 34.29         | 0.85         |   | 84   | Paraguay                   | 1.69  | 1.69          | 0.34         |   |
| 21   | Finland                  | 29.25  | 29.25         | 0.84         |   | 85   | Morocco                    | 1.60  | 1.60          | 0.33         |   |
| 22   | Spain                    | 28.10  | 28.10         | 0.83         |   | 86   | Brazil                     | 1.59  | 1.59          | 0.33         |   |
| 23   | Singapore                | 25.84  | 25.84         | 0.83         |   | 87   | Indonesia                  | 1.57  | 1.57          | 0.32         |   |
| 24   | Israel                   | 23.19  | 23.19         | 0.82         |   | 88   | Serbia                     | 1.51  | 1.51          | 0.31         |   |
| 25   | Italy                    | 23.13  | 23.13         | 0.81         |   | 89   | Montenegro                 | 1.42  | 1.42          | 0.30         |   |
| 26   | Bulgaria                 | 22.70  | 22.70         | 0.80         |   | 90   | Egypt                      | 1.24  | 1.24          | 0.29         |   |
| 27   | Belgium                  | 22.13  | 22.13         | 0.79         |   | 91   | Philippines                | 1.16  | 1.16          | 0.29         |   |
| 28   | Slovenia                 | 21.12  | 21.12         | 0.79         |   | 92   | Cambodia                   | 1.11  | 1.11          | 0.28         |   |
| 29   | Portugal                 | 18.90  | 18.90         | 0.78         |   | 93   | Kenya                      | 1.06  | 1.06          | 0.27         |   |
| 30   | Czech Republic           | 17.08  | 17.08         | 0.77         |   | 94   | Botswana                   | 1.05  | 1.05          | 0.26         |   |
| 31   | Japan                    | 15.09  | 15.09         | 0.76         |   | 95   | Senegal                    | 1.05  | 1.05          | 0.25         |   |
| 32   | Croatia                  | 14.14  | 14.14         | 0.75         |   | 96   | Azerbaijan                 | 1.03  | 1.03          | 0.25         |   |
| 33   | Lithuania                | 13.81  | 13.81         | 0.75         |   | 97   | Niger                      | 1.02  | 1.02          | 0.24         |   |
| 34   | Mauritius                | 12.72  | 12.72         | 0.74         |   | 98   | India                      | 0.95  | 0.95          | 0.23         |   |
| 35   | Greece                   | 12.42  | 12.42         | 0.73         |   | 99   | Sri Lanka                  | 0.78  | 0.78          | 0.22         |   |
| 36   | Turkey                   | 12.20  | 12.20         | 0.72         |   | 100  | Honduras                   | 0.65  | 0.65          | 0.21         |   |
| 37   | Costa Rica               | 11.51  | 11.51         | 0.71         |   | 101  | Togo                       | 0.64  | 0.64          | 0.21         |   |
| 38   | United Arab Emirates     | 11.20  | 11.20         | 0.71         |   | 102  | Mongolia                   | 0.64  | 0.64          | 0.20         |   |
| 39   | Hungary                  | 10.33  | 10.33         | 0.70         |   | 103  | Pakistan                   | 0.62  | 0.62          | 0.19         |   |
| 40   | Latvia                   | 9.43   | 9.43          | 0.69         |   | 104  | Benin                      | 0.60  | 0.60          | 0.18         |   |
| 41   | Estonia                  | 9.22   | 9.22          | 0.68         |   | 105  | Nigeria                    | 0.52  | 0.52          | 0.17         |   |
| 42   | Namibia                  | 8.66   | 8.66          | 0.67         |   | 106  | Côte d'Ivoire              | 0.51  | 0.51          | 0.17         |   |
| 43   | Korea, Rep.              | 8.19   | 8.19          | 0.67         |   | 107  | Algeria                    | 0.49  | 0.49          | 0.16         |   |
| 44   | Kuwait                   | 8.14   | 8.14          | 0.66         |   | 108  | Nepal                      | 0.47  | 0.47          | 0.15         |   |
| 45   | Albania                  | 7.29   | 7.29          | 0.65         |   | 109  | Zimbabwe                   | 0.40  | 0.40          | 0.14         |   |
| 46   | Poland                   | 7.07   | 7.07          | 0.64         |   | 110  | Yemen                      | 0.37  | 0.37          | 0.13         |   |
| 47   | Brunei Darussalam        | 7.05   | 7.05          | 0.63         |   | 111  | Bangladesh                 | 0.36  | 0.36          | 0.13         |   |
| 48   | Lebanon                  | 6.87   | 6.87          | 0.63         |   | 112  | Kazakhstan                 | 0.33  | 0.33          | 0.12         | ○ |
| 49   | Jordan                   | 6.63   | 6.63          | 0.62         |   | 113  | Uganda                     | 0.23  | 0.23          | 0.11         |   |
| 50   | TFYR of Macedonia        | 6.57   | 6.57          | 0.61         |   | 114  | Kyrgyzstan                 | 0.20  | 0.20          | 0.10         |   |
| 51   | Uruguay                  | 6.38   | 6.38          | 0.60         |   | 115  | Malawi                     | 0.19  | 0.19          | 0.10         |   |
| 52   | Malaysia                 | 6.34   | 6.34          | 0.60         |   | 116  | Cameroon                   | 0.17  | 0.17          | 0.09         |   |
| 53   | Bahrain                  | 5.44   | 5.44          | 0.59         |   | 117  | Tanzania, United Rep.      | 0.17  | 0.17          | 0.08         |   |
| 54   | Thailand                 | 5.37   | 5.37          | 0.58         |   | 118  | Rwanda                     | 0.16  | 0.16          | 0.07         | ○ |
| 55   | Peru                     | 5.30   | 5.30          | 0.57         |   | 119  | Mali                       | 0.15  | 0.15          | 0.06         |   |
| 56   | Trinidad and Tobago      | 4.54   | 4.54          | 0.56         | ● | 120  | Madagascar                 | 0.13  | 0.13          | 0.06         |   |
| 57   | Romania                  | 4.46   | 4.46          | 0.56         |   | 121  | Zambia                     | 0.11  | 0.11          | 0.05         | ○ |
| 58   | Qatar                    | 4.41   | 4.41          | 0.55         |   | 122  | Burkina Faso               | 0.07  | 0.07          | 0.04         | ○ |
| 59   | Ukraine                  | 4.39   | 4.39          | 0.54         |   | 123  | Tajikistan                 | 0.05  | 0.05          | 0.03         | ○ |
| 60   | Guatemala                | 4.30   | 4.30          | 0.53         |   | 124  | Guinea                     | 0.05  | 0.05          | 0.02         |   |
| 61   | Russian Federation       | 3.34   | 3.34          | 0.52         |   | 125  | Burundi                    | 0.04  | 0.04          | 0.02         | ○ |
| 62   | South Africa             | 3.23   | 3.23          | 0.52         |   | 126  | Mozambique                 | 0.03  | 0.03          | 0.01         | ○ |
| 63   | Saudi Arabia             | 3.10   | 3.10          | 0.51         |   | 127  | Ethiopia                   | 0.00  | 0.00          | 0.00         | ○ |
| 64   | Slovakia                 | 3.08   | 3.08          | 0.50         |   |      |                            |       |               |              |   |

SOURCE: ZookNIC Inc; United Nations, Department of Economic and Social Affairs, Population Division, *World Population Prospects: The 2015 Revision* (population)

NOTE: ● Indicates a strength; ○ a weakness

# 7.3.2

## Country-code top-level domains (ccTLDs)

Country-code top-level domains (ccTLDs) (per thousand population 15–69 years old) | 2016

| Rank | Country/Economy          | Value  | Score (0–100) | Percent rank |   | Rank | Country/Economy            | Value | Score (0–100) | Percent rank |   |
|------|--------------------------|--------|---------------|--------------|---|------|----------------------------|-------|---------------|--------------|---|
| 1    | Montenegro               | 100.00 | 100.00        | 0.98         | ● | 65   | Bulgaria                   | 2.03  | 2.03          | 0.49         |   |
| 1    | Netherlands              | 100.00 | 100.00        | 0.98         | ● | 66   | Indonesia                  | 1.98  | 1.98          | 0.48         |   |
| 1    | Switzerland              | 100.00 | 100.00        | 0.98         | ● | 67   | Bosnia and Herzegovina     | 1.96  | 1.96          | 0.48         |   |
| 4    | Denmark                  | 98.36  | 98.36         | 0.98         | ● | 68   | Costa Rica                 | 1.61  | 1.61          | 0.47         |   |
| 5    | Germany                  | 83.84  | 83.84         | 0.97         | ● | 69   | Trinidad and Tobago        | 1.48  | 1.48          | 0.46         |   |
| 6    | Iceland                  | 77.01  | 77.01         | 0.96         |   | 70   | Mongolia                   | 1.44  | 1.44          | 0.45         |   |
| 7    | United Kingdom           | 69.54  | 69.54         | 0.95         |   | 71   | TFYR of Macedonia          | 1.37  | 1.37          | 0.44         |   |
| 8    | Luxembourg               | 63.94  | 63.94         | 0.94         |   | 72   | Peru                       | 1.36  | 1.36          | 0.44         |   |
| 9    | Sweden                   | 63.56  | 63.56         | 0.94         |   | 73   | Botswana                   | 1.35  | 1.35          | 0.43         |   |
| 10   | New Zealand              | 62.42  | 62.42         | 0.93         |   | 74   | Albania                    | 1.34  | 1.34          | 0.42         |   |
| 11   | Austria                  | 61.44  | 61.44         | 0.92         | ● | 75   | Paraguay                   | 1.26  | 1.26          | 0.41         |   |
| 12   | Belgium                  | 58.05  | 58.05         | 0.91         | ● | 76   | Bahrain                    | 1.24  | 1.24          | 0.40         |   |
| 13   | Norway                   | 56.82  | 56.82         | 0.90         |   | 77   | Panama                     | 1.19  | 1.19          | 0.40         |   |
| 14   | Australia                | 52.79  | 52.79         | 0.90         |   | 78   | Ecuador                    | 1.15  | 1.15          | 0.39         |   |
| 15   | Czech Republic           | 49.65  | 49.65         | 0.89         | ● | 79   | Azerbaijan                 | 1.08  | 1.08          | 0.38         |   |
| 16   | Latvia                   | 43.03  | 43.03         | 0.88         |   | 80   | Dominican Republic         | 1.07  | 1.07          | 0.37         |   |
| 17   | Estonia                  | 40.66  | 40.66         | 0.87         |   | 81   | Jamaica                    | 0.96  | 0.96          | 0.37         |   |
| 18   | Portugal                 | 35.57  | 35.57         | 0.87         | ● | 82   | Brunei Darussalam          | 0.93  | 0.93          | 0.36         |   |
| 19   | Finland                  | 31.59  | 31.59         | 0.86         |   | 83   | Nepal                      | 0.83  | 0.83          | 0.35         |   |
| 20   | Hungary                  | 29.08  | 29.08         | 0.85         | ● | 84   | Morocco                    | 0.79  | 0.79          | 0.34         |   |
| 21   | Canada                   | 28.65  | 28.65         | 0.84         |   | 85   | India                      | 0.73  | 0.73          | 0.33         |   |
| 22   | Poland                   | 27.93  | 27.93         | 0.83         | ● | 86   | Kenya                      | 0.69  | 0.69          | 0.33         |   |
| 23   | Lithuania                | 26.56  | 26.56         | 0.83         | ● | 87   | Saudi Arabia               | 0.62  | 0.62          | 0.32         |   |
| 24   | Slovakia                 | 25.47  | 25.47         | 0.82         | ● | 88   | El Salvador                | 0.57  | 0.57          | 0.31         |   |
| 25   | Slovenia                 | 24.40  | 24.40         | 0.81         |   | 89   | Bolivia, Plurinational St. | 0.49  | 0.49          | 0.30         |   |
| 26   | Italy                    | 21.40  | 21.40         | 0.80         |   | 90   | Guatemala                  | 0.45  | 0.45          | 0.29         |   |
| 27   | France                   | 20.19  | 20.19         | 0.79         |   | 91   | Honduras                   | 0.44  | 0.44          | 0.29         |   |
| 28   | Ireland                  | 20.18  | 20.18         | 0.79         |   | 92   | Kyrgyzstan                 | 0.40  | 0.40          | 0.28         |   |
| 29   | Romania                  | 18.39  | 18.39         | 0.78         | ● | 93   | Kuwait                     | 0.40  | 0.40          | 0.27         |   |
| 30   | Hong Kong (China)        | 17.49  | 17.49         | 0.77         |   | 94   | Thailand                   | 0.38  | 0.38          | 0.26         |   |
| 31   | Colombia                 | 17.24  | 17.24         | 0.76         |   | 95   | Tajikistan                 | 0.37  | 0.37          | 0.25         |   |
| 32   | Spain                    | 16.65  | 16.65         | 0.75         |   | 96   | Malawi                     | 0.31  | 0.31          | 0.25         |   |
| 33   | Greece                   | 16.30  | 16.30         | 0.75         |   | 97   | Philippines                | 0.31  | 0.31          | 0.24         |   |
| 34   | Russian Federation       | 15.18  | 15.18         | 0.74         |   | 98   | Jordan                     | 0.29  | 0.29          | 0.23         | ○ |
| 35   | Israel                   | 13.48  | 13.48         | 0.73         |   | 99   | Lebanon                    | 0.27  | 0.27          | 0.22         |   |
| 36   | Singapore                | 11.89  | 11.89         | 0.72         |   | 100  | Cameroon                   | 0.27  | 0.27          | 0.21         |   |
| 37   | Chile                    | 11.85  | 11.85         | 0.71         |   | 101  | Tunisia                    | 0.20  | 0.20          | 0.21         |   |
| 38   | Mali                     | 11.07  | 11.07         | 0.71         | ● | 102  | Sri Lanka                  | 0.17  | 0.17          | 0.20         |   |
| 39   | Uruguay                  | 10.02  | 10.02         | 0.70         |   | 103  | Senegal                    | 0.17  | 0.17          | 0.19         |   |
| 40   | Croatia                  | 9.53   | 9.53          | 0.69         |   | 104  | Côte d'Ivoire              | 0.14  | 0.14          | 0.18         |   |
| 41   | South Africa             | 8.90   | 8.90          | 0.68         |   | 105  | Oman                       | 0.13  | 0.13          | 0.17         |   |
| 42   | Korea, Rep.              | 8.03   | 8.03          | 0.67         |   | 106  | Tanzania, United Rep.      | 0.13  | 0.13          | 0.17         |   |
| 43   | Brazil                   | 7.66   | 7.66          | 0.67         |   | 107  | Burundi                    | 0.11  | 0.11          | 0.16         |   |
| 44   | Malta                    | 7.30   | 7.30          | 0.66         |   | 108  | Pakistan                   | 0.11  | 0.11          | 0.15         |   |
| 45   | Argentina                | 5.79   | 5.79          | 0.65         |   | 109  | Nigeria                    | 0.10  | 0.10          | 0.14         |   |
| 46   | China                    | 5.78   | 5.78          | 0.64         |   | 110  | Algeria                    | 0.09  | 0.09          | 0.13         |   |
| 47   | United Arab Emirates     | 5.63   | 5.63          | 0.63         |   | 111  | Mozambique                 | 0.08  | 0.08          | 0.13         |   |
| 48   | Belarus                  | 5.18   | 5.18          | 0.63         |   | 112  | Rwanda                     | 0.06  | 0.06          | 0.12         |   |
| 49   | Japan                    | 5.06   | 5.06          | 0.62         |   | 113  | Cambodia                   | 0.06  | 0.06          | 0.11         |   |
| 50   | Ukraine                  | 5.05   | 5.05          | 0.61         |   | 114  | Zimbabwe                   | 0.06  | 0.06          | 0.10         |   |
| 51   | Armenia                  | 4.89   | 4.89          | 0.60         |   | 115  | Guinea                     | 0.05  | 0.05          | 0.10         |   |
| 52   | Cyprus                   | 4.70   | 4.70          | 0.60         |   | 116  | Uganda                     | 0.05  | 0.05          | 0.09         |   |
| 53   | Serbia                   | 4.35   | 4.35          | 0.59         |   | 117  | Namibia                    | 0.04  | 0.04          | 0.08         | ○ |
| 54   | Malaysia                 | 4.34   | 4.34          | 0.58         |   | 118  | Madagascar                 | 0.04  | 0.04          | 0.07         |   |
| 55   | Iran, Islamic Rep.       | 4.29   | 4.29          | 0.57         |   | 119  | Burkina Faso               | 0.04  | 0.04          | 0.06         |   |
| 56   | Qatar                    | 3.45   | 3.45          | 0.56         |   | 120  | Egypt                      | 0.04  | 0.04          | 0.06         | ○ |
| 57   | Kazakhstan               | 3.09   | 3.09          | 0.56         |   | 121  | Benin                      | 0.02  | 0.02          | 0.05         | ○ |
| 58   | United States of America | 2.92   | 2.92          | 0.55         |   | 122  | Yemen                      | 0.02  | 0.02          | 0.04         |   |
| 59   | Mexico                   | 2.77   | 2.77          | 0.54         |   | 123  | Bangladesh                 | 0.01  | 0.01          | 0.03         | ○ |
| 60   | Viet Nam                 | 2.59   | 2.59          | 0.53         |   | 124  | Ethiopia                   | 0.01  | 0.01          | 0.02         |   |
| 61   | Moldova, Rep.            | 2.34   | 2.34          | 0.52         |   | 125  | Niger                      | 0.00  | 0.00          | 0.02         |   |
| 62   | Mauritius                | 2.31   | 2.31          | 0.52         |   | 126  | Zambia                     | 0.00  | 0.00          | 0.01         | ○ |
| 63   | Georgia                  | 2.14   | 2.14          | 0.51         |   | 127  | Togo                       | 0.00  | 0.00          | 0.00         | ○ |
| 64   | Turkey                   | 2.05   | 2.05          | 0.50         |   |      |                            |       |               |              |   |

SOURCE: ZookNIC Inc; United Nations, Department of Economic and Social Affairs, Population Division, *World Population Prospects: The 2015 Revision* (population)

NOTE: ● indicates a strength; ○ a weakness

## 7.3.3

## Wikipedia yearly edits

Wikipedia yearly page edits (per million population 15–69 years old) | 2016

| Rank | Country/Economy          | Value  | Score (0–100) | Percent rank |   | Rank | Country/Economy                   | Value | Score (0–100) | Percent rank |   |
|------|--------------------------|--------|---------------|--------------|---|------|-----------------------------------|-------|---------------|--------------|---|
| 1    | Serbia                   | 100.00 | 100.00        | 1.00         | ● | 65   | Costa Rica (2014)                 | 45.42 | 45.42         | 0.49         |   |
| 2    | Norway                   | 75.54  | 75.54         | 0.99         | ● | 66   | Saudi Arabia                      | 44.85 | 44.85         | 0.48         |   |
| 3    | Israel                   | 73.40  | 73.40         | 0.98         | ● | 67   | Brazil                            | 44.65 | 44.65         | 0.48         |   |
| 4    | Sweden                   | 71.00  | 71.00         | 0.98         | ● | 68   | United Arab Emirates (2014)       | 44.38 | 44.38         | 0.47         |   |
| 5    | Estonia                  | 70.73  | 70.73         | 0.97         | ● | 69   | Malaysia                          | 44.29 | 44.29         | 0.46         |   |
| 6    | Finland                  | 69.98  | 69.98         | 0.96         |   | 70   | Qatar (2014)                      | 43.94 | 43.94         | 0.45         |   |
| 7    | Armenia                  | 69.57  | 69.57         | 0.95         | ● | 71   | Trinidad and Tobago (2014)        | 42.41 | 42.41         | 0.44         |   |
| 8    | Netherlands              | 69.27  | 69.27         | 0.94         |   | 72   | Lebanon (2014)                    | 41.71 | 41.71         | 0.44         |   |
| 9    | Hong Kong (China)        | 68.02  | 68.02         | 0.94         |   | 73   | Kyrgyzstan (2014)                 | 41.50 | 41.50         | 0.43         |   |
| 10   | France                   | 67.25  | 67.25         | 0.93         | ● | 74   | Peru                              | 41.39 | 41.39         | 0.42         |   |
| 11   | Iceland (2014)           | 67.15  | 67.15         | 0.92         |   | 75   | Thailand                          | 41.22 | 41.22         | 0.41         |   |
| 12   | United Kingdom           | 66.89  | 66.89         | 0.91         |   | 76   | Colombia                          | 41.00 | 41.00         | 0.40         |   |
| 13   | New Zealand              | 66.67  | 66.67         | 0.90         |   | 77   | Sri Lanka (2014)                  | 39.88 | 39.88         | 0.40         |   |
| 14   | Latvia                   | 66.63  | 66.63         | 0.90         | ● | 78   | Nepal (2014)                      | 39.81 | 39.81         | 0.39         |   |
| 15   | Germany                  | 65.49  | 65.49         | 0.89         |   | 79   | Mauritius (2014)                  | 39.42 | 39.42         | 0.38         |   |
| 16   | Hungary                  | 65.47  | 65.47         | 0.88         | ● | 80   | Dominican Republic (2014)         | 39.21 | 39.21         | 0.37         |   |
| 17   | Luxembourg (2014)        | 65.40  | 65.40         | 0.87         |   | 81   | Brunei Darussalam (2014)          | 38.96 | 38.96         | 0.37         |   |
| 18   | Spain                    | 65.22  | 65.22         | 0.87         |   | 82   | Philippines                       | 38.89 | 38.89         | 0.36         |   |
| 19   | Austria                  | 65.00  | 65.00         | 0.86         |   | 83   | Oman (2014)                       | 38.42 | 38.42         | 0.35         |   |
| 20   | Slovenia                 | 64.86  | 64.86         | 0.85         |   | 84   | Morocco                           | 38.29 | 38.29         | 0.34         |   |
| 21   | Switzerland              | 64.72  | 64.72         | 0.84         |   | 85   | Mexico                            | 38.21 | 38.21         | 0.33         |   |
| 22   | Czech Republic           | 64.62  | 64.62         | 0.83         |   | 86   | Ecuador (2014)                    | 37.87 | 37.87         | 0.33         |   |
| 23   | Canada                   | 64.13  | 64.13         | 0.83         |   | 87   | El Salvador (2014)                | 37.65 | 37.65         | 0.32         |   |
| 24   | Australia                | 63.80  | 63.80         | 0.82         |   | 88   | Paraguay (2014)                   | 36.36 | 36.36         | 0.31         |   |
| 25   | Denmark                  | 63.25  | 63.25         | 0.81         |   | 89   | South Africa                      | 36.32 | 36.32         | 0.30         |   |
| 26   | Bulgaria                 | 63.20  | 63.20         | 0.80         |   | 90   | Guatemala (2014)                  | 35.60 | 35.60         | 0.29         |   |
| 27   | Ireland                  | 63.14  | 63.14         | 0.79         |   | 91   | Egypt                             | 34.75 | 34.75         | 0.29         |   |
| 28   | Uruguay                  | 62.96  | 62.96         | 0.79         | ● | 92   | Namibia (2014)                    | 34.56 | 34.56         | 0.28         |   |
| 29   | Italy                    | 62.52  | 62.52         | 0.78         |   | 93   | Bolivia, Plurinational St. (2014) | 34.56 | 34.56         | 0.27         |   |
| 30   | Lithuania                | 61.59  | 61.59         | 0.77         |   | 94   | Indonesia                         | 34.45 | 34.45         | 0.26         |   |
| 31   | Poland                   | 60.22  | 60.22         | 0.76         |   | 95   | Honduras (2014)                   | 33.60 | 33.60         | 0.25         |   |
| 32   | Cyprus (2014)            | 60.15  | 60.15         | 0.75         |   | 96   | Tunisia (2014)                    | 32.79 | 32.79         | 0.25         |   |
| 33   | Belgium                  | 59.91  | 59.91         | 0.75         |   | 97   | Tajikistan (2014)                 | 31.78 | 31.78         | 0.24         |   |
| 34   | Russian Federation       | 59.63  | 59.63         | 0.74         |   | 98   | Jamaica (2014)                    | 30.93 | 30.93         | 0.23         |   |
| 35   | Greece                   | 59.42  | 59.42         | 0.73         |   | 99   | Algeria (2014)                    | 28.87 | 28.87         | 0.22         |   |
| 36   | TFYR of Macedonia (2014) | 59.41  | 59.41         | 0.72         |   | 100  | India                             | 28.40 | 28.40         | 0.21         |   |
| 37   | Croatia                  | 59.35  | 59.35         | 0.71         |   | 101  | Pakistan                          | 28.25 | 28.25         | 0.21         |   |
| 38   | Slovakia                 | 59.05  | 59.05         | 0.71         |   | 102  | Cambodia (2014)                   | 28.14 | 28.14         | 0.20         |   |
| 39   | Ukraine                  | 58.93  | 58.93         | 0.70         |   | 103  | Bangladesh                        | 26.33 | 26.33         | 0.19         |   |
| 40   | Georgia                  | 58.86  | 58.86         | 0.69         |   | 104  | Yemen (2014)                      | 24.03 | 24.03         | 0.18         |   |
| 41   | United States of America | 58.84  | 58.84         | 0.68         |   | 105  | Kenya (2014)                      | 23.60 | 23.60         | 0.17         |   |
| 42   | Malta (2014)             | 58.61  | 58.61         | 0.67         |   | 106  | Benin (2014)                      | 21.56 | 21.56         | 0.17         |   |
| 43   | Bosnia and Herzegovina   | 58.22  | 58.22         | 0.67         |   | 107  | Uganda (2014)                     | 18.08 | 18.08         | 0.16         |   |
| 44   | Singapore                | 57.68  | 57.68         | 0.66         |   | 108  | Côte d'Ivoire (2014)              | 16.58 | 16.58         | 0.15         |   |
| 45   | Portugal                 | 56.40  | 56.40         | 0.65         |   | 109  | Madagascar (2014)                 | 15.39 | 15.39         | 0.14         |   |
| 46   | Belarus                  | 55.33  | 55.33         | 0.64         |   | 110  | China                             | 15.13 | 15.13         | 0.13         | ○ |
| 47   | Japan                    | 54.76  | 54.76         | 0.63         |   | 111  | Botswana (2014)                   | 14.13 | 14.13         | 0.13         |   |
| 48   | Azerbaijan               | 54.42  | 54.42         | 0.63         |   | 112  | Nigeria (2014)                    | 12.64 | 12.64         | 0.12         |   |
| 49   | Chile                    | 53.86  | 53.86         | 0.62         |   | 113  | Zimbabwe (2014)                   | 11.85 | 11.85         | 0.11         |   |
| 50   | Korea, Rep.              | 53.57  | 53.57         | 0.61         |   | 114  | Senegal (2014)                    | 10.60 | 10.60         | 0.10         |   |
| 51   | Montenegro (2014)        | 53.06  | 53.06         | 0.60         |   | 115  | Tanzania, United Rep. (2014)      | 10.13 | 10.13         | 0.10         |   |
| 52   | Jordan                   | 51.96  | 51.96         | 0.60         |   | 116  | Mozambique (2014)                 | 9.81  | 9.81          | 0.09         |   |
| 53   | Argentina                | 51.47  | 51.47         | 0.59         |   | 117  | Rwanda (2014)                     | 9.31  | 9.31          | 0.08         |   |
| 54   | Turkey                   | 50.32  | 50.32         | 0.58         |   | 118  | Togo (2014)                       | 9.16  | 9.16          | 0.07         |   |
| 55   | Iran, Islamic Rep.       | 50.10  | 50.10         | 0.57         |   | 119  | Cameroon (2014)                   | 6.64  | 6.64          | 0.06         | ○ |
| 56   | Kazakhstan               | 49.76  | 49.76         | 0.56         |   | 120  | Zambia (2014)                     | 6.58  | 6.58          | 0.06         | ○ |
| 57   | Moldova, Rep. (2014)     | 49.68  | 49.68         | 0.56         |   | 121  | Mali (2014)                       | 4.50  | 4.50          | 0.05         |   |
| 58   | Kuwait (2014)            | 49.43  | 49.43         | 0.55         |   | 122  | Burundi (2014)                    | 2.85  | 2.85          | 0.04         |   |
| 59   | Romania                  | 49.35  | 49.35         | 0.54         |   | 123  | Ethiopia (2014)                   | 2.65  | 2.65          | 0.03         |   |
| 60   | Albania (2014)           | 49.10  | 49.10         | 0.53         |   | 124  | Malawi (2014)                     | 2.07  | 2.07          | 0.02         | ○ |
| 61   | Bahrain (2014)           | 49.05  | 49.05         | 0.52         |   | 125  | Burkina Faso (2014)               | 1.11  | 1.11          | 0.02         | ○ |
| 62   | Mongolia (2014)          | 48.87  | 48.87         | 0.52         |   | 126  | Guinea (2014)                     | 0.02  | 0.02          | 0.01         | ○ |
| 63   | Panama (2014)            | 48.16  | 48.16         | 0.51         |   | 127  | Niger (2014)                      | 0.00  | 0.00          | 0.00         | ○ |
| 64   | Viet Nam                 | 47.72  | 47.72         | 0.50         |   |      |                                   |       |               |              |   |

SOURCE: Wikimedia Foundation; United Nations, Department of Economic and Social Affairs, Population Division, *World Population Prospects: The 2012 Revision* (population)

NOTE: ● Indicates a strength; ○ a weakness



# 7.3.4

## Video uploads on YouTube

Number of video uploads on YouTube (scaled by population 15–69 years old) | 2016

| Rank | Country/Economy          | Value  | Score (0–100) | Percent rank |   | Rank | Country/Economy            | Value | Score (0–100) | Percent rank |   |
|------|--------------------------|--------|---------------|--------------|---|------|----------------------------|-------|---------------|--------------|---|
| 1    | United States of America | 100.00 | 100.00        | 1.00         | ● | 65   | Egypt                      | 7.95  | 7.95          | 0.11         |   |
| 2    | Latvia                   | 81.80  | 81.80         | 0.99         | ● | 66   | Algeria                    | 6.49  | 6.49          | 0.10         |   |
| 3    | United Kingdom           | 76.36  | 76.36         | 0.97         | ● | 67   | South Africa               | 2.93  | 2.93          | 0.08         | ○ |
| 4    | Israel                   | 64.85  | 64.85         | 0.96         |   | 68   | India                      | 2.51  | 2.51          | 0.07         | ○ |
| 5    | Netherlands              | 64.02  | 64.02         | 0.94         |   | 69   | Senegal                    | 1.88  | 1.88          | 0.06         | ○ |
| 6    | Sweden                   | 63.18  | 63.18         | 0.93         |   | 70   | Kenya                      | 1.05  | 1.05          | 0.04         | ○ |
| 7    | Estonia                  | 62.97  | 62.97         | 0.92         |   | 71   | Yemen                      | 0.84  | 0.84          | 0.03         |   |
| 8    | New Zealand              | 60.88  | 60.88         | 0.90         |   | 72   | Nigeria                    | 0.42  | 0.42          | 0.01         | ○ |
| 9    | Canada                   | 58.58  | 58.58         | 0.89         |   | 73   | Uganda                     | 0.00  | 0.00          | 0.00         | ○ |
| 10   | Ireland                  | 57.32  | 57.32         | 0.88         |   | n/a  | Albania                    | n/a   | n/a           | n/a          |   |
| 11   | Denmark                  | 56.07  | 56.07         | 0.85         |   | n/a  | Armenia                    | n/a   | n/a           | n/a          |   |
| 11   | Finland                  | 56.07  | 56.07         | 0.85         |   | n/a  | Azerbaijan                 | n/a   | n/a           | n/a          |   |
| 13   | Singapore                | 55.86  | 55.86         | 0.83         |   | n/a  | Bangladesh                 | n/a   | n/a           | n/a          |   |
| 14   | Hong Kong (China)        | 54.60  | 54.60         | 0.82         |   | n/a  | Belarus                    | n/a   | n/a           | n/a          |   |
| 15   | Spain                    | 53.35  | 53.35         | 0.81         |   | n/a  | Benin                      | n/a   | n/a           | n/a          |   |
| 16   | Switzerland              | 49.16  | 49.16         | 0.79         |   | n/a  | Bolivia, Plurinational St. | n/a   | n/a           | n/a          |   |
| 17   | Norway                   | 47.49  | 47.49         | 0.76         |   | n/a  | Botswana                   | n/a   | n/a           | n/a          |   |
| 17   | Portugal                 | 47.49  | 47.49         | 0.76         |   | n/a  | Brunei Darussalam          | n/a   | n/a           | n/a          |   |
| 19   | Italy                    | 47.28  | 47.28         | 0.75         |   | n/a  | Burkina Faso               | n/a   | n/a           | n/a          |   |
| 20   | Kuwait                   | 45.82  | 45.82         | 0.74         | ● | n/a  | Burundi                    | n/a   | n/a           | n/a          |   |
| 21   | Korea, Rep.              | 45.40  | 45.40         | 0.71         |   | n/a  | Cambodia                   | n/a   | n/a           | n/a          |   |
| 21   | Saudi Arabia             | 45.40  | 45.40         | 0.71         |   | n/a  | Cameroon                   | n/a   | n/a           | n/a          |   |
| 23   | Australia                | 44.77  | 44.77         | 0.68         |   | n/a  | China                      | n/a   | n/a           | n/a          |   |
| 23   | Czech Republic           | 44.77  | 44.77         | 0.68         |   | n/a  | Costa Rica                 | n/a   | n/a           | n/a          |   |
| 25   | Belgium                  | 44.14  | 44.14         | 0.67         |   | n/a  | Côte d'Ivoire              | n/a   | n/a           | n/a          |   |
| 26   | France                   | 43.31  | 43.31         | 0.65         |   | n/a  | Cyprus                     | n/a   | n/a           | n/a          |   |
| 27   | Bahrain                  | 42.89  | 42.89         | 0.64         |   | n/a  | Dominican Republic         | n/a   | n/a           | n/a          |   |
| 28   | Russian Federation       | 42.05  | 42.05         | 0.63         |   | n/a  | Ecuador                    | n/a   | n/a           | n/a          |   |
| 29   | Brazil                   | 39.75  | 39.75         | 0.60         |   | n/a  | El Salvador                | n/a   | n/a           | n/a          |   |
| 29   | Greece                   | 39.75  | 39.75         | 0.60         |   | n/a  | Ethiopia                   | n/a   | n/a           | n/a          |   |
| 31   | Lithuania                | 39.54  | 39.54         | 0.58         |   | n/a  | Georgia                    | n/a   | n/a           | n/a          |   |
| 32   | United Arab Emirates     | 39.12  | 39.12         | 0.57         |   | n/a  | Guatemala                  | n/a   | n/a           | n/a          |   |
| 33   | Hungary                  | 38.91  | 38.91         | 0.56         |   | n/a  | Guinea                     | n/a   | n/a           | n/a          |   |
| 34   | Qatar                    | 37.66  | 37.66         | 0.54         |   | n/a  | Honduras                   | n/a   | n/a           | n/a          |   |
| 35   | Argentina                | 37.45  | 37.45         | 0.53         |   | n/a  | Iceland                    | n/a   | n/a           | n/a          |   |
| 36   | Bulgaria                 | 36.82  | 36.82         | 0.50         |   | n/a  | Iran, Islamic Rep.         | n/a   | n/a           | n/a          |   |
| 36   | Germany                  | 36.82  | 36.82         | 0.50         |   | n/a  | Jamaica                    | n/a   | n/a           | n/a          |   |
| 38   | Chile                    | 35.98  | 35.98         | 0.49         |   | n/a  | Kazakhstan                 | n/a   | n/a           | n/a          |   |
| 39   | Poland                   | 35.77  | 35.77         | 0.47         |   | n/a  | Kyrgyzstan                 | n/a   | n/a           | n/a          |   |
| 40   | Romania                  | 35.36  | 35.36         | 0.46         |   | n/a  | Luxembourg                 | n/a   | n/a           | n/a          |   |
| 41   | Austria                  | 34.94  | 34.94         | 0.43         | ○ | n/a  | Madagascar                 | n/a   | n/a           | n/a          |   |
| 41   | Ukraine                  | 34.94  | 34.94         | 0.43         |   | n/a  | Malawi                     | n/a   | n/a           | n/a          |   |
| 43   | Croatia                  | 30.33  | 30.33         | 0.42         |   | n/a  | Mali                       | n/a   | n/a           | n/a          |   |
| 44   | Turkey                   | 29.50  | 29.50         | 0.40         |   | n/a  | Malta                      | n/a   | n/a           | n/a          |   |
| 45   | Slovenia                 | 28.87  | 28.87         | 0.39         | ○ | n/a  | Mauritius                  | n/a   | n/a           | n/a          |   |
| 46   | Thailand                 | 28.24  | 28.24         | 0.38         |   | n/a  | Moldova, Rep.              | n/a   | n/a           | n/a          |   |
| 47   | Serbia                   | 26.99  | 26.99         | 0.36         |   | n/a  | Mongolia                   | n/a   | n/a           | n/a          |   |
| 48   | Slovakia                 | 26.57  | 26.57         | 0.35         |   | n/a  | Mozambique                 | n/a   | n/a           | n/a          |   |
| 49   | Japan                    | 25.31  | 25.31         | 0.33         | ○ | n/a  | Namibia                    | n/a   | n/a           | n/a          |   |
| 50   | TFYR of Macedonia        | 25.10  | 25.10         | 0.32         |   | n/a  | Nepal                      | n/a   | n/a           | n/a          |   |
| 51   | Mexico                   | 24.90  | 24.90         | 0.31         |   | n/a  | Niger                      | n/a   | n/a           | n/a          |   |
| 52   | Viet Nam                 | 24.27  | 24.27         | 0.29         |   | n/a  | Pakistan                   | n/a   | n/a           | n/a          |   |
| 53   | Montenegro               | 23.85  | 23.85         | 0.28         |   | n/a  | Panama                     | n/a   | n/a           | n/a          |   |
| 54   | Colombia                 | 23.43  | 23.43         | 0.26         |   | n/a  | Paraguay                   | n/a   | n/a           | n/a          |   |
| 55   | Bosnia and Herzegovina   | 23.22  | 23.22         | 0.25         |   | n/a  | Rwanda                     | n/a   | n/a           | n/a          |   |
| 56   | Indonesia                | 22.80  | 22.80         | 0.24         |   | n/a  | Sri Lanka                  | n/a   | n/a           | n/a          |   |
| 57   | Peru                     | 20.29  | 20.29         | 0.22         |   | n/a  | Tajikistan                 | n/a   | n/a           | n/a          |   |
| 58   | Malaysia                 | 19.04  | 19.04         | 0.21         | ○ | n/a  | Tanzania, United Rep.      | n/a   | n/a           | n/a          |   |
| 59   | Jordan                   | 18.83  | 18.83         | 0.19         | ○ | n/a  | Togo                       | n/a   | n/a           | n/a          |   |
| 60   | Lebanon                  | 16.95  | 16.95         | 0.18         |   | n/a  | Trinidad and Tobago        | n/a   | n/a           | n/a          |   |
| 61   | Oman                     | 12.97  | 12.97         | 0.17         |   | n/a  | Uruguay                    | n/a   | n/a           | n/a          |   |
| 62   | Morocco                  | 12.55  | 12.55         | 0.15         | ○ | n/a  | Zambia                     | n/a   | n/a           | n/a          |   |
| 63   | Philippines              | 9.21   | 9.21          | 0.13         | ○ | n/a  | Zimbabwe                   | n/a   | n/a           | n/a          |   |
| 63   | Tunisia                  | 9.21   | 9.21          | 0.13         | ○ |      |                            |       |               |              |   |

SOURCE: Google, parent company of YouTube; United Nations, Department of Economic and Social Affairs, Population Division, *World Population Prospects: The 2012 Revision* (population)

NOTE: ● indicates a strength; ○ a weakness



# Appendix III

Sources and Definitions



## Sources and Definitions

This appendix complements the data tables by providing, for each of the 81 indicators included in the Global Innovation Index (GII) this year, its title, its description, its definition, and its source. For each indicator for each country/economy, the most recent value within the 10-year period 2007–16 was used (with four exceptions: indicators 2.2.2, 5.1.2, 6.2.5, and 7.2.4, for which time periods were extended to 2006, and are noted in this appendix). Further details are explained in Appendix IV Technical Notes. The single year given next to the description corresponds to the most frequent year for which data were available; when more than one year is considered, the period is indicated at the end of the indicator's source in parentheses.

Some indicators received special treatment in the computation. A few variables required scaling by some other indicator to be comparable across countries, or through division by gross domestic product (GDP) in current US dollars, purchasing power parity GDP in international dollars (PPP\$ GDP), population, total exports, total trade, and so on. Details are provided in this appendix. The scaling factor was in each case the value corresponding to the same year of the particular indicator. In addition, 35 indicators that were assigned half weight are singled out with an 'a'. Finally, indicators for which higher scores indicate worse outcomes, commonly known as 'bads',

are differentiated with a 'b' (details on the computation can be found in Appendix IV Technical Notes).

A total of 57 variables are hard data; 19 are composite indicators from international agencies, distinguished with an asterisk (\*); and 5 are survey questions from the World Economic Forum's Executive Opinion Survey (EOS), singled out with a dagger (†).

# 1 Institutions

## 1.1 Political environment

### 1.1.1 Political stability and absence of violence/terrorism

Political stability and absence of violence/terrorism index\* | 2015

Index that measures perceptions of the likelihood of political instability and/or politically motivated violence, including terrorism. Scores are standardized.

Source: World Bank, *Worldwide Governance Indicators, 2016 update*. (<http://info.worldbank.org/governance/wgi/index.aspx#home>)

### 1.1.2 Government effectiveness

Government effectiveness index\* | 2015

Index that reflects perceptions of the quality of public services, the quality of the civil service and the degree of its independence from political pressures, the quality of policy formulation and implementation, and the credibility of the government's commitment to such policies. Scores are standardized.

Source: World Bank, *Worldwide Governance Indicators, 2016 update*. (<http://info.worldbank.org/governance/wgi/index.aspx#home>)

## 1.2 Regulatory environment

### 1.2.1 Regulatory quality

Regulatory quality index\*\*a | 2015

Index that reflects perceptions of the ability of the government to formulate and implement sound policies and regulations that permit and promote private-sector development. Scores are standardized.

Source: World Bank, *Worldwide Governance Indicators, 2016 update*. (<http://info.worldbank.org/governance/wgi/index.aspx#home>)

### 1.2.2 Rule of law

Rule of law index\*\*a | 2015

Index that reflects perceptions of the extent to which agents have confidence in and abide by the rules of society, and in particular the quality of contract enforcement, property rights, the police, and the courts, as well as the likelihood of crime and violence. Scores are standardized.

Source: World Bank, *Worldwide Governance Indicators, 2016 update*. (<http://info.worldbank.org/governance/wgi/index.aspx#home>)

### 1.2.3 Cost of redundancy dismissal

Sum of notice period and severance pay for redundancy dismissal (in salary weeks, averages for workers with 1, 5, and 10 years of tenure, with a minimum threshold of 8 weeks)<sup>b</sup> | 2016

*Doing Business* has historically studied the flexibility of regulation of employment specifically as it relates to the areas of hiring, working hours, and redundancy. Over the period from 2007 to 2011 improvements were made to align the methodology for the labour market regulation indicators (formerly the employing workers indicators) with the letter and spirit of the International Labour Organization (ILO) conventions. Redundancy cost measures the cost of advance notice requirements and severance payments due when terminating a redundant worker, expressed in weeks of salary. The average value of notice requirements and severance payments applicable to a worker with 1 year of tenure, a worker with 5 years, and a worker with 10 years is also considered. One month is recorded as 4 and 1/3 weeks. If the redundancy cost adds up to 8 or fewer weeks of salary, a value of 8 is assigned but the actual number of weeks is published. If the cost adds up to more than 8 weeks of salary, the score is the number of weeks. Assumptions about the worker: the worker is a cashier in a supermarket or grocery store, age 19, with one year of work experience; is a full-time employee; is not a member of the labour union, unless membership is mandatory. Assumptions about the business: the business is a limited liability company (or the equivalent in the economy); operates a supermarket or grocery store in the economy's largest business city (for 11 economies the data are also collected for the second largest business city); has 60 employees; is subject to collective bargaining agreements if such agreements cover more than 50% of the food retail sector and they apply even to firms that are not party to them; abides by every law and regulation but does not grant workers more benefits than those mandated by law, regulation, or (if applicable) collective bargaining agreements.

Source: World Bank, *Ease of Doing Business Index 2017: Equal Opportunity for All (2014–16)*. (<http://www.doingbusiness.org/reports/global-reports/doing-business-2017>)

## 1.3 Business environment

### 1.3.1 Ease of starting a business

Ease of starting a business (distance to frontier)\* | 2016

The ranking of economies on the ease of starting a business is determined by sorting their distance to frontier scores for starting a business. These scores are the

simple average of the distance to frontier scores for each of the component indicators. *Doing Business* records all procedures officially required, or commonly done in practice, for an entrepreneur to start up and formally operate an industrial or commercial business, as well as the time and cost to complete these procedures and the paid-in minimum capital requirement. These procedures include obtaining all necessary licenses and permits and completing any required notifications, verifications, or inscriptions for the company and employees with relevant authorities. To make the data comparable across economies, several assumptions about the business and the procedures are used. The business: is a limited liability company (or its legal equivalent). If there is more than one type of limited liability company in the economy, the limited liability form most common among domestic firms is chosen. Information on the most common form is obtained from incorporation lawyers or the statistical office; the business operates in the economy's largest business city. For 11 economies the data are also collected for the second largest business city; the business is 100% domestically owned and has five owners, none of whom is a legal entity; has start-up capital of 10 times income per capita; performs general industrial or commercial activities, such as the production or sale to the public of products or services. The business does not perform foreign trade activities and does not handle products subject to a special tax regime, for example, liquor or tobacco. It is not using heavily polluting production processes; leases the commercial plant or offices and is not a proprietor of real estate; the amount of the annual lease for the office space is equivalent to 1 times income per capita; the size of the entire office space is approximately 929 square meters (10,000 square feet); does not qualify for investment incentives or any special benefits; has at least 10 and up to 50 employees one month after the commencement of operations, all of them domestic nationals; has a turnover of at least 100 times income per capita; has a company deed 10 pages long. The distance to frontier score shows the distance of an economy to the 'frontier', which is derived from the most efficient practice or highest score achieved on each indicator.

Source: World Bank, *Ease of Doing Business Index 2017: Equal Opportunity for All (2016)*. (<http://www.doingbusiness.org/reports/global-reports/doing-business-2017>)



### 1.3.2 Ease of resolving insolvency

Ease of resolving insolvency (distance to frontier)\*  
| 2016

The ranking of economies on the ease of resolving insolvency is determined by sorting their distance to frontier scores for resolving insolvency. These scores are the simple average of the distance to frontier scores for the recovery rate and the strength of insolvency framework index. The recovery rate is recorded as cents on the dollar recovered by secured creditors through reorganization, liquidation, or debt enforcement (foreclosure or receivership) proceedings. The calculation takes into account the outcome: whether the business emerges from the proceedings as a going concern or the assets are sold piecemeal. Then the costs of the proceedings are deducted (1 cent for each percentage point of the value of the debtor's estate). Finally, the value lost as a result of the time the money remains tied up in insolvency proceedings is taken into account, including the loss of value due to depreciation of a hotel's furniture. Consistent with international accounting practice, the annual depreciation rate for furniture is taken to be 20%. The furniture is assumed to account for a quarter of the total value of assets. The recovery rate is the present value of the remaining proceeds, based on end-2015 lending rates from the International Monetary Fund's *International Financial Statistics*, supplemented with data from central banks and the Economist Intelligence Unit. If an economy had zero cases a year over the past five years involving a judicial reorganization, judicial liquidation, or debt enforcement procedure (foreclosure or receivership), the economy receives a 'no practice' mark on the time, cost, and outcome indicators. This means that creditors are unlikely to recover their money through a formal legal process. The recovery rate for 'no practice' economies is zero. In addition, a 'no practice' economy receives a score of 0 on the strength of insolvency framework index even if its legal framework includes provisions related to insolvency proceedings (liquidation or reorganization). The strength of insolvency framework index is based on four other indices: commencement of proceedings index, management of debtor's assets index, reorganization proceedings index, and creditor participation index. To make the data on the time, cost, and outcome of insolvency proceedings comparable across economies, several assumptions about the business and the case are used: the business is a limited liability company; operates in the economy's largest business city. For 11 economies the data are also collected

for the second largest business city; the business is 100% domestically owned, with the founder, who is also chairman of the supervisory board, owning 51% (no other shareholder holds more than 5% of shares); has downtown real estate, where it runs a hotel, as its major asset; has a professional general manager; has 201 employees and 50 suppliers, each of which is owed money for the last delivery; has a 10-year loan agreement with a domestic bank secured by a mortgage over the hotel's real estate property. A universal business charge (an enterprise charge) is also assumed in economies where such collateral is recognized. If the laws of the economy do not specifically provide for an enterprise charge but contracts commonly use some other provision to that effect, this provision is specified in the loan agreement; the business has observed the payment schedule and all other conditions of the loan up to now; has a market value, operating as a going concern, of 100 times income per capita or \$200,000, whichever is greater. The market value of the company's assets, if sold piecemeal, is 70% of the market value of the business. Refer to indicator 1.3.1 for details regarding the distance to frontier measure.

Source: World Bank, *Ease of Doing Business Index 2017: Equal Opportunity for All (2016)*. (<http://www.doingbusiness.org/reports/global-reports/doing-business-2017>)

### 1.3.3 Ease of paying taxes

Ease of paying taxes (distance to frontier)\* | 2016

The ranking of economies on the ease of paying taxes is determined by sorting their distance to frontier scores for paying taxes. These scores are the simple average of the distance to frontier scores for each of the component indicators, with a threshold and a nonlinear transformation applied to one of the component indicators, the total tax rate. The 'threshold' is defined as the total tax rate at the 15th percentile of the overall distribution of the total tax rate indicator for all years included in the analysis up to and including *Doing Business 2015*. The threshold is set at 26.1%. All economies with a total tax rate below this threshold receive the same score as the economy at the threshold. The threshold is not based on any economic theory of an 'optimal tax rate' that minimizes distortions or maximizes efficiency in an economy's overall tax system. Instead, it is mainly empirical in nature, set at the lower end of the distribution of tax rates levied on medium-size enterprises in the manufacturing sector as observed through the paying taxes indicators. To make the data comparable

across economies, several assumptions about the business and the taxes and contributions are used. The business: is a limited liability, taxable company. If there is more than one type of limited liability company in the economy, the limited liability form most common among domestic firms is chosen. The most common form is reported by incorporation lawyers or the statistical office; the business started operations on 1 January 2014. At that time the company purchased all the assets shown in its balance sheet and hired all its workers; it operates in the economy's largest business city. For 11 economies the data are also collected for the second largest business city; the business is 100% domestically owned and has five owners, all of whom are natural persons; at the end of 2014, it has a start-up capital of 102 times income per capita; performs general industrial or commercial activities. Specifically, it produces ceramic flowerpots and sells them at retail. It does not participate in foreign trade (no import or export) and does not handle products subject to a special tax regime, for example, liquor or tobacco; at the beginning of 2015, it owns two plots of land, one building, machinery, office equipment, computers, and one truck and leases one truck; does not qualify for investment incentives or any benefits apart from those related to the age or size of the company; has 60 employees—4 managers, 8 assistants, and 48 workers. All are nationals, and one manager is also an owner. The company pays for additional medical insurance for employees (not mandated by any law) as an additional benefit. In addition, in some economies reimbursable business travel and client entertainment expenses are considered fringe benefits. When applicable, it is assumed that the company pays the fringe benefit tax on this expense or that the benefit becomes taxable income for the employee. The case study assumes no additional salary for meals, transportation, education, or others. Therefore, even when such benefits are frequent, they are not added to or removed from the taxable gross salaries to arrive at the labour tax or contribution calculation; it has a turnover of 1,050 times income per capita; makes a loss in the first year of operation; has a gross margin (pretax) of 20% (that is, sales are 120% of the cost of goods sold); distributes 50% of its net profits as dividends to the owners at the end of the second year; sells one of its plots of land at a profit at the beginning of the second year; is subject to a series of detailed assumptions on expenses and transactions to further standardize the case. For example, the owner who is also a manager spends 10% of income

per capita on traveling for the company (20% of this owner's expenses are purely private, 20% are for entertaining customers, and 60% are for business travel). All financial statement variables are proportional to 2012 income per capita as of and including *Doing Business 2014* (this is an update from *Doing Business 2013* and previous years' reports, where the variables were proportional to 2005 income per capita). For some economies a multiple of two or three times the income per capita has been used to estimate the financial statement variables. The 2012 income per capita was not sufficient to bring the salaries of all the case study employees up to the minimum wage thresholds that exist in these economies. Assumptions about the taxes and contributions: all the taxes and contributions recorded are those paid in the second year of operation (calendar year 2015). A tax or contribution is considered distinct if it has a different name or is collected by a different agency. Taxes and contributions with the same name and agency, but charged at different rates depending on the business, are counted as the same tax or contribution; the number of times the company pays taxes and contributions in a year is the number of different taxes or contributions multiplied by the frequency of payment (or withholding) for each tax. The frequency of payment includes advance payments (or withholding) as well as regular payments (or withholding). Refer to indicator 1.3.1 for details regarding the distance to frontier measure.

Source: World Bank, *Ease of Doing Business Index 2017: Equal Opportunity for All* (2016). (<http://www.doingbusiness.org/reports/global-reports/doing-business-2017>)

## 2 Human capital and research

### 2.1 Education

#### 2.1.1 Expenditure on education

Government expenditure on education (% of GDP) | 2013

Government operating expenditures in education, including wages and salaries and excluding capital investments in buildings and equipment, as a percentage of gross domestic product (GDP).

Source: UNESCO Institute for Statistics, *UIS online database* (2007–16). (<http://data.uis.unesco.org/>)

#### 2.1.2 Government expenditure on education per pupil, secondary

Government expenditure per pupil, secondary (% of GDP per capita) | 2013

Government spending on education divided by the total number of secondary students, as a percentage of GDP per capita. Government expenditure (current and capital) includes government spending on educational institutions (both public and private), education administration, and subsidies for private entities (students/households and other private entities).

Source: UNESCO Institute for Statistics, *UIS online database* (2007–16). (<http://data.uis.unesco.org/>)

#### 2.1.3 School life expectancy

School life expectancy, primary to tertiary education (years) | 2014

Total number of years of schooling that a child of a certain age can expect to receive in the future, assuming that the probability of his or her being enrolled in school at any particular age is equal to the current enrolment ratio for that age.

Source: UNESCO Institute for Statistics, *UIS online database* (2007–16). (<http://data.uis.unesco.org/>)

#### 2.1.4 Assessment in reading, mathematics, and science

PISA average scales in reading, mathematics, and science<sup>a</sup> | 2015

The Organisation for Economic Co-operation and Development (OECD) Programme for International Student Assessment (PISA) develops triennial international surveys that examine 15-year-old students' performance in reading, mathematics, and science. The scores are calculated in each year so that the mean is 500 and the standard deviation 100. The statistical data for Israel are supplied by and under the responsibility of the relevant Israeli authorities. The use of such data by the OECD is without prejudice to the status of the Golan Heights, East Jerusalem, and Israeli settlements in the West Bank under the terms of international law. B-S-J-G (China) refers to the four PISA-participating China provinces: Beijing, Shanghai, Jiangsu, and Guangdong. CABA (Argentina) refers to the adjudicated region of Ciudad Autónoma de Buenos Aires (CABA). FYROM refers to the Former Yugoslav Republic of Macedonia. Russia refers to the Russian Federation. 2015 scores from the United Arab Emirates are from Dubai. 2010 scores from India are from Himachal Pradesh and Tamil Nadu (average); 2010

scores from the Bolivarian Republic of Venezuela are from Miranda. The results of adjudication and subsequent further examinations showed that the PISA Technical Standards were met in all countries and economies that participated in PISA 2015 except for the following countries: In Albania, the PISA assessment was conducted in accordance with the operational standards and guidelines of the OECD. However, because of the ways in which the data were captured, it was not possible to match the data in the test with the data from the student questionnaire. As a result, Albania cannot be included in analyses that relate students' responses from the questionnaires to the test results. In Argentina, the PISA assessment was conducted in accordance with the operational standards and guidelines of the OECD. However, there was a significant decline in the proportion of 15-year-olds who were covered by the test, both in absolute and relative numbers. There had been a re-structuring of Argentina's secondary schools, except for those in the adjudicated region of Ciudad Autónoma de Buenos Aires, which is likely to have affected the coverage of eligible schools listed in the sampling frame. As a result, Argentina's results may not be comparable to those of other countries or to results for Argentina from previous years. In Kazakhstan, the national coders were found to be lenient in marking. Consequently, the human-coded items did not meet PISA standards and were excluded from the international data. Since human-coded items form an important part of the constructs that are tested by PISA, the exclusion of these items resulted in a significantly smaller coverage of the PISA test. As a result, Kazakhstan's results may not be comparable to those of other countries or to results for Kazakhstan from previous years. In Malaysia, the PISA assessment was conducted in accordance with the operational standards and guidelines of the OECD. However, the weighted response rate among the initially sampled Malaysian schools (51%) falls well short of the standard PISA response rate of 85%. Therefore, the results may not be comparable to those of other countries or to results for Malaysia from previous years.

Source: OECD Programme for International Student Assessment (PISA) (2010–15). ([www.pisa.oecd.org/](http://www.pisa.oecd.org/))

#### 2.1.5 Pupil-teacher ratio, secondary

Pupil-teacher ratio, secondary<sup>a,b</sup> | 2015

The number of pupils enrolled in secondary school divided by the number of secondary school teachers (regardless of

their teaching assignment). Where the data are missing for some countries, the ratios for upper-secondary are reported; if these are also missing, the ratios for lower-secondary are reported instead.

Source: UNESCO Institute for Statistics, UIS online database (2007–16). (<http://data.uis.unesco.org>)

## 2.2 Tertiary education

### 2.2.1 Tertiary enrolment

School enrolment, tertiary (% gross)<sup>a</sup> | 2015

The ratio of total tertiary enrolment, regardless of age, to the population of the age group that officially corresponds to the tertiary level of education. Tertiary education, whether or not at an advanced research qualification, normally requires, as a minimum condition of admission, the successful completion of education at the secondary level.

Source: UNESCO Institute for Statistics, UIS online database (2007–16). (<http://data.uis.unesco.org>)

### 2.2.2 Graduates in science and engineering

Tertiary graduates in science, engineering, manufacturing, and construction (% of total tertiary graduates) | 2013

The share of all tertiary graduates in science, manufacturing, engineering, and construction out of all tertiary graduates. Because of the change in the International Standard Classification of Education (ISCED) fields of classification and the transition to new questionnaires, when countries did not report detailed data, the UIS was not able to re-assign numbers into new field classifications. As a result, the UIS was not able to produce this indicator for select countries, per recommendation of the UIS, the dataset from the Global Innovation Index 2016 was used.

Source: UNESCO Institute for Statistics, UIS online database (2006–14). (<http://data.uis.unesco.org>)

### 2.2.3 Tertiary-level inbound mobility

Tertiary-level inbound mobility rate (%)<sup>a</sup> | 2015

The number of students from abroad studying in a given country, as a percentage of the total tertiary enrolment in that country.

Source: UNESCO Institute for Statistics, UIS online database (2007–16). (<http://data.uis.unesco.org>)

## 2.3 Research and development (R&D)

### 2.3.1 Researchers

Researchers, full-time equivalence (FTE) (per million population) | 2015

Researchers per million population, full-time equivalence. Researchers in R&D are professionals engaged in the conception or creation of new knowledge, products, processes, methods, or systems and in the management of the projects concerned. Postgraduate PhD students (ISCED97 level 6) engaged in R&D are included.

Source: UNESCO Institute for Statistics, UIS online database (2007–15). (<http://data.uis.unesco.org>)

### 2.3.2 Gross expenditure on R&D (GERD)

GERD: Gross expenditure on R&D (% of GDP) | 2015

Total domestic intramural expenditure on R&D during a given period as a percentage of GDP. Intramural R&D expenditure is all expenditure for R&D performed within a statistical unit or sector of the economy during a specific period, whatever the source of funds.

Source: UNESCO Institute for Statistics, UIS online database (2007–15). (<http://data.uis.unesco.org>)

### 2.3.3 Global R&D companies, average expenditure top 3

Average expenditure of the top 3 global companies by R&D, mn \$US\* | 2016

Average expenditure on R&D of the top three global companies. If a country has fewer than three global companies listed, the figure is either the average of the sum of the two companies listed or the total for a single listed company. A score of zero is given to countries with no listed companies.

Source: EU JRC Industrial R&D Investment Scoreboard 2016. (<https://iri.jrc.ec.europa.eu/scoreboard16.html>)

### 2.3.4 QS university ranking average score of top 3 universities

Average score of the top 3 universities at the QS world university ranking\* | 2016

Average score of the top three universities per country. If fewer than three universities are listed in the QS ranking of the global top 700 universities, the sum of the scores of the listed universities is divided by three, thus implying a score of zero for the non-listed universities.

Source: QS Quacquarelli Symonds Ltd, QS World University Ranking 2016/2017, Top Universities. (<https://www.topuniversities.com/university-rankings/world-university-rankings/2016>)

## 3 Infrastructure

### 3.1 Information and communication technologies (ICTs)

#### 3.1.1 ICT access

ICT access index\* | 2016

The ICT access index is a composite index that weights five ICT indicators (20% each): (1) Fixed telephone subscriptions per 100 inhabitants; (2) Mobile cellular telephone subscriptions per 100 inhabitants; (3) International Internet bandwidth (bit/s) per Internet user; (4) Percentage of households with a computer; and (5) Percentage of households with Internet access. It is the first sub-index in ITU's ICT Development Index (IDI).

Source: International Telecommunication Union, Measuring the Information Society 2016, ICT Development Index 2016. (<http://www.itu.int/en/ITU-D/Statistics/Pages/publications/mis2016.aspx>)

#### 3.1.2 ICT use

ICT use index\* | 2016

The ICT use index is a composite index that weights three ICT indicators (33% each): (1) Percentage of individuals using the Internet; (2) Fixed (wired)-broadband Internet subscriptions per 100 inhabitants; (3) Active mobile-broadband subscriptions per 100 inhabitants. It is the second sub-index in ITU's ICT Development Index (IDI).

Source: International Telecommunication Union, Measuring the Information Society 2016, ICT Development Index 2016. (<http://www.itu.int/en/ITU-D/Statistics/Pages/publications/mis2016.aspx>)

#### 3.1.3 Government's online service

Government's online service index\* | 2016

To arrive at a set of Online Service Index (OSI) values for 2016, a total of 111 researchers, including UN experts and online United Nations Volunteers (UNVs) from over 60 countries with coverage of 66 languages assessed each country's national website in the native language, including the national portal, e-services portal, and e-participation portal, as well

as the websites of the related ministries of education, labour, social services, health, finance, and environment as applicable. The UNVs included qualified graduate students and volunteers from universities in the field of public administration.

Note: The precise meaning of these values varies from one edition of the Survey to the next as understanding of the potential of e-government changes and the underlying technology evolves. Read about the methodology at <http://unpan3.un.org/egovkb/en-us/About/Methodology>.

Source: United Nations Public Administration Network, e-Government Survey 2016. (<https://publicadministration.un.org/egovkb/en-us/Reports/UN-E-Government-Survey-2016>)

### 3.1.4 Online e-participation E-Participation Index\* | 2016

The E-Participation Index (EPI) is derived as a supplementary index to the UN E-Government Survey. It extends the dimension of the Survey by focusing on the use of online services to facilitate provision of information by governments to citizens ('e-information sharing'), interaction with stakeholders ('e-consultation'), and engagement in decision-making processes.

A country's EPI reflects its e-participation mechanisms that are deployed by the government as compared to all other countries. The purpose of this measure is not to prescribe any particular practice, but rather to offer insight into how different countries are using online tools to promote interaction between citizen and government, as well as among citizens, for the benefit of all. Because the EPI is a qualitative assessment based on the availability and relevance of participatory services available on government websites, the comparative ranking of countries is for illustrative purposes and should serve only as an indicator of the broad trends in promoting citizen engagement. As with the E-Government Development Index (EGDI), the EPI is not intended as an absolute measurement of e-participation, but rather it attempts to capture the e-participation performance of countries relative to one another at a particular point in time. The index ranges from 0 to 1, with 1 showing greater e-participation.

Note: The precise meaning of these values varies from one edition of the Survey to the next as understanding of the potential of e-government changes and the underlying technology evolves.

Read about the methodology at <http://unpan3.un.org/egovkb/en-us/About/Methodology>.

Source: United Nations Public Administration Network, e-Government Survey 2016. (<https://publicadministration.un.org/egovkb/en-us/Reports/UN-E-Government-Survey-2016>)

## 3.2 General infrastructure

### 3.2.1 Electricity output

Electricity output (kWh per capita)<sup>3</sup> | 2014

Electricity production, measured at the terminals of all alternator sets in a station. In addition to hydropower, coal, oil, gas, and nuclear power generation, this indicator covers generation by geothermal, solar, wind, and tide and wave energy, as well as that from combustible renewables and waste. Production includes the output of electric plants that are designed to produce electricity only as well as that of combined heat and power plants. Electricity output in kWh is scaled by population.

Source: International Energy Agency (IEA) World Energy Balances on-line data service, 2015 edition (2014–15). (<http://www.iea.org/statistics/>)

### 3.2.2 Logistics performance

Logistics Performance Index<sup>3a</sup> | 2016

A multidimensional assessment of logistics performance, the Logistics Performance Index (LPI) ranks 160 countries on six dimensions of trade—including customs performance, infrastructure quality, and timeliness of shipments—that have increasingly been recognized as important to development. The data used in the ranking come from a survey of logistics professionals who are asked questions about the foreign countries in which they operate. The LPI's six components include: (1) the efficiency of customs and border management clearance ('Customs'); (2) the quality of trade and transport infrastructure ('Infrastructure'); (3) the ease of arranging competitively priced shipments ('Ease of arranging shipments'); (4) the competence and quality of logistics services—trucking, forwarding, and customs brokerage ('Quality of logistics services'); (5) the ability to track and trace consignments ('Tracking and tracing'); and (6) the frequency with which shipments reach consignees within scheduled or expected delivery times ('Timeliness'). The LPI uses standard statistical techniques to aggregate the data into a single indicator that can be used for cross-country comparisons.

Source: World Bank and Turku School of Economics, Logistics Performance Index 2016; Arvis et al., 2016, *Connecting to Compete 2016: Trade Logistics in the Global Economy*. (<http://lpi.worldbank.org/>)

### 3.2.3 Gross capital formation

Gross capital formation (% of GDP) | 2016

Gross capital formation is expressed as a ratio of total investment in current local currency to GDP in current local currency. Investment or gross capital formation is measured by the total value of the gross fixed capital formation and changes in inventories and acquisitions less disposals of valuables for a unit or sector, on the basis of the System of National Accounts (SNA) of 1993.

Source: International Monetary Fund, World Economic Outlook Database, October 2016 (PPP\$ GDP). (<https://www.imf.org/external/pubs/ft/weo/2016/02/weodata/index.aspx>)

## 3.3 Ecological sustainability

### 3.3.1 GDP per unit of energy use

GDP per unit of energy use (2010 PPP\$ per kg of oil equivalent) | 2014

Purchasing power parity gross domestic product (PPP\$ GDP) per kilogram of oil equivalent of energy use. Total primary energy supply (TPES) is made up of production + imports – exports – international marine bunkers – international aviation bunkers +/- stock changes.

Source: International Energy Agency (IEA) World Energy Balances on-line data service, 2016 edition (2014–15). (<http://www.iea.org/statistics/>)

### 3.3.2 Environmental performance

Environmental Performance Index\* | 2015

This index ranks countries on 20 performance indicators tracked across policy categories that cover both environmental public health and ecosystem vitality. These indicators gauge how close countries are to established environmental policy goals. The index ranges from 0 to 100, with 100 indicating best performance.

Source: Yale University and Columbia University Environmental Performance Index 2016. (<http://epi.yale.edu/>)



### 3.3.3 ISO 14001 environmental certificates

ISO 14001 Environmental management systems—Requirements with guidance for use: Number of certificates issued (per billion PPP\$ GDP)<sup>3</sup> | 2015

ISO 14001:2015 specifies the requirements for an environmental management system that an organization can use to enhance its environmental performance. ISO 14001:2015 is intended for use by an organization seeking to manage its environmental responsibilities in a systematic manner that contributes to the environmental pillar of sustainability. ISO 14001:2015 helps an organization achieve the intended outcomes of its environmental management system, which provide value for the environment, the organization itself, and interested parties. Consistent with the organization's environmental policy, the intended outcomes of an environmental management system include enhancement of environmental performance, fulfillment of compliance obligations, and achievement of environmental objectives. ISO 14001:2015 is applicable to any organization, regardless of size, type, or nature, and applies to the environmental aspects of its activities, products, and services that the organization determines it can either control or influence from a life cycle perspective. ISO 14001:2015 does not state specific environmental performance criteria. ISO 14001:2015 can be used in whole or in part to systematically improve environmental management. Claims of conformity to ISO 14001:2015, however, are not acceptable unless all its requirements are incorporated into an organization's environmental management system and fulfilled without exclusion. The data are reported per billion PPP\$ GDP.

Source: International Organization for Standardization, *The ISO Survey 2015*; International Monetary Fund, *World Economic Outlook Database, October 2016 (PPP\$ GDP) (2015)*. (<https://www.iso.org/the-iso-survey.html>; <https://www.imf.org/external/pubs/ft/weo/2016/02/weodata/index.aspx>)

strength of the legal rights index (range 0–12) and the depth of credit information index (range 0–8). *Doing Business* measures the legal rights of borrowers and lenders with respect to secured transactions through one set of indicators and the reporting of credit information through another. The first set of indicators measures whether certain features that facilitate lending exist within the applicable collateral and bankruptcy laws. The second set measures the coverage, scope, and accessibility of credit information available through credit reporting service providers such as credit bureaus or credit registries. Although *Doing Business* compiles data on getting credit for public registry coverage (% of adults) and for private bureau coverage (% of adults), these indicators are not included in the ranking. Refer to indicator 1.3.1 for details regarding the distance to frontier measure.

Source: World Bank, *Ease of Doing Business Index 2017: Equal Opportunity for All (2016)*. (<http://www.doingbusiness.org/reports/global-reports/doing-business-2017>)

### 4.1.2 Domestic credit to private sector

Domestic credit to private sector (% of GDP) | 2015

Domestic credit to private sector refers to financial resources provided to the private sector by financial corporations, such as through loans, purchases of non-equity securities, and trade credits and other accounts receivable, that establish a claim for repayment. For some countries these claims include credit to public enterprises. The financial corporations include monetary authorities and deposit money banks, as well as other financial corporations where data are available (including corporations that do not accept transferable deposits but do incur such liabilities as time and savings deposits). Examples of other financial corporations are finance and leasing companies, money lenders, insurance corporations, pension funds, and foreign exchange companies.

Source: International Monetary Fund, *International Financial Statistics and data files*; and World Bank and OECD GDP estimates; extracted from the World Bank's *World Development Indicators database (2008–15)*. (<http://data.worldbank.org/>)

### 4.1.3 Microfinance institutions' gross loan portfolio

Microfinance institutions: Gross loan portfolio (% of GDP) | 2015

Combined gross loan balances per microfinance institution (current US\$), divided by GDP (current US\$) and multiplied by 100.

Source: Microfinance Information Exchange, *Mix Market database*; International Monetary Fund, *World Economic Outlook Database, October 2016 (current US\$ GDP) (2007–15)*. (<https://reports.themix.org/>; <https://www.imf.org/external/pubs/ft/weo/2016/02/weodata/index.aspx>)

## 4.2 Investment

### 4.2.1 Ease of protecting minority investors

Ease of protecting minority investors (distance to frontier)\* | 2016

The ranking is the simple average of the distance to frontier scores for the extent of conflict of interest regulation index and the extent of shareholder governance index. The extent of conflict of interest regulation index measures the protection of shareholders against directors' misuse of corporate assets for personal gain by distinguishing three dimensions of regulation that address conflicts of interest: transparency of related-party transactions (extent of disclosure index), shareholders' ability to sue and hold directors liable for self-dealing (extent of director liability index), and access to evidence and allocation of legal expenses in shareholder litigation. The extent of shareholder governance index measures shareholders' rights in corporate governance by distinguishing three dimensions of good governance: shareholders' rights and role in major corporate decisions (extent of shareholder rights index); governance safeguards protecting shareholders from undue board control and entrenchment (extent of ownership and control index); and corporate transparency on ownership stakes, compensation, audits, and financial prospects (extent of corporate transparency index). The index also measures whether a subset of relevant rights and safeguards are available in limited companies. The data come from a questionnaire administered to corporate and securities lawyers and are based on securities regulations, company laws, civil procedure codes, and court rules of evidence. Refer to indicator 1.3.1 for details regarding the distance to frontier measure.

## 4 Market sophistication

### 4.1 Credit

#### 4.1.1 Ease of getting credit

Ease of getting credit (distance to frontier)\* | 2016

The ranking of economies on the ease of getting credit is determined by sorting their distance to frontier scores for getting credit. These scores are the distance to frontier score for the sum of the

Source: World Bank, *Ease of Doing Business Index 2017: Equal Opportunity for All* (2016). (<http://www.doingbusiness.org/reports/global-reports/doing-business-2017>)

#### 4.2.2 Market capitalization

Market capitalization of listed domestic companies (% of GDP)<sup>a</sup> | 2015

Market capitalization (also known as 'market value') is the share price times the number of shares outstanding (including their several classes) for listed domestic companies. Investment funds, unit trusts, and companies whose only business goal is to hold shares of other listed companies are excluded. Data are end-of-year values.

Source: World Federation of Exchanges database; extracted from the World Bank's World Development Indicators database (2008–15). (<http://data.worldbank.org/>)

#### 4.2.3 Venture capital deals

Venture capital per investment location: Number of deals (per billion PPP\$ GDP)<sup>a</sup> | 2016

Thomson Reuters data on private equity deals, per deal, with information on the location of investment, investment company, investor firms, and funds, among other details. The data are reported per billion PPP\$ GDP.

Note: Formerly the Intellectual Property and Science business of Thomson Reuters, *Clarivate Analytics* is now an independent company.

Source: Thomson Reuters, *Thomson One Banker Private Equity* database; *International Monetary Fund, World Economic Outlook Database October 2016* (PPP\$ GDP) (2015–16). (<https://www.thomsonone.com>; <https://www.imf.org/external/pubs/ft/weo/2016/02/weodata/index.aspx>)

### 4.3 Trade, competition, and market scale

#### 4.3.1 Applied tariff rate, weighted mean

Tariff rate, applied, weighted mean, all products (%)<sup>a,b</sup> | 2015

Weighted mean applied tariff is the average of effectively applied rates weighted by the product import shares corresponding to each partner country. Data are classified using the Harmonized System of trade at the six- or eight-digit level. Tariff line data were matched to Standard International Trade Classification (SITC) revision 3 codes to define commodity groups and import weights. To the extent possible, specific rates have been converted to their ad valorem equivalent rates and have been included in the

calculation of weighted mean tariffs. Import weights were calculated using the United Nations Statistics Division's Commodity Trade (Comtrade) database. Effectively applied tariff rates at the six- and eight-digit product level are averaged for products in each commodity group. When the effectively applied rate is unavailable, the most favoured nation rate is used instead.

Source: World Bank, based on data from United Nations Conference on Trade and Development's *Trade Analysis and Information System (TRAINS)* database and the World Trade Organization's (WTO) *Integrated Data Base (IDB)* and *Consolidated Tariff Schedules (CTS)* database; extracted from World Bank World Development Indicators database (2011–15). (<http://data.worldbank.org/>)

#### 4.3.2 Intensity of local competition

Average answer to the survey question: In your country, how intense is competition in the local markets? [1 = not intense at all; 7 = extremely intense]<sup>a</sup> | 2016

Source: World Economic Forum, *Executive Opinion Survey 2016–2017*. (<https://www.weforum.org/reports/the-global-competitiveness-report-2016-2017-1>)

#### 4.3.3 Domestic market scale

Domestic market size as measured by GDP, bn PPP\$ | 2016

The domestic market size is measured by gross domestic product (GDP) based on the purchasing-power-parity (PPP) valuation of country GDP, in current international dollars (billions).

Source: World Bank, *International Monetary Fund, World Economic Outlook Database October 2016* (PPP\$ GDP) (2016). (<https://www.imf.org/external/pubs/ft/weo/2016/02/weodata/index.aspx>)

senior officials and managers, 2 Professionals, 3 Technicians and associate professionals (2007–15); ISCO-68: 1 Professional, technical and related workers (category 0 Armed forces is excluded), 2 Administrative and managerial workers, 3 Clerical and related workers (years 2007–08).

Source: International Labour Organization ILOSTAT Database of Labour Statistics (2007–15). (<http://www.ilo.org/ilostat/>)

#### 5.1.2 Firms offering formal training

Firms offering formal training (% of firms) | 2013

The percentage of firms offering formal training programs for their permanent, full-time employees. The time period of data for Guinea includes 2006 for heightened coverage based on this economy's GII 2016 data availability.

Source: World Bank, *Enterprise Surveys* (2006–16). (<http://www.enterprisesurveys.org/>)

#### 5.1.3 GERD performed by business enterprise

GERD: Performed by business enterprise (% of GDP)<sup>a</sup> | 2015

Gross expenditure on R&D performed by business enterprise as a percentage of GDP.

Source: UNESCO Institute for Statistics, *UIS online database* (2007–15). (<http://data.uis.unesco.org>)

#### 5.1.4 GERD financed by business enterprise

GERD: Financed by business enterprise (% of total GERD)<sup>a</sup> | 2015

Gross expenditure on R&D financed by business enterprise as a percentage of total gross expenditure on R&D.

Source: UNESCO Institute for Statistics, *UIS online database* (2007–16). (<http://data.uis.unesco.org>)

#### 5.1.5 Females employed with advanced degrees

Females employed with advanced degrees, % total employed (25+ years old)<sup>a</sup> | 2015

The percentage of females employed with advanced degrees out of total employed. The employed comprise all persons of working age who, during a specified brief period, were in one of the following categories: (1) paid employment (whether at work or with a job but not at work); or (2) self-employment (whether at work or with an enterprise but not at work). Data are disaggregated by level of education, which refers to the highest level of education completed, classified according to the International

## 5 Business sophistication

### 5.1 Knowledge workers

#### 5.1.1 Employment in knowledge-intensive services

Employment in knowledge-intensive services (% of workforce) | 2015

Sum of people in categories 1 to 3 as a percentage of total people employed, according to the International Standard Classification of Occupations (ISCO). Categories included are: ISCO-08: 1 Managers, 2 Professionals, and 3 Technicians and associate professionals (years 2007–15); ISCO-88: 1 Legislators,



Standard Classification of Education (ISCE).

Source: International Labour Organization, ILOSTAT Annual Indicators (2009–16); and Statistics Canada, Table 282-0004; Labour Force Survey estimates (LFS) by educational attainment, sex and age group, annual, CANSIM, accessed 9 February 2017. (<http://www.ilo.org/ilostat/>; <http://laborsta.ilo.org/>; <http://www.statcan.gc.ca/>)

## 5.2 Innovation linkages

### 5.2.1 University/industry research collaboration

Average answer to the survey question: In your country, to what extent do businesses and universities collaborate on research and development (R&D)? [1 = do not collaborate at all; 7 = collaborate extensively]<sup>†</sup> | 2016

Source: World Economic Forum, Executive Opinion Survey 2016–2017. (<https://www.weforum.org/reports/the-global-competitiveness-report-2016-2017-1>)

### 5.2.2 State of cluster development

Average answer to the survey question on the role of clusters in the economy: In your country, how widespread are well-developed and deep clusters (geographic concentrations of firms, suppliers, producers of related products and services, and specialized institutions in a particular field)? [1 = nonexistent; 7 = widespread in many fields]<sup>†</sup> | 2016

Source: World Economic Forum, Executive Opinion Survey 2016–2017. (<https://www.weforum.org/reports/the-global-competitiveness-report-2016-2017-1>)

### 5.2.3 GERD financed by abroad

GERD: Financed by abroad (% of total GERD) | 2015

Percentage of gross expenditure on R&D financed by abroad—i.e., with foreign financing.

Source: UNESCO Institute for Statistics, UIS online database (2007–16). (<http://data.uis.unesco.org>)

### 5.2.4 Joint venture/strategic alliance deals

Joint ventures/strategic alliances: Number of deals, fractional counting (per billion PPP\$ GDP)<sup>‡</sup> | 2016

Thomson Reuters data on joint ventures/strategic alliances deals, per deal, with details on the country of origin of partner firms, among others. For each year, each participating nation of each company in a deal ( $n$  countries per deal) gets, per deal, a score equivalent to  $1/n$  (with the effect that all country scores add up to the number of deals reported that year). The data are reported per billion PPP\$ GDP.

Note: Formerly the Intellectual Property and Science business of Thomson Reuters, Clarivate Analytics is now an independent company.

Source: Thomson Reuters, Thomson One Banker Private Equity, SDC Platinum database; International Monetary Fund World Economic Outlook Database, October 2016 (PPP\$ GDP) (2015–16). (<http://banker.thomsonib.com>; <https://www.imf.org/external/pubs/ft/weo/2016/02/weodata/index.aspx>)

### 5.2.5 Patent families filed in two offices

Number of patent families filed by residents in at least two offices (per billion PPP\$ GDP)<sup>‡</sup> | 2013

A ‘patent family’ is a set of interrelated patent applications filed in one or more countries or jurisdictions to protect the same invention. Patent families containing applications filed in at least two different offices is a subset of patent families where protection of the same invention is sought in at least two different countries. In this report, ‘patent families data’ refers to patent applications filed by residents in at least two IP offices; the data are scaled by PPP\$ GDP (billions). A ‘patent’ is a set of exclusive rights granted by law to applicants for inventions that are new, non-obvious, and commercially applicable. A patent is valid for a limited period of time (generally 20 years), during which patent holders can commercially exploit their inventions on an exclusive basis. In return, applicants are obliged to disclose their inventions to the public in a manner that enables others, skilled in the art, to replicate the invention. The patent system is designed to encourage innovation by providing innovators with time-limited exclusive legal rights, thus enabling them to appropriate the returns from their innovative activity.

Source: World Intellectual Property Organization, Intellectual Property Statistics; International Monetary Fund, World Economic Outlook Database, October 2016 (PPP\$ GDP) (2008–13). (<http://www.wipo.int/ipstats/>; <https://www.imf.org/external/pubs/ft/weo/2016/02/weodata/index.aspx>)

## 5.3 Knowledge absorption

### 5.3.1 Intellectual property payments

Charges for use of intellectual property n.i.e., payments (% of total trade)<sup>‡</sup> | 2015

Charges for the use of intellectual property not included elsewhere payments (% of total trade) according to the Extended Balance of Payments Services Classification EBOPS 2010—that is, code SH Charges for the use of intellectual property not included elsewhere as a

percentage of total trade. ‘Total trade’ is defined as the sum of total imports code G goods and code SOX commercial services (excluding government goods and services not included elsewhere) plus total exports of code G goods and code SOX commercial services (excluding government goods and services not included elsewhere), divided by 2. According to the sixth edition of the International Monetary Fund’s *Balance of Payments Manual*, the item ‘Goods’ covers general merchandise, net exports of goods under merchandising and nonmonetary gold. The ‘commercial services’ category is defined as being equal to ‘services’ minus ‘government goods and services not included elsewhere’. Receipts are between residents and nonresidents for the use of proprietary rights (such as patents, trademarks, copyrights, industrial processes and designs including trade secrets, franchises), and for licenses to reproduce or distribute (or both) intellectual property embodied in produced originals or prototypes (such as copyrights on books and manuscripts, computer software, cinematographic works, and sound recordings) and related rights (such as for live performances and television, cable, or satellite broadcast).

Source: World Trade Organization, *Trade in Commercial Services database*, based on the sixth (2009) edition of the International Monetary Fund’s *Balance of Payments Manual and Balance of Payments database* (2009–15). (<http://stat.wto.org/StatisticalProgram/WSDStatProgramSeries.aspx>; <http://www.oecd.org/std/its/EBOPS-2010.pdf>)

### 5.3.2 High-tech imports

High-tech net imports (% of total trade) | 2015

High-technology imports minus re-exports (% of total trade). The list of commodities contains technical products with a high intensity of R&D, based on the Eurostat classification, itself based on SITC Rev.4 and the Organisation for Economic Co-operation and Development (OECD) definition. Commodities belong to the following sectors: aerospace; computers & office machines; electronics, telecommunications; pharmacy; scientific instruments; electrical machinery; chemistry; non-electrical machinery; and armament.

Source: United Nations, COMTRADE database; Eurostat, Annex 5: High-tech aggregation by SITC Rev. 4, April 2009 (2010–15). (<http://comtrade.un.org/>; [http://ec.europa.eu/eurostat/cache/metadata/Annexes/htec\\_esms\\_an5.pdf](http://ec.europa.eu/eurostat/cache/metadata/Annexes/htec_esms_an5.pdf))

### 5.3.3 ICT services imports

Telecommunications, computers, and information services imports (% of total trade) | 2015

Telecommunications, computer and information services (% of total trade) according to the Extended Balance of Payments Services Classification EBOPS 2010, coded SI: Telecommunications, computer and information services.

Source: World Trade Organization, *Trade in Commercial Services database, based on the sixth (2009) edition of the International Monetary Fund's Balance of Payments Manual and Balance of Payments database (2009–15)*. (<http://stat.wto.org/StatisticalProgram/WSDStatProgramSeries.aspx>; <http://www.oecd.org/std/its/EBOPS-2010.pdf>)

### 5.3.4 Foreign direct investment net inflows

Foreign direct investment (FDI), net inflows (% of GDP, three-year average) | 2015

Foreign direct investment is the average of the most recent three years of net inflows of investment to acquire a lasting management interest (10 percent or more of voting stock) in an enterprise operating in an economy other than that of the investor. It is the sum of equity capital, reinvestment of earnings, other long-term capital, and short-term capital as shown in the balance of payments. This series shows net inflows (new investment inflows less disinvestment) in the reporting economy from foreign investors, and is divided by GDP.

Source: International Monetary Fund, *International Financial Statistics and Balance of Payments databases, World Bank, International Debt Statistics, and World Bank and OECD GDP estimates; extracted from the World Bank's World Development Indicators database (2013–15)*. (<http://data.worldbank.org/>)

### 5.3.5 Research talent in business enterprise

Researchers in business enterprise (%) | 2015

Full-time equivalence (FTE) researchers in the business enterprise sector refers to 'researchers' as professionals engaged in the conception or creation of new knowledge, products, processes, methods, and systems, as well as in the management of these projects, broken down by the sectors in which they are employed (business enterprise, government, higher education, and private non-profit organizations). In the context of R&D statistics, the business enterprise sector includes all firms, organizations, and institutions whose primary activity is the market production of goods or services (other than higher education) for sale to the general public at an economically significant

price, and the private non-profit institutions mainly serving them; the core of this sector is made up of private enterprises. This also includes public enterprises.

Source: UNESCO Institute for Statistics, *UIS online database (2007–15)*; (<http://data.uis.unesco.org>)

## 6 Knowledge and technology outputs

### 6.1 Knowledge creation

#### 6.1.1 Patent applications by origin

Number of resident patent applications filed at a given national or regional patent office (per billion PPP\$ GDP)<sup>3</sup> | 2015

'Patent' is defined in the description of indicator 5.2.5. A 'resident patent application' refers to an application filed with an IP office or an office acting on behalf of the state or jurisdiction in which the first-named applicant has residence. For example, an application filed with the Japan Patent Office (JPO) by a resident of Japan is considered a resident application for Japan. Similarly, an application filed with the European Patent Office (EPO) by an applicant who resides in any of the EPO member states, for example, Germany, is considered a resident application for that member state (Germany).

Source: World Intellectual Property Organization, *Intellectual Property Statistics; International Monetary Fund, World Economic Outlook Database, October 2016 (PPP\$ GDP) (2010–15)*. (<http://www.wipo.int/ipstats/>; <https://www.imf.org/external/pubs/ft/weo/2016/02/weodata/index.aspx>)

#### 6.1.2 PCT international applications by origin

Number of international patent applications filed by residents at the Patent Cooperation Treaty (per billion PPP\$ GDP)<sup>3</sup> | 2016

These are the number of Patent Cooperation Treaty (PCT) international patent applications filed through the WIPO-administered Patent Cooperation Treaty in 2016. A 'PCT international application' refers to a patent application filed through the WIPO-administered Patent Cooperation Treaty (PCT) during the international phase outlined by the PCT System. The origin of PCT applications are defined by the residence of the first-named applicant. The PCT System facilitates the filing of patent applications worldwide, making it possible to seek patent protection for an invention simultaneously in each of a large number

of countries by first filing a single international patent application.

Source: World Intellectual Property Organization, *Intellectual Property Statistics; International Monetary Fund, World Economic Outlook Database, October 2016 (PPP\$ GDP) (2014–16)*. (<http://www.wipo.int/ipstats/>; <https://www.imf.org/external/pubs/ft/weo/2016/02/weodata/index.aspx>)

#### 6.1.3 Utility model applications by origin

Number of utility model applications filed by residents at the national patent office (per billion PPP\$ GDP) | 2015

These are the number of resident utility model applications filed at a given national or regional patent office in 2014. A 'resident UM application' refers to an application filed with an IP office of, or an office acting on behalf of, the state or jurisdiction in which the first-named applicant has residence. For example, an application filed with the IP office of Germany by a resident of Germany is considered a resident application for Germany. A utility model grant is a special form of patent right issued by a state or jurisdiction to an inventor or the inventor's assignee for a fixed period of time. The terms and conditions for granting a utility model are slightly different from those for normal patents and include a shorter term of protection and less stringent patentability requirements. A utility model is sometimes referred to in certain countries as 'petty patents', 'short-term patents', or 'innovation patents'.

Source: World Intellectual Property Organization, *Intellectual Property Statistics; International Monetary Fund, World Economic Outlook Database, October 2016 (PPP\$ GDP) (2010–15)*. (<http://www.wipo.int/ipstats/>; <https://www.imf.org/external/pubs/ft/weo/2016/02/weodata/index.aspx>)

#### 6.1.4 Scientific and technical publications

Number of scientific and technical journal articles (per billion PPP\$ GDP)<sup>3</sup> | 2016

The number of scientific and engineering articles published in those fields, including: agriculture, astronomy, astrophysics, automation control systems, biochemistry molecular biology, biodiversity conservation, biotechnology applied microbiology, cell biology, chemistry, computer science, construction building technology, dentistry oral surgery medicine, engineering, environmental sciences, ecology, evolutionary biology, food science technology, general internal medicine, life sciences and biomedicine, marine freshwater biology, materials science, mathematical computational biology, mathematics, metallurgy and

metallurgical engineering, meteorology atmospheric science, microbiology, nuclear science and technology, plant sciences, radiology nuclear medicine medical imaging, reproductive biology, research experimental medicine, science and technology, telecommunications, telecommunications, transportation, and veterinary sciences. Article counts are from a set of journals covered by the Science Citation Index (SCI) and the Social Sciences Citation Index (SSCI). Articles are classified by year of publication and assigned to each country/economy on the basis of the institutional address(es) listed in the article. Articles are counted on a count basis (rather than a fractional basis)—that is, for articles with collaborating institutions from multiple countries/economies, each country/economy receives credit on the basis of its participating institutions. The data are reported per billion PPP\$ GDP.

Note: Formerly the Intellectual Property and Science business of Thomson Reuters, *Clarivate Analytics* is now an independent company.

Source: *Clarivate Analytics, special tabulations from Thomson Reuters, Web of Science, Science Citation Index (SCI) and Social Sciences Citation Index (SSCI); International Monetary Fund, World Economic Outlook Database, October 2016 (PPP\$ GDP) (2016).* (<https://apps.whoofknowledge.com>; <https://www.imf.org/external/pubs/ft/weo/2016/02/weodata/index.aspx>)

#### 6.1.5 Citable documents H index

The H index is the economy's number of published articles (H) that have received at least H citations<sup>a</sup> | 2016

The H index expresses the journal's number of articles (H) that have received at least H citations. It quantifies both journal scientific productivity and scientific impact, and is also applicable to scientists, journals, etc. The H index is tabulated from the number of citations received in subsequent years by articles published in a given year, divided by the number of articles published that year.

Source: *SCImago (2017) SJR—SCImago Journal & Country Rank*. Retrieved February 2017. (<http://www.scimagojr.com>)

## 6.2 Knowledge impact

### 6.2.1 Growth rate of GDP per person engaged

Growth rate of GDP per person engaged (constant 1990 PPP\$) | 2015

Growth of gross domestic product (GDP) per person engaged provides a measure of labour productivity (defined as output

per unit of labour input). GDP per person employed is GDP divided by total employment in the economy. PPP\$ GDP is converted to 1990 US\$, converted at Geary Khamis PPPs.

Source: *The Conference Board Total Economy Database™ Output, Labor and Labor Productivity, 1950–2016, May 2016.* (<https://www.conference-board.org/data/economydatabase/>)

### 6.2.2 New business density

New business density (new registrations per thousand population 15–64 years old)<sup>a</sup> | 2014

Number of new firms, defined as firms registered in the current year of reporting, per thousand population aged 15–64 years old.

Source: *World Bank, Doing Business 2016, Entrepreneurship (2009–14).* (<http://www.doingbusiness.org/data/exploretopics/entrepreneurship>)

### 6.2.3 Total computer software spending

Total computer software spending (% of GDP)<sup>a</sup> | 2016

Computer software spending includes the total value of purchased or leased packaged software such as operating systems, database systems, programming tools, utilities, and applications. It excludes expenditures for internal software development and outsourced custom software development. The data are a combination of actual figures and estimates. Data are reported as a percentage of GDP.

Source: *IHS Global Insight, Information and Communication Technology Database.* (<https://www.ihs.com/index.html>)

### 6.2.4 ISO 9001 quality certificates

ISO 9001 Quality management systems—Requirements: Number of certificates issued (per billion PPP\$ GDP)<sup>a</sup> | 2015

ISO 9001:2015 specifies requirements for a quality management system when an organization needs to demonstrate its ability to consistently provide products and services that meet customer and applicable statutory and regulatory requirements, and aims to enhance customer satisfaction through the effective application of the system, including processes for improvement of the system and the assurance of conformity to customer and applicable statutory and regulatory requirements. All the requirements of ISO 9001:2015 are generic and are intended to be applicable to any organization, regardless of its type or size, or the products and services it provides. The

data are reported per billion PPP\$ GDP. Refer to indicator 3.3.3 for more details.

Source: *International Organization for Standardization (ISO), The ISO Survey of Management System Standard Certifications, 1993–2015; International Monetary Fund, World Economic Outlook database, October 2016 (PPP\$ GDP) (2015).* (<http://www.iso.org>; <https://www.imf.org/external/pubs/ft/weo/2016/02/weodata/index.aspx>)

### 6.2.5 High-tech and medium-high-tech output

High-tech and medium-high-tech output (% of total manufactures output)<sup>a</sup> | 2014

High-tech and medium-high-tech output as a percentage of total manufactures output, on the basis of the Organisation for Economic Co-operation and Development (OECD) classification of Technology Intensity Definition, itself based on International Standard Industrial Classification ISIC Revision 3. The time periods of data for Iceland, Madagascar, and Pakistan include 2006 for heightened coverage based on these economies' GII 2016 data availability.

Source: *United Nations Industrial Development Organization (UNIDO), Industrial Statistics Database, 3- and 4-digit level of International Standard Industrial Classification ISIC Revision 3 (INDSTAT4 2016); OECD, Directorate for Science, Technology and Industry, Economic Analysis and Statistics Division, 'ISIC REV. 3 Technology Intensity Definition: Classification of Manufacturing Industries into Categories Based on R&D Intensities', 7 July 2011 (2006–14).* (<http://www.unido.org/statistics.html>; <http://unsstats.un.org/unsd/cr/registry/regcst.asp?cl=27>; <http://www.oecd.org/sti/ind/48350231.pdf>)

## 6.3 Knowledge diffusion

### 6.3.1 Intellectual property receipts

Charges for use of intellectual property n.i.e., receipts (% of total trade)<sup>a</sup> | 2015

Charges for the use of intellectual property not included elsewhere receipts (% of total trade) according to the Extended Balance of Payments Services Classification EBOPS 2010—that is, code SH Charges for the use of intellectual property not included elsewhere as a percentage of total trade. 'Total trade' is defined as the sum of total imports code G goods and code SOX commercial services (excluding government goods and services not included elsewhere) plus total exports of code G goods and code SOX commercial services (excluding government goods and services not included elsewhere), divided by 2. According to the sixth edition of the International Monetary Fund's *Balance of Payments*

*Manual*, the item ‘Goods’ covers general merchandise, net exports of goods under merchandising and nonmonetary gold. The ‘commercial services’ category is defined as being equal to ‘services’ minus ‘government goods and services not included elsewhere’. Receipts are between residents and nonresidents for the use of proprietary rights (such as patents, trademarks, copyrights, industrial processes, and designs including trade secrets, franchises), and for licenses to reproduce or distribute (or both) intellectual property embodied in produced originals or prototypes (such as copyrights on books and manuscripts, computer software, cinematographic works, and sound recordings) and related rights (such as for live performances and television, cable, or satellite broadcast).

Source: World Trade Organization, *Trade in Commercial Services database*, based on the sixth (2009) edition of the International Monetary Fund’s *Balance of Payments Manual and Balance of Payments database (2007–15)*. (<http://stat.wto.org/StatisticalProgram/WSDStatProgramSeries.aspx>; <http://www.oecd.org/std/its/EBOPS-2010.pdf>)

### 6.3.2 High-tech exports

High-tech net exports (% of total trade)<sup>a</sup> | 2015

High-technology exports minus re-exports (% of total trade). See indicator 5.3.2 for details.

Source: United Nations, *COMTRADE database*; Eurostat, *Annex 5: High-tech aggregation by SITC Rev. 4, April 2009 (2010–15)*. (<http://comtrade.un.org/>; [http://ec.europa.eu/eurostat/cache/metadata/Annexes/htec\\_esms\\_an5.pdf](http://ec.europa.eu/eurostat/cache/metadata/Annexes/htec_esms_an5.pdf))

### 6.3.3 ICT services exports

Telecommunications, computers, and information services exports (% of total trade)<sup>a</sup> | 2015

Telecommunications, computer and information services (% of total trade) according to the Extended Balance of Payments Services Classification EBOPS 2010, coded S1: Telecommunications, computer and information services.

Source: World Trade Organization, *Trade in Commercial Services database*, based on the sixth (2009) edition of the International Monetary Fund’s *Balance of Payments Manual and Balance of Payments database (2009–15)*. (<http://stat.wto.org/StatisticalProgram/WSDStatProgramSeries.aspx>; <http://www.oecd.org/std/its/EBOPS-2010.pdf>)

### 6.3.4 Foreign direct investment net outflows

Foreign direct investment (FDI), net outflows (% of GDP, three-year average)<sup>a</sup> | 2015

Foreign direct investment refers to the average of the most recent three years of direct investment equity flows in an economy. It is the sum of equity capital, reinvestment of earnings, and other capital. Direct investment is a category of cross-border investment associated with a resident in one economy having control or a significant degree of influence on the management of an enterprise that is resident in another economy. Ownership of 10 percent or more of the ordinary shares of voting stock is the criterion for determining the existence of a direct investment relationship. This series shows net outflows of investment from the reporting economy to the rest of the world, and is divided by GDP.

Source: International Monetary Fund, *Balance of Payments database*, supplemented by data from the United Nations Conference on Trade and Development and official national sources; extracted from the World Bank’s *World Development Indicators database (2013–15)*. (<http://data.worldbank.org/>)

limited to the jurisdiction of the IP office that registers the trademark. Trademarks can be registered by filing an application at the relevant national or regional office(s) or by filing an international application through the Madrid System. A resident trademark application is one that is filed with an IP office or an office acting on behalf of the state or jurisdiction in which the applicant has residence. For example, an application filed with the Japan Patent Office (JPO) by a resident of Japan is considered a resident application for Japan. Similarly, an application filed with the Office for Harmonization in the Internal Market (OHIM) by an applicant who resides in any of the EU member states, such as France, is considered a resident application for that member state (France).

Source: World Intellectual Property Organization, *Intellectual Property Statistics*; International Monetary Fund, *World Economic Outlook Database, October 2016 (PPP\$ GDP) (2010–15)*. (<http://www.wipo.int/ipstats/>; <https://www.imf.org/external/pubs/ft/weo/2016/02/weodata/index.aspx>)

### 7.1.2 Industrial designs by origin

Number of designs contained in industrial design applications filed at a given national or regional office (per billion PPP\$ GDP)<sup>a</sup> | 2015

This indicator refers to the number of designs contained in industrial design applications filed at a given national or regional office in 2015. Data refer to industrial design application design counts—the number of designs contained in applications—and include designs contained in resident industrial design applications filed at both the national office and at the regional office, where applicable. ‘Resident design counts’ refers to the number of designs contained in applications filed with the IP office of or at an office acting on behalf of the state or jurisdiction in which the applicant has residence. For example, an application filed with the Japan Patent Office (JPO) by a resident of Japan is considered a resident application for Japan. Similarly, an application filed with the Office for Harmonization in the Internal Market (OHIM) by an applicant who resides in any of the OHIM member states, such as Italy, is considered as a resident application for that member state (Italy).

Source: World Intellectual Property Organization, *Intellectual Property Statistics*; International Monetary Fund, *World Economic Outlook Database, October 2016 (PPP\$ GDP) (2013–15)*. (<http://www.wipo.int/ipstats/>; <https://www.imf.org/external/pubs/ft/weo/2016/02/weodata/index.aspx>)

## 7 Creative outputs

### 7.1 Intangible assets

#### 7.1.1 Trademark application class count by origin

Number of trademark applications issued to residents at a given national or regional office (per billion PPP\$ GDP) | 2015

The count of trademark applications is based on the total number of goods and services classes specified in resident trademark applications filed at a given national or regional office in 2015. Data refer to trademark application class counts—the number of classes specified in resident trademark applications—and include those filed at both the national office and the regional office, where applicable. Data are scaled by PPP\$ GDP (billions). A ‘trademark’ is a sign used by the owner of certain products or provider of certain services to distinguish them from the products or services of other companies. A trademark can consist of words and/or combinations of words, such as slogans, names, logos, figures and images, letters, numbers, sounds and moving images, or a combination thereof. The procedures for registering trademarks are governed by the legislation and procedures of national and regional IP offices. Trademark rights are



### 7.1.3 ICTs and business model creation

Average answer to the question: In your country, to what extent do ICTs enable new business models? [1 = not at all; 7 = to a great extent]<sup>†</sup> | 2016

Source: World Economic Forum, Executive Opinion Survey 2016–2017. (<https://www.weforum.org/reports/the-global-competitiveness-report-2016-2017-1>)

### 7.1.4 ICTs and organizational model creation

Average answer to the question: In your country, to what extent do ICTs enable new organizational models (e.g., virtual teams, remote working, telecommuting) within companies? [1 = not at all; 7 = to a great extent]<sup>†</sup> | 2016

Source: World Economic Forum, Executive Opinion Survey 2016–2017. (<https://www.weforum.org/reports/the-global-competitiveness-report-2016-2017-1>)

## 7.2 Creative goods and services

### 7.2.1 Cultural and creative services exports

Cultural and creative services exports (% of total trade)<sup>a</sup> | 2015

Creative services exports (% of total exports) according to the Extended Balance of Payments Services Classification EBOPS 2010—that is, EBOPS code S13 Information services; code SJ22 Advertising, market research, and public opinion polling services; code SK1 Audiovisual and related services; and code SK24 Other personal cultural and recreational services as a percentage of total trade. On the score for the United States of America (USA), this includes S13 Information services; the category Movies & TV programming from Table 2.1 (U.S. Trade in Services, BEA) in the absence of available data for code SK1 Audiovisual and related services (the category Movies & TV programming is specific to the USA in BPM6 statistics and does not have a code); Sports and performing arts (U.S. Trade in Services, BEA) is used instead of code SK24; Advertising (U.S. Trade in Services, BEA) is used instead of code SJ22.

Source: World Trade Organization, *Trade in Commercial Services database*, based on the sixth (2009) edition of the International Monetary Fund's *Balance of Payments Manual and Balance of Payments database*; Bureau of Economic Analysis (BEA) released October 2016 (2007–15). (<http://stat.wto.org/StatisticalProgram/WSDStatProgramSeries.aspx>; <http://www.oecd.org/std/its/EBOPS-2010.pdf>; <https://www.bea.gov/iTable/iTable.cfm>)

### 7.2.2 National feature films produced

Number of national feature films produced (per million population 15–69 years old)<sup>a</sup> | 2015

A film with a running time of 60 minutes or longer. It includes works of fiction, animation, and documentaries. It is intended for commercial exhibition in cinemas. Feature films produced exclusively for television broadcasting, as well as newsreels and advertising films, are excluded. Data are reported per million population 15–69 years old. For Cambodia, Cameroon, Madagascar, and Nigeria, this indicator covers only feature films in video format.

Source: UNESCO Institute for Statistics, *UIS online database*; United Nations, Department of Economic and Social Affairs, Population Division, *World Population Prospects: The 2015 Revision (population) (2008–15)*. (<http://data.uis.unesco.org>; <http://esa.un.org/unpd/wpp/>)

### 7.2.3 Global entertainment and media market

Global entertainment and media market (per thousand population 15–69 years old)<sup>a,d</sup> | 2015

The Global Entertainment and Media Outlook (the Outlook) provides a single comparable source of five-year forecast and five-year historic consumer and advertiser spending data and commentary for 13 entertainment and media segments, across 61 countries. The data and intuitive online functionality allow one to easily browse, compare and contrast spending, and create charts and graphs. The segments covered by the Outlook are book publishing, business-to-business, filmed entertainment, Internet access, Internet advertising, magazine publishing, music, newspaper publishing, out-of-home advertising, radio, TV advertising, TV subscriptions and license fees, and video games. The score and rankings for the Global Media Expenditures for the 60 countries considered in the Outlook report are based on advertising and consumer digital and non-digital data in US\$ millions at average 2015 exchange rates for the year 2015. These results are reported normalized per thousand population, 15–69 years old, for the year 2015. The figures for Algeria, Bahrain, the Islamic Republic of Iran, Jordan, Kuwait, Lebanon, Malta, Morocco, Oman, Qatar, Tunisia, and the Republic of Yemen were estimated from a total corresponding to Middle East and North Africa (MENA) countries using a breakdown of total GDP (current US\$) for the above-mentioned countries to define referential percentages.

Source: The source of the data for the base of these calculations was derived from PwC's *Global Entertainment and Media Outlook, 2016–2020*; United Nations, Department of Economic and Social Affairs, Population Division, *World Population Prospects: The 2015 Revision (population)*; World Economic Outlook Database, October 2016 (current US\$ GDP); Middle East & North Africa in World Bank's DataBank. (<http://www.pwc.com/outlook>; <http://esa.un.org/unpd/wpp/>; <https://www.imf.org/external/pubs/ft/weo/2016/02/weodata/index.aspx>; <http://data.worldbank.org/region/middle-east-and-north-africa>)

### 7.2.4 Printing and publishing output

Printing and publishing manufactures output (% of manufactures total output) | 2014

Publishing, printing, and reproduction of recorded media output (ISIC Rev. 3 code 22) as a percentage of total manufacturing output (ISIC rev.3 code D). The time periods of data for Iceland, Madagascar, and Pakistan include 2006 for heightened coverage based on these economies' GII 2016 data availability.

Source: United Nations Industrial Development Organization, *Industrial Statistics Database*; 2-digit level of International Standard Industrial Classification ISIC Revision 3 (INDSTAT2 2015) (2006–14). (<http://www.unido.org/statistics.html>; <http://unstats.un.org/unsd/cr/registry/regcst.asp?cl=2>)

### 7.2.5 Creative goods exports

Creative goods exports (% of total trade) | 2015

Total value of creative goods exports, net of re-exports (current US\$) over total trade. 'Total trade' is defined as the sum of total imports code G goods and code SOX commercial services (excluding government goods and services not included elsewhere) plus total exports of code G goods and code SOX commercial services (excluding government goods and services not included elsewhere), divided by 2. According to the sixth edition of the International Monetary Fund's *Balance of Payments Manual*, the item 'Goods' covers general merchandise, net exports of goods under merchanting and non-monetary gold. The 'commercial services' category is defined as being equal to 'services' minus 'government goods and services not included elsewhere'.

Source: United Nations, COMTRADE database; 2009 UNESCO Framework for Cultural Statistics, Table 3, International trade of cultural goods and services based on the 2007 Harmonised System (HS 2007); World Trade Organization, Trade in Commercial Services database, itself based on the sixth (2009) edition of the International Monetary Fund's Balance of Payments Manual and Balance of Payments database (2010–15). (<http://comtrade.un.org/>; <http://www.uis.unesco.org/culture/Documents/framework-cultural-statistics-culture-2009-en.pdf>; <http://stat.wto.org/StatisticalProgram/WSDStatProgramSeries.aspx>; <http://www.oecd.org/std/its/EBOPS-2010.pdf>)

## 7.3 Online creativity

### 7.3.1 Generic top-level domains (gTLDs)

Generic top-level domains (gTLDs) (per thousand population 15–69 years old) | 2016

A generic top-level domain (gTLD) is one of the categories of top-level domains (TLDs) maintained by the Internet Assigned Numbers Authority (IANA) for use in the Internet. Generic TLDs can be unrestricted (.com, .info, .net, and .org) or restricted—that is, used on the basis of fulfilling eligibility criteria (.biz, .name, and .pro). Of these, the statistic covers the five generic domains .biz, .info, .org, .net, and .com. Generic domains .name and .pro, and sponsored domains (.arpa, .aero, .asia, .cat, .coop, .edu, .gov, .int, .jobs, .mil, .museum, .tel, .travel, and .xxx) are not included. Neither are country-code top-level domains (refer to indicator 7.3.2).

The statistic represents the total number of registered domains (i.e., net totals by December 2016, existing domains + new registrations – expired domains). Data are collected on the basis of a 4% random sample of the total population of domains drawn from the root zone files (a complete listing of active domains) for each TLD. The geographic location of a domain is determined by the registration address for the domain name registrant that is returned from a whois query. These registration data are parsed by country and postal code and then aggregated to any number of geographic levels such as county, city, or country/economy. The original hard data were scaled by thousand population 15–69 years old. For confidentiality reasons, only normalized values are reported; while relative positions are preserved, magnitudes are not.

Source: ZookNIC Inc; United Nations, Department of Economic and Social Affairs, Population Division, World Population Prospects: The 2015 Revision (population). (<http://www.zooknic.com>; <http://esa.un.org/unpd/wpp/Excel-Data/population.htm>)

### 7.3.2 Country-code top-level domains (ccTLDs)

Country-code top-level domains (ccTLDs) (per thousand population 15–69 years old) | 2016

A country-code top-level domain (ccTLD) is one of the categories of top-level domains (TLDs) maintained by the Internet Assigned Numbers Authority (IANA) for use in the Internet. Country-code TLDs are two-letter domains especially designated for a particular economy, country, or autonomous territory (there are 324 ccTLDs, in various alphabets/characters). The statistic represents the total number of registered domains (i.e., net totals by December 2016, existing domains + new registrations – expired domains). Data are collected from the registry responsible for each ccTLD and represent the total number of domain registrations in the ccTLD. Each ccTLD is assigned to the country with which it is associated rather than based on the registration address of the registrant. ZookNIC reports that, for the ccTLDs it covers, 85–100% of domains are registered in the same country; the only exceptions are the ccTLDs that have been licensed for commercial worldwide use. Of this year's GII sample of countries, this is the case for the ccTLDs of the following economies: Argentina ar, Armenia am, Austria at, Bangladesh bd, Belarus by, Belgium be, Brazil br, Canada ca, Chile cl, China cn, Colombia co, Denmark dk, Estonia ee, Finland fi, France fr, Germany de, Greece gr, Guatemala gt, Hong Kong (China) hk, Iceland is, India in, Indonesia id, Islamic Republic of Iran ir, Israel il, Italy it, Latvia lv, Lithuania lt, Luxembourg lu, Malaysia my, Mauritius mu, Moldova md, Mongolia mn, Montenegro me, Nicaragua ni, Norway no, Peru pe, Poland pl, Republic of Korea kr, Romania ro, Serbia rs, Slovenia si, Spain es, Sri Lanka lk, Sweden se, Switzerland ch, Thailand th, Tunisia tn, Turkey tr, and Viet Nam vn (this list is based on [www.wikipedia.org](http://www.wikipedia.org)). Data are reported per thousand population 15–69 years old. For confidentiality reasons, only normalized values are reported; while relative positions are preserved, magnitudes are not.

Source: ZookNIC Inc; United Nations, Department of Economic and Social Affairs, Population Division, World Population Prospects: The 2015 Revision (population). (<http://www.zooknic.com>; <https://esa.un.org/unpd/wpp/>)

### 7.3.3 Wikipedia yearly edits

Wikipedia yearly edits by country (per million population 15–69 years old) | 2014

Data extracted from Wikimedia Foundation's internal data sources. For every country with more than 100,000 edit counts in 2016, the data from 2016 are used. For all other countries, the data from 2014 are utilized. The data excludes bot contributions to the extent that is identifiable in the data sources. Data are reported per million population 15–69 years old.

Source: Wikimedia Foundation; United Nations, Department of Economic and Social Affairs, Population Division, World Population Prospects: The 2012 Revision (population). (<https://wikimediafoundation.org>; <https://esa.un.org/unpd/wpp/>)

### 7.3.4 Video uploads on YouTube

Number of video uploads on YouTube (scaled by population 15–69 years old) | 2015

Total number of video uploads on YouTube, per country, scaled by population 15–69 years old. The raw data are survey based: the country of affiliation is chosen by each user on the basis of a multi-choice selection. This metric counts all video upload events by users. For confidentiality reasons, only normalized values are reported; while relative positions are preserved, magnitudes are not.

Source: Google, parent company of YouTube; United Nations, Department of Economic and Social Affairs, Population Division, World Population Prospects: The 2012 Revision (population). (<http://www.youtube.com>; <http://esa.un.org/unpd/wpp/Excel-Data/population.htm>; <http://www.comscore.com/Industries/Media>)



# Appendix IV

Technical Notes



## Technical Notes

### Audit by the Joint Research Centre of the European Commission

The Joint Research Centre (JRC) of the European Commission has researched extensively on the complexity of composite indicators ranking economies' performances along policy lines. For the seventh consecutive year, the JRC has agreed to perform a thorough robustness and sensitivity analysis of the Global Innovation Index (GII) to look at some structural changes made to the list of indicators by the GII developing team (see Table 1 of Annex 2 to Chapter 1 for more details).

The recommendations from the JRC audit of the 2016 GII model were reviewed and incorporated into the 2017 GII model. Expanding on recommendations included in the GII 2016, this year an economy must have a minimum symmetric data coverage of at least 36 indicators in the Innovation Input Sub-Index (66%) and 18 indicators in the Innovation Output Sub-Index (66%), and it must have scores for at least two sub-pillars per pillar. The GII rules on data requirements will be continually strengthened in future years, incentivizing countries to further improve their data collection.

A final audit was performed in May 2017 on the 2017 GII model, the results of which are included in Annex 3 to Chapter 1.

### Composite indicators

The GII relies on seven pillars. Each pillar is divided into three sub-pillars, and each sub-pillar is composed of two to five individual indicators. Each sub-pillar score is calculated as the weighted average of its individual indicators. Each pillar score is calculated as the weighted average of its sub-pillar scores.

The notion of weights as importance coefficients was, as in the previous three years, discarded to ensure a greater statistical coherence of the model, following the recommendations of the JRC.<sup>1</sup>

The GII includes three indices and one ratio:

1. The Innovation Input Sub-Index is the simple average of the first five pillar scores.
2. The Innovation Output Sub-Index is the simple average of the last two pillar scores.
3. The Global Innovation Index is the simple average of the Input and Output Sub-Indices.
4. The Innovation Efficiency Ratio is the ratio of the Output Sub-Index over the Input Sub-Index.

Country/economy rankings are provided for indicator, sub-pillar, pillar, and index scores.

The Innovation Efficiency Ratio serves to highlight those economies that have achieved more with less as well as those that lag behind in terms of achieving their innovation

potential. In theory, assuming that innovation results go hand in hand with innovation enablers, efficiency ratios should evolve around the number one. This measure thus allows us to complement the GII by providing an insight that should be neutral to the development stages of economies.<sup>2</sup>

### Individual indicators

The model includes 81 indicators, which fall into the following three categories:

1. quantitative/objective/hard data (57 indicators),
2. composite indicators/index data (19 indicators), and
3. survey/qualitative/subjective/soft data (5 indicators).

### Hard data

Hard data series (57 indicators) are drawn from a variety of public and private sources such as United Nations agencies, including the United Nations Educational, Scientific and Cultural Organization (UNESCO), the United Nations Industrial Development Organization (UNIDO), the World Intellectual Property Organization (WIPO), the World Bank, the Joint Research Centre of the European Commission (JRC), PwC, Bureau van Dijk (BvD), Thomson Reuters, IHS Global Insight, and Google.

Indicators are often correlated with population, gross domestic

product (GDP), or some other size-related factor; they require scaling by some relevant size indicator for economy comparisons to be valid. Most indicators are either scaled at the source or do not need to be scaled; for the rest, the scaling factor was chosen to represent a fair picture of economy differences. This affected 40 indicators, which can be broadly divided into four groups:

1. Indicators 2.1.1, 2.3.2, 3.2.3, 4.1.2, 4.1.3, 4.2.2, 5.1.3, 5.3.4, 6.2.3, and 6.3.4 were scaled by GDP in current US dollars.<sup>3</sup>
2. The count variables 3.3.3, 4.2.3, 5.2.4, 5.2.5, 6.1.1, 6.1.2, 6.1.3, 6.1.4, 6.2.4, 7.1.1, and 7.1.2 were scaled by GDP in purchasing power parity current international dollars (PPP\$ GDP). This choice of denominator was dictated by a willingness to appropriately account for differences in development stages; in addition, scaling these variables by population would improperly bias results to the detriment of economies with large young or large ageing populations.<sup>4</sup>
3. Variables 3.2.1, 5.1.5, 6.2.2, 7.2.2, 7.2.3, 7.3.1, 7.3.2, 7.3.3, and 7.3.4 were scaled by population (total population for 3.2.1, population 25+ years old for 5.1.5, population 15–64 years old for 6.2.2, and population 15–69 years old for the rest).<sup>5</sup>
4. Sectoral indicators 5.3.1, 5.3.2, 5.3.3, 6.3.1, 6.3.2, 6.3.3, 7.2.1, and 7.2.5 were scaled by total trade; indicators 6.2.5 and 7.2.4 were scaled by the total unit corresponding to the particular statistic.<sup>6</sup>

### Indices

Composite indicators come from a series of specialized agencies and academic institutions such as the World Bank, the International Telecommunication Union (ITU), the UN Public Administration Network (UNPAN), and Yale and Columbia Universities. Statisticians discourage the use of an ‘index within an index’ on two main grounds: the distorting effect of the use of different computing methodologies and the risk of duplicating variables. The normalization procedure partially solves for the former (more on this below). To avoid incurring the mistake of including a particular indicator more than once (directly and indirectly through a composite indicator), only indices with a narrow focus (19 in total) were selected.

Any remaining downside is outweighed by the gains in terms of model parsimony, acknowledgement of expert opinion, and focus on multi-dimensional phenomena that can hardly be captured by a single indicator.<sup>7</sup>

### Survey data

Survey data are drawn from the World Economic Forum’s Executive Opinion Survey (EOS). Survey questions are drafted to capture subjective perceptions on specific topics; five EOS questions were retained to capture phenomena strongly linked to innovative activities for which hard data either do not exist or have low economy coverage.

### Country/economy coverage and missing data

This year’s GII covers 127 economies, which were selected on the basis of the availability of data. Economies with a minimum indicator coverage of 36 indicators in the

Innovation Input Sub-Index (66%) and 18 indicators in the Innovation Output Sub-Index (66%) were retained. This minimum data coverage threshold rule was adjusted—on the recommendation of the JRC—from the 60% minimum coverage for both Sub-Indices introduced in the GII 2016—to maintain and improve the significance of both the GII results and the country sample. In addition, all selected countries are required to have scores for at least two sub-pillars per pillar.

The last record available for each economy was considered, with a cut-off at year 2007, with four exceptions: indicators 2.2.2, 5.1.2, 6.2.5, and 7.2.4, for which time periods were extended to 2006.<sup>8</sup>

For the sake of transparency and replicability of results, no additional effort was made to fill missing values. Missing values are indicated with ‘n/a’ and are not considered in the sub-pillar score. However, the JRC audit assessed the robustness of the GII modelling choices (i.e., no imputation of missing data, fixed predefined weights, and arithmetic averages) by imputing missing data, applying random weights, and using geometric averages. Since 2012, on the basis of this assessment, a confidence interval is provided for each ranking in the GII as well as the Input and Output Sub-Indices (see Annex 3 to Chapter 1).

### Treatment of series with outliers

Potentially problematic indicators with outliers that could polarize results and unduly bias the rankings were treated according to the rules listed below, following the recommendations of the JRC. This affected a total of 33 indicators; 31 out of the 57 hard data indicators and 2 out of the 19 composite indicators.

**First rule: Selection**

The identification of indicators as problematic used skewness or kurtosis. The problematic indicators had either:

- an absolute value of skewness greater than 2.25, or
- a kurtosis greater than 3.5.<sup>9</sup>

**Second rule: Treatment**

Series with one to five outliers (28 cases) were winsorized: The values distorting the indicator distribution were assigned the next highest value, up to the level where skewness and/or kurtosis entered within the ranges specified above.<sup>10</sup>

With one exception (see note 10) for series with five or more outliers (5 cases), skewness and/or kurtosis entered within the ranges specified above after multiplication by a given factor  $f$  and transformation by natural logs.<sup>11</sup> Since only ‘goods’ were affected (i.e., indicators for which higher values indicate better outcomes, as opposed to ‘bads’), the formula used was:

$$\ln \left[ \frac{(\max \times f - 1) (\text{economy value} - \min)}{\max - \min} + 1 \right]^{12}$$

where ‘min’ and ‘max’ are the minimum and maximum indicator sample values.

**Normalization**

The 81 indicators were then normalized into the [0, 100] range, with higher scores representing better outcomes. Normalization was made according to the min-max method, where the min and max values were given by the minimum and maximum indicator sample values respectively, except for index and survey data, for which the original series’ range of values was kept as min and max values (for example, [1, 7] for the World Economic Forum Executive

Opinion Survey questions; [0, 100] for World Bank’s World Governance Indicators; [0, 10] for ITU indices, etc.). The following formula was applied:

**• Goods:**

$$\frac{\text{economy value} - \min}{\max - \min} \times 100$$

**• Bads:**

$$\frac{\max - \text{economy value}}{\max - \min} \times 100$$

**Notes**

- 1 Paruolo et al. (2013) show that a theoretical inconsistency exists between the real theoretical meaning of weights and the meaning generally attributed to them by the standard practice in constructing composite indicators that use them as importance coefficients in combination with linear aggregation rules. The approach followed in the GII this year, in the last several years, is to assign weights of 0.5 or 1.0 to each component in a composite to ensure the highest correlations between them (i.e., indicator/sub-pillar, sub-pillar/pillar, etc.). Two sub-pillars (7.2 Creative goods and services, and 7.3 Online creativity) and 35 indicators (1.2.1, 1.2.2, 2.1.4, 2.1.5, 2.2.1, 2.2.3, 3.2.1, 3.2.2, 3.3.3, 4.2.2, 4.2.3, 4.3.1, 4.3.2, 5.1.3, 5.1.4, 5.1.5, 5.2.1, 5.2.4, 5.2.5, 5.3.1, 6.1.1, 6.1.2, 6.1.4, 6.1.5, 6.2.2, 6.2.3, 6.2.4, 6.2.5, 6.3.1, 6.3.2, 6.3.3, 7.1.2, 7.2.1, 7.2.2, and 7.2.3) are weighted 0.5; the rest have a weight of 1.0.
- 2 To account for differences in development, other composite indicators use weighting schemes differentiated by income level.
- 3 These indicators are expenditure on education (2.1.1); gross expenditure on R&D (GERD) (2.3.2); gross capital formation (3.2.3); domestic credit to private sector (4.1.2); microfinance institutions’ gross loan portfolio (4.1.3); market capitalization (4.2.2); GERD performed by business enterprise (5.1.3); foreign direct investment net inflows (5.3.4); total computer software spending (6.2.3); and foreign direct investment net outflows (6.3.4).
- 4 These count variables are mainly indicators that increase disproportionately with economic growth. They include: ISO 14001 environmental certificates (3.3.3); venture capital deals (4.2.3); joint venture/strategic alliance deals (5.2.4); patent families filed in two or more offices (5.2.5); patent applications by origin (6.1.1); PCT applications by origin (6.1.2); utility model applications by origin (6.1.3); scientific and technical publications (6.1.4); ISO 9001 quality certificates (6.2.4); trademark application class count by origin (7.1.1); and industrial designs by origin (7.1.2).
- 5 These variables are electricity output (3.2.1); females employed with advanced degrees (5.1.5); new business density (6.2.2); national feature films produced (7.2.2); global entertainment and media market (7.2.3); generic (7.3.1) and country-code (7.3.2) top-level Internet domains; Wikipedia yearly edits (7.3.3); and video uploads on YouTube (7.3.4).
- 6 Intellectual property payments (5.3.1); high-tech imports less re-imports (5.3.2); ICT services imports (5.3.3); intellectual property receipts (6.3.1); high-tech exports less re-exports (6.3.2); ICT services exports (6.3.3); cultural and creative services exports (7.2.1); and creative goods exports (7.2.5) were scaled by total trade; high-tech and medium-high-tech output (6.2.5) and printing and publishing output (7.2.4) were scaled by total manufactures output.
- 7 For example, GII sub-pillar 3.1 Information and communication technologies (ICTs) is composed of four indices: ITU’s ICT Access and Use sub-indices and UNPAN’s Government Online Service and E-Participation indices. The first two are components of ITU’s ICT Development Index together with an ICT skills sub-index that was not considered, because it duplicates GII pillar 2. Similarly, the Online Service Index is a component of UNPAN’s E-Government Development Index together with two indices on Telecommunication Infrastructure and Human Capital that were not considered, because they duplicate GII pillars 3 and 2, respectively. The e-Participation Index was developed separately by UNPAN in 2010.

- 8 Indicator 2.2.2 (graduates in science and engineering): Because of the change in ISCED fields of classification and the transition to new questionnaires, when countries did not report detailed data, the UIS was not able to re-assign numbers into new field classifications. As a result, the UIS was not able to produce this indicator for these countries, so—per the recommendation of the UIS—the dataset from the GII 2016 was used. There was one economy affected: Hong Kong (China). Indicator 5.1.2 (firms offering formal training): The time period of data for Guinea includes 2006 for heightened coverage based on this economy's GII 2016 data availability. Indicator 6.2.5 (high-tech and medium-high-tech output) and indicator 7.2.4 (printing and publishing output): The time periods of data for Iceland, Madagascar, and Pakistan for these indicators include 2006 for heightened coverage based on these economies' GII 2016 data availability.
- 9 Based on Groeneveld and Meeden (1984), which sets the criteria of absolute skewness above 1 and kurtosis above 3.5. The skewness criterion was relaxed to account for the small sample at hand (127 economies).
- 10 This distributional issue affects the following variables: 1.2.3, 3.2.1, 3.3.3, 4.2.2, 5.3.2, 5.3.3, 6.1.5, 6.2.1, 6.2.2, 6.3.2, 7.1.1, 7.2.4, and 7.3.1 (1 outlier); 5.3.1, 7.2.1, 7.2.2, and 7.3.2 (2 outliers); 2.2.3, 4.1.3, 4.2.3, 5.2.5, 6.1.1, 6.1.2, 6.1.3, 6.2.5, and 6.3.3 (3 outliers); and 7.1.2 (4 outliers). The treatment criterion was relaxed this year to allow a single series (6.3.4) with 7 outliers—6 outliers given the next highest value and 1 given the next lowest value—to be winsorized instead of subjected to natural log transformation. This is because applying a log transformation at 1, 10, and 100 had the reverse effect, and instead of reducing skewness and kurtosis, it increased them.
- 11 This distributional issue affects variables 2.3.3, 4.3.3, 5.3.4, 6.3.1, and 7.2.5 (factor  $f$  of 1).
- 12 The corresponding formula for bads is:

$$\ln \left[ \frac{(\max \times f - 1) \times (\max - \text{economy value})}{\max - \min} + 1 \right]$$

These formulas achieve two things: converting all series into 'goods' and scaling the series to the range [1, max] so that natural logs are positive starting at 0.

## References

- Groeneveld, R. A. and G. Meeden. 1984. 'Measuring Skewness and Kurtosis'. *The Statistician* 33: 391–99.
- Paruolo P., M. Saisana, and A. Saltelli. 2013. 'Ratings and Rankings: Voodoo or Science?' *Journal of the Royal Statistical Society A* 176(2), doi: 0964–1998/13/176000.



# Appendix **v**

About the Authors



## About the Authors

**Robson Braga de Andrade** is President of the National Confederation of Industry (CNI), Director of the Social Services for the Industry (SESI), President of the Board of the National Service for Industrial Training (SENAI), and President of the Orteng Group, a leading company that has produced equipment for energy, oil, gas, mining, steel, sanitation, telecommunications, and transport sectors for over 30 years. He is a member of the Economic and Social Development Council of the Presidency of the Republic (CDES) and a member of the National Council of Industrial Development (CNDI). He was Vice-President of CNI from 2002 until 2010, President of the State Federation of Industries of Minas Gerais (FIEMG) from 2002 to 2010; a member of Minas Gerais State Economic and Social Development Council; Director of the Latin American Business Council (CEAL) from 2004 to 2006; President of the Association of the Electrical Appliances and Electronics Industry (Sinaees) from 2004 until 2010; a member of the Brazilian Association of Infrastructure and Basic Industries (ABDIB) Strategic Council from 2001 to 2003; and a member of the Brazilian Association of Electric and Electronic Industry (Abinee) Board from 2001 until 2004. He graduated in Mechanical Engineering from the Federal University of Minas Gerais (UFMG) and has postgraduate diplomas in Strategic Management for Business Leaders from the Dom Cabral Foundation, in Minas Gerais State, and from INSEAD, France.

**Kyle Bergquist** is a Data Analyst in the Economics and Statistics Division of the World Intellectual Property Organization (WIPO). Mr Bergquist holds a Master of Science in Economics from the University of Neuchâtel in Switzerland and a Bachelor of Arts in Political Science from the University of Nevada in the United States. Prior to working at WIPO, Mr Bergquist was a data analyst for the patient safety department at CRICO, the malpractice insurance company for the Harvard medical community, where his research focused on the occurrence and prevention of adverse medical events as well as risk assessment. His research topics of interest are intellectual property, environmental policy, and economic geography.

**Rosario Castañón** holds degrees in Chemical Engineering, a Master's degree in Planning, and a PhD in Business Administration from the National University of Mexico (UNAM). She worked as a technical information analyst at INFOTEC and Head of UNAM's Technology Transfer Department. Currently she is Senior Researcher at the Center for Applied Science and Technological Development. She has been a consultant for the European Patent Office and the World Intellectual Property Organization as well as for private Mexican firms. She coordinated a programme to generate SME innovation projects in the field of chemistry in the State of Mexico. Based on this experience, she participated in CONACYT's project for the development of Mexico's state innovation agendas as well as the North Mexico's Innovation Agendas for the Agri-food Sector. She teaches Management of Technology at UNAM and the Iberoamerican University as well as specialized courses on intellectual property management and competitive intelligence.

**Delgermaa Chuluunbaatar** is an Agricultural Extension Officer at the Food and Agriculture Organization of the United Nations (FAO). She has 18 years of experience working in areas of agri-food systems, agronomy, agricultural extension, and innovation systems. She has a PhD in Interdisciplinary Studies with focus on rural development and agricultural extension.

**Sónia Dias** is a Senior Plant Genetic Resources and Knowledge Management Expert in the Research and Extension Unit at the Food and Agriculture Organization of the United Nations (FAO). She coordinates the knowledge management activities of the Research and Extension Unit at FAO. Ms Dias holds an MSc on Plant Genetic Resources for Conservation and Utilization from Birmingham University, United Kingdom, and has more than 15 years of experience with FAO, CGIAR, and the National Agricultural Research Institute in Portugal.

**Guilherme Afif Domingos** is the President-Director of Sebrae Nacional. He holds a Bachelor's degree in Business Administration from the School of Economics, Colégio São Luís. Mr Domingos has been fighting for more than 40 years to simplify and improve the business environment for micro and small companies in Brazil. He was the Chairman of *Bem Mais Simples Brasil* programme's council, and held the position of Chief Minister of the Secretariat for Micro and Small Enterprises of the Presidency of the Republic between May 2013 and September 2015. Between 2011 and 2014, he was Vice-Governor of São Paulo. He has held several positions in government departments of the State of São Paulo, was the President of the Confederation of Trade Associations of Brazil (CACB), President of the Federation of Commercial Associations of São Paulo State (FACESP), and President of the Trade Association of São Paulo (ACSP). He ran for Senate in 2006 and received more than 8 million votes. In 1986, he was the third most voted federal constituent deputy. Mr Domingos was a candidate for the Presidency of the Republic in 1989, when he received more than 3.2 million votes. In 1979, he was in charge of the presidency of the Development Bank of the State of São Paulo (Badesp). Between 1990 and 2007 he was the President-Director of Indiana Seguros, a company founded by his grandfather in the 1940s.

**Marcos Domínguez-Torreiro** is a Research Fellow at the Competence Centre on Composite Indicators and Scoreboards (COIN) of the Joint Research Centre of the European Commission (Italy), where he conducts research and policy support tasks in the field of Econometrics and Applied Statistics. After his undergraduate studies in Economics and Business Administration, he completed his doctoral thesis in Applied Economics at the University of Vigo, Spain. His past work experience includes the private sector, universities, and public administration. He has co-authored books and research articles dealing with finance, consumer behaviour, environmental and natural resource economics, rural development, and institutional economics.

**Soumitra Dutta** is the Founding Dean of the Cornell SC Johnson College of Business at Cornell University. Previously he was the Anne and Elmer Lindseth Dean at the Samuel Curtis Johnson Graduate School of Management at Cornell University, New York. Prior to July 2012, he was the Roland Berger Chaired Professor of Business and Technology at INSEAD and the founding director of eLab, a centre of excellence in the digital economy. His current research is on technology strategy and innovation policies at both corporate and national levels. He has won several awards for research and pedagogy and is actively involved in strategy and policy consulting. His research has been showcased in the global media and he has received a number of awards, including the Light of India Award '12 (from the Times of India media group) and the Global Innovation Award '13 (from INNOVEX in Israel). Professor Dutta obtained his PhD in Computer Science and his MSc in Business Administration from the University of California at Berkeley.

**Julius Ecuru**, PhD, is an expert in technological innovation systems. He is currently Head of the Bioresources Innovation Network for Eastern Africa Development (BioInnovate Africa) Programme, which is based at the International Centre of Insect Physiology and Ecology (*icipe*) in Nairobi, Kenya. BioInnovate is a regional initiative that supports scientists at universities, public research institutes, and firms in Burundi, Ethiopia, Kenya, Rwanda, Tanzania, and Uganda to connect bio-based ideas and technologies to business and the market in the sectors of agriculture, environment, and industry. Dr Ecuru has been working for the Uganda National Council for Science and Technology as Assistant Executive Secretary in research and innovation. He has a unique blend of expertise that encompasses research, innovation, and industrial policy development. He is active in national, regional, and international discussions on bioscience innovation systems and policies. His research interests include understanding and designing innovation eco-systems that support the development and use of bio-based technologies for inclusive growth and sustainable development in low- and middle-income countries, specifically in Africa. His work is at the nexus of industry, agriculture, and the environment. Dr Ecuru is also a non-resident fellow of the African Centre for Technology Studies, and a board member of the East Africa Resilient Africa Network, which promotes local innovative solutions for communities' resilience against natural and human-induced stresses.

**Harold van Es** is a Professor and former Chair of Soil and Crop Sciences at Cornell University, USA. He received degrees from the University of Amsterdam, Iowa State University, and North Carolina State University. His current work focuses on precision agricultural management using digital technologies. He is the lead inventor for the computational nitrogen advisor Adapt-N, a comprehensive soil health test, as well as several field research methods. He has published over 120 peer-reviewed papers and chapters (Google Scholar h-index=33), co-authored a widely read book on sustainable soil management (*Building Soils for Better Crops*), and advised 50 graduate students. He was the 2016 President of the Soil Science Society of America, and is a fellow of that society as well as of the American Society of Agronomy.

**Rafael Escalona Reynoso** has been Lead Researcher at the Global Innovation Index since October 2013. His previous professional experience includes working as Economic and Science and Technology Policy Advisor to the Senate of Mexico and as a member of the Trade and Foreign Investment Advisory Board at the office of the President of Mexico. His research experience at Cornell University includes comparative studies between Mexico and Spain on the regulatory aspects of modern biotechnology and the biosafety of genetically modified organisms (GMOs), and on the reach of intellectual property rights (IPRs) in the information technologies era. He holds a PhD in Regional Planning and a Master of Public Administration from Cornell University as well as a BA in Economics from Universidad Panamericana in Mexico.

**Carsten Fink** is the Chief Economist of the World Intellectual Property Organization (WIPO) based in Geneva. Before joining WIPO, he was Professor of International Economics at the University of St. Gallen. He has also held the positions of Visiting Professor at the Fondation Nationale des Sciences Politiques (Sciences Po) in Paris and Visiting Senior Fellow at the Group d'Économie Mondiale, a research institute at Sciences Po. Prior to his academic appointments, Dr Fink worked for more than 10 years at the World Bank. Among other positions, he was a Senior Economist in the International Trade Team of the World Bank Institute, working out of the World Bank's office in Geneva, and an Economist in the Trade Division of the World Bank's research department, based in Washington, DC. Dr Fink's research work—focused on intellectual property, innovation, and international trade—has been published in academic journals and books. He holds a Doctorate in Economics from the University of Heidelberg in Germany and a Master of Science in Economics from the University of Oregon in the United States of America.

**Samy Gaiji** is a Senior Agricultural Research Officer and Head of the the Food and Agriculture Organization of the United Nations (FAO)'s Research and Extension Unit. Mr Gaiji holds an MSc degree in Agronomy and Genetics from SupAgro (Montpellier) and AgroParis Tech (Paris), France. He has brought an extensive experience in Agriculture Research and Innovation Systems (ARIS) to his 25-year career in private breeding companies, CIRAD, FAO, the United Nations Environment Programme (UNEP), the World Bank, and CGIAR.

**Kavery Ganguly** is a part-time Senior Consultant working with the Policy Advocacy and Research team at the Confederation of Indian Industry (CII) – Jubilant Bhartia Food and Agriculture Centre of Excellence (FACE). Her focus areas include policy issues related to marketing, high-value chains, food-grain management, and the role of business models in securing food and nutrition security in India. Prior to joining CII, she worked with the International Food Policy Research Institute (IFPRI) from 2004 to 2011 on various issues related to the social safety net, biofuels, value chains, and the overall agricultural policy environment in India and South Asia. Ms Ganguly has been working in the area of policy research for the past 13 years on issues related to food and agriculture and their socioeconomic implications. During this time, she has co-authored several papers, book chapters, media articles, and research reports and also participated in various national and international workshops. Ms Ganguly completed her Master's degree in Economics (International Trade with Specialization in World Economy) from the School of International Studies, Jawaharlal Nehru University, New Delhi.

**Leonid Gokhberg** is First Vice-Rector of the Higher School of Economics (HSE)—one of the most prominent research universities in Russia. He is also Director of the HSE Institute for Statistical Studies and Economics of Knowledge (ISSEK). Professor Gokhberg's area of expertise is statistics and indicators on science, technology, and innovation as well as foresight and policy studies in this area. He has authored over 400 publications in Russian and international peer-reviewed journals, monographs, and university textbooks. Professor Gokhberg has coordinated dozens of national and international projects, including some aimed at establishing statistical frameworks for measuring innovation in industry; services and agriculture; and engineering and industrial design, emerging technologies and nanotechnology in particular; national S&T Foresight-2025 and 2030, sectorial and regional foresight and roadmapping exercises; understanding innovation behaviour of companies; surveying public awareness of S&T and innovation; and developing methodologies for evaluating public research institutions, measuring efficiency of S&T policies, and so on, funded by public agencies, businesses, and international organizations. Professor Gokhberg has served as a consultant of the OECD, Eurostat, UNESCO, and other international and national agencies. He is also a member of the GII Advisory Board, the OECD Government Foresight Network, and OECD and Eurostat working groups and task forces on indicators for S&T and innovation and information society and education, as well as steering committees of various prestigious international and national initiatives. Professor Gokhberg is Editor-in-Chief of the Scopus-indexed scientific journal *Foresight and STI Governance* (<https://foresight-journal.hse.ru/en/>) and editor of the Springer academic book series *Science, Technology, and Innovation Studies* (<http://www.springer.com/series/13398>), and he participates on the editorial boards of several other influential journals. He holds PhD and Dr. of Sc. degrees in Economics.

**Miguel I. Gómez** is an Associate Professor at Cornell University and concentrates his research and extension programme on two interrelated areas under the umbrella of food marketing and distribution: One is Food Value Chains Competitiveness and Sustainability. His work in this area involves multi-disciplinary collaborations; his primary contribution is the development of models to assess supply chain performance in multiple dimensions: economic, social, and environmental. The second area is Food Value Chain Negotiation, where he combines theory and outreach methods, emphasizing key concepts such as price transmission, demand response, buyer-seller negotiations, market power, and retail performance. In addition, his research in this area extends to economic development. Specifically, he examines the incentives and barriers of smallholder farmer participation in food value chains with an emphasis on Latin America. His research and extension programme is both domestic and international in scope, the latter emphasizing food value chains in Latin America and the Caribbean. In addition, his applied research efforts aim at enhancing market opportunities for horticultural products (fruits, vegetables, and ornamentals), benefiting producers, food processors/distributors, and consumers worldwide.

**Christian Grovermann** is an Agricultural Economist at the Research Institute of Organic Agriculture (FiBL) in Switzerland. Until March 2017 he worked at the Research and Extension Unit of the Food and Agriculture Organization of the United Nations (FAO) on the development and piloting of instruments for assessing agricultural innovation systems. He holds an MSc in Sustainable Resource Management and a PhD in Agricultural Economics from the University of Hohenheim, Germany, where he carried out research on the evaluation of pesticide reduction strategies.

**Francesca Guadagno** is an Economist at the World Intellectual Property Organization (WIPO). Her research interests cover the broad area of innovation and development, with a focus on the role of public policies. Before joining WIPO, she was a consultant at the Globalization and Development Strategies Division of UNCTAD. She has considerable experience in policy-oriented research, working with the Asian Development Bank, the Dutch Ministry of Foreign Affairs, the Gates Foundation, the E15 Initiative, the ECDPM, UNIDO, and WIPO. Dr Guadagno holds a Master of Economics and Management of Innovation from Bocconi University (Milan, Italy), a second Master of Management of Innovation from the Rotterdam School of Management (the Netherlands), and a PhD in Innovation Studies and Development from UNU-MERIT and Maastricht University (School of Business and Economics).

**Yuko Harayama** is an Executive Member of the Council for Science, Technology and Innovation (CSTI) at the Cabinet Office in Japan. Prior to joining the CSTI, she spent two years at the Organisation for Economic Co-operation and Development (OECD) as the Deputy Director of the Directorate for Science, Technology and Industry (STI), and 10 years at the Graduate School of Engineering of Tohoku University as a professor of Science and Technology Policy. In Japan, she served as a member of different commissions related to Science, Technology and Innovation at Cabinet Office and ministerial levels. Her experience prior to Tohoku University includes being a Fellow at the Research Institute of Economy, Trade and Industry in Japan and an Assistant Professor in the Department of Political Economy at the University of Geneva. Dr Harayama holds a PhD in Education Sciences and a PhD in Economics, both from the University of Geneva. She received Chevalier de la Légion d'honneur in 2011 and was awarded an honorary doctorate from the University of Neuchâtel in 2014.

**Barry H. Jaruzelski** is a Thought Leader with Strategy&, PwC's strategy consulting business, where he advises senior high-tech and industrial executives on corporate and innovation strategy. He is a Principal with PwC US, based in Florham Park, New Jersey. In 2013, Mr Jaruzelski was named one of the 'Top 25 Consultants' by *Consulting* magazine. He was also awarded the Gold Medal for Original Research by the American Association of Business Press Editors for the 2012 instalment of the Global Innovation 1000, a study he created in 2005. He has been a guest lecturer on the challenges of innovation at Harvard, Wharton, Columbia, MIT-Sloan, NYU-Stern, and UVA-Darden business schools. He often appears as an expert commentator on ABC News, CNBC, CNN, NPR and BBC, and has authored articles on innovation published in *Scientific American*, *Financial Times*, *Forbes*, *Fortune*, *Wired*, *All China Review*, and *strategy+business*, among others. He holds a BS from the University of Pennsylvania's Wharton School and an MBA from Columbia University.

**Tom Johnson** is a Principal with PwC US, based in Minneapolis, Minnesota. He leads PwC's US advisory agribusiness segment, including coordinating client engagements across the global PwC network, facilitating thought leadership on agribusiness trends, and tracking merger and acquisition activities and emerging technology start-ups in the agribusiness sector. He focuses on operational strategy and technology advisory for large agribusiness, grocery chains, food service operators, food distributors, and food manufacturers. Mr Johnson has consulted on technology investments with growers, co-ops, seed and crop protection suppliers, animal nutrition and animal health providers, ag-services organizations, and major food trader/processors across the US agriculture value chain. He has a Bachelor's degree in Computer Science from the University of Tennessee, Knoxville.



**Dick Kawooya** is an Assistant Professor at the University of South Carolina School of Library and Information Science (SLIS). He currently serves as an International Expert on a World Intellectual Property Organization (WIPO) study on *Innovation in the Agro-Based Industry in Uganda: An Empirical Study of Agricultural Innovation in a Low-Income Economy*. He was part of the African Innovation Research and Training Project and network, Open AIR, under which he studied the role of intellectual property (IP) in the exchange and interactions between informal and formal sectors in Africa's emerging automotive industry. He was the Lead Researcher for the African Copyright and Access to Knowledge (ACA2K) Project (2007–2010). Dr Kawooya holds a PhD in Communication and Information from the University of Tennessee. His doctoral research explored Ugandan traditional musicians' construction of ownership. Dr Kawooya held an Open Society Institute (OSI) Fellowship in 2006–2007 at the Center for Policy Studies, Central European University, Budapest, conducting research on the impact of copyright on the representation of African knowledge and access to general knowledge (e.g., e-resources). He has served as a member of the Commonwealth of Learning (CoL) Copyright Expert Group and as Uganda's national copyright expert (representing the Consortium of Ugandan University Libraries) for the international Electronic Information for Libraries (eIFL). Dr Kawooya has attended, and presented at, several WIPO meetings, including the June 2005 Inter-sessional Intergovernmental Meeting (IIM) on a Development Agenda for WIPO.

**Ilya Kuzminov** is Deputy Head of S&T Foresight Division at the Institute for Statistical Studies and Economics of Knowledge in National Research University Higher School of Economics. Dr Kuzminov is responsible for the coordination of research activities in the fields of future-oriented studies of environmental technologies, sustainable development, mining, agriculture, and forestry sectors. He participated in a number of foresight and S&T development monitoring activities, including S&T Foresight of the Russian Federation, Critical Technologies, and several sectoral foresight studies. Recently he was engaged in the preparation of the S&T Foresight for the Russian Agriculture and Food Sector 2030, which was approved by the Prime Minister and endorsed by the Decree of the Ministry of Agriculture of the Russian Federation as an official strategic planning document. His scientific interests include theory, methodology, and practices of research in global challenges and grand responses in S&T and innovation, priority setting, scenario designing, roadmapping, foresight evaluation and implementation into policy making, and environmental management, as well as big data and machine learning approaches to data analysis for S&T and innovation (including text mining, semantic analysis, and knowledge discovery). Dr Kuzminov has 28 scientific publications and has participated in more than 25 large-scale scientific research projects on foresight and sectoral strategic planning. He holds a PhD in Economic and Social Geography.

**Bruno Lanvin** is INSEAD's Executive Director for Global Indices. From 2007 to 2015 he was the Executive Director of INSEAD's eLab, managing INSEAD's teams in Paris, Singapore, and Abu Dhabi, and then Executive Director for INSEAD's European Competitiveness Initiative (IECI). From 2000 to 2007 Dr Lanvin worked for the World Bank, where he was inter alia Senior Advisor for E-strategies and Regional Coordinator (Europe and Central Asia) for ICT and e-government issues. He also headed the Capacity Building Practice of the World Bank's Global ICT Department and was Chairman of the Bank's e-Thematic Group. From June 2001 to December 2003, he was the Manager of the Information for Development Program (infoDev) at the World Bank. In 2000 Dr Lanvin was appointed Executive Secretary of the G8-DOT Force. Until then, he was Head of Electronic Commerce in the United Nations Conference on Trade and Development (UNCTAD) in Geneva, and occupied various senior positions including Chief of the Cabinet of the Director-General of the United Nations in New York, Head of Strategic Planning, and later Chief of the SME Trade Competitiveness Unit of UNCTAD/SITE. He was the main drafter, team leader, and editor of *Building Confidence: Electronic Commerce and Development*, published in January 2000. Since 2002, he has been co-authoring *The Global Information Technology Report* (INSEAD-World Economic Forum-Cornell University); he is currently the co-editor of the *Global Innovation Index* report (INSEAD-WIPO-Cornell University). In 2013, he created and launched the first edition of the *Global Talent Competitiveness Index* (GTCI), and still is the co-editor of this annual report. He holds a BA in Mathematics and Physics from the University of Valenciennes (France), an MBA from Ecole des Hautes Etudes Commerciales (HEC) in Paris, a PhD in Economics from the University of Paris I (La Sorbonne) in France, and is an alumn of INSEAD (IDP-C). A frequent speaker at high-level meetings, he advises a number of global companies and governments and has been a member of numerous boards for many years, including those of ICANN, IDA-Infocomm, GovTech, IP-Watch, AAID, and the Bin Rashid Foundation for Government Innovation.

**Jordan Litner** joined Cornell University in July 2015. He is the Project Manager of the Global Innovation Index 2017. His previous professional experience includes working as an Account Supervisor of E-commerce and Digital Marketing with Fortune 500 companies at iProspect in Boston, Massachusetts, USA. Prior to that, he was a coordinator for study abroad programming with the Institute for Study Abroad (IFSAs), Butler University, which involved student recruitment, marketing and social media development, and university outreach. He obtained his Bachelor of Arts from the Johns Hopkins University in Baltimore, Maryland, where he studied Economics and Applied Mathematics & Statistics. He is currently continuing his education at the Cornell SC Johnson College of Business at Cornell University.

**Travis J. Lybbert** is a Professor at the University of California, Davis, in the Agricultural & Resource Economics Department. As an economist, he has published research in applied microeconomics on topics ranging from poverty dynamics, climate change, and childhood nutrition to technology adoption, intellectual property, and innovation policy. Collaborating with researchers, students, NGOs, governments, and firms, he has lived and worked in India, Haiti, and throughout Sub-Saharan Africa, North Africa and Europe. He has spent time as a visiting researcher in the Intellectual Property Division of the World Trade Organization, in the Economics and Statistics Division of the World Intellectual Property Organization, and in universities in Ghana, Germany, and Sweden. He was a Fulbright Scholar in Morocco before earning his MS and PhD in Applied Economics from Cornell University in 2004.

**Olivia Mejia** holds a Bachelor's degree in Economics and a Master's degree in Latin American Studies from the National University of Mexico (UNAM). She is currently a Research Fellow at UNAM's Institute of Economics Research. Her lines of research are in the fields of technological innovation in the agri-food sector. She has been a speaker at several national and international congresses and has published scholarly articles and book chapters. She has taught in several universities, among which UNAM's Faculty of Economics stands out. She also participated in CONACYT's project for the development of Mexico's state innovation agendas.

**Abdoulaye Saley Moussa** is an Agricultural Research Officer in the Research and Extension Unit at FAO. He leads the development of the diagnostic tool for agricultural innovation system. He holds a PhD in Environmental Sciences from North-West University (South Africa) and has more than 15 years of experience with CGIAR and regional programmes.

**Karin Nichterlein** is an Agricultural Research Officer at FAO's Research and Extension Unit, leading work on capacity development for agricultural innovation systems and heading the Secretariat of the Tropical Agriculture Platform (TAP) initiative. She holds an MSc and a PhD in Agricultural Sciences from Justus-Liebig University in Giessen, Germany, and has more than 30 years of experience in managing agricultural research and innovation projects in Africa, Asia, and Europe.

**Julio Raffo** is a Senior Economic Officer at the Economic and Statistics Division of the World Intellectual Property Organization (WIPO). He holds a PhD in Economics from the Université de Paris Nord and has post-doctoral experience in the École Polytechnique Fédérale de Lausanne. His research topics of interest are the economics and metrics of innovation and intellectual property, with a particular focus on their intersection with socioeconomic development.

**Katie Ricketts** is an Applied Economist who has worked on urban and agricultural development issues as an academic researcher, nonprofit practitioner, and government staffer. Throughout much of her career, she has maintained a sharp focus on the linkages between agricultural development, nutrition/health, and rural economic development. While on staff at Cornell University, she managed a large research effort aimed at evaluating the linkages between economics, poverty, and human health with the Tata-Cornell Agriculture and Nutrition Initiative (TCI). Prior to working for Cornell University, Ms Ricketts worked with the Food and Agriculture Organization of the United Nations (FAO), and held positions at International Center for Tropical Research (CIAT) and Oxfam UK. In the past year, she broadened her scope to include working on US domestic policy issues including the gender wage gap, climate resiliency and adaptation in urban centres, and housing affordability and economic inequality on behalf of local US government agencies. She holds an MSc in Applied Economics from Cornell University and a BA in International Development Studies from the University of California Los Angeles (UCLA) and currently resides in Colorado.

**Karla Mariela Rodríguez** holds a degree in Chemistry from the National University of Mexico (UNAM). She is currently a Technology Intelligence Analyst at CamBioTec, a consultancy firm based in Mexico City. She has participated in designing the R&D projects of Mexican firms using scientific and technological information. She has also performed activities related to technological and strategic analysis in different fields such as industrial oils and lubricants, metallurgical processes, renewable energy, and biotechnology, among others. She has participated in the scaling up process and technology transfer for the generation of Premium cocoa through biotechnological processes. She also collaborated in CONACYT's project for the development of Mexico's state innovation agendas.

**Michaela Saisana** leads the European Commission's Competence Centre on Composite Indicators and Scoreboards (COIN) at the Joint Research Centre in Italy. She conducts and coordinates research on the monitoring of multi-dimensional phenomena that feed into EU policy formulation and legislation. She collaborates, by auditing performance indices, with over 100 international organizations and world-class universities, including the United Nations, UNICEF, Transparency International, the World Economic Forum, INSEAD, the World Intellectual Property Organization, Yale University, Columbia University, and Harvard University. Her publications deal with composite indicators, multi-criteria analysis, multi-objective optimization, data envelopment analysis, and sensitivity analysis (20 peer-reviewed articles, 2 books, 60 working papers). She provides regular trainings/seminars on composite indicators (over 30 trainings and 60 invited lectures). In 2004 she was awarded the European Commission's JRC Young Scientist Prize in Statistics and Econometrics in recognition of her research on composite indicators. She has a PhD and an MSc in Chemical Engineering.

**Kritika Saxena** is a Doctoral Candidate in Development Economics at the Graduate Institute for International and Development Studies (IHEID) in Geneva. Her research interests cover the broad areas of innovation, development, and the environment, with a particular focus on the role of public policies and finance in innovation and green growth. Before starting her doctoral studies, she was an Economist Intern at the World Intellectual Property Organization (WIPO). She has also worked as Research Analyst at the World Bank in New Delhi, where she contributed to policy-oriented research and flagship reports. She has worked in various capacities on development research projects with the Jameel Poverty Action Lab (India), the National Council of Applied Economic Research (India), and the Overseas Development Institute (United Kingdom). She holds a Master's degree in International Economics from IHEID in Geneva and a Master of Development Economics from the University of East Anglia, United Kingdom.

**Ankur Seth** is part of the Policy Advocacy and Research team at the Confederation of Indian Industry (CII) – Jubilant Bhartia Food and Agriculture Centre of Excellence (FACE). His present profile involves working on evidence-based research and programme management in the area of Agriculture Technology and Innovation. He has been working closely with farmers, rural entrepreneurs, government agencies, industry, and international partners to understand the barriers to technology adoption, identifying suitable technologies for Indian farms and assessing the impact of technology-oriented government policies. Prior to joining CII-FACE, he worked in the energy and financial services sector where he held portfolios in consulting, market research, and the product development domain. He has completed his Bachelor's in Engineering (Information Technology) and holds an MBA from Fore School of Management, New Delhi. He has also trained in Data Analysis at the Indian Institute of Technology, Kharagpur.

**José Luis Solleiro** is Senior Researcher at the Center for Applied Science and Technological Development of the National University of Mexico (UNAM). He is also a member of Mexico's National System of Researchers. He holds a degree in Industrial Engineering from UNAM and a PhD in Innovation Management from the Vienna University of Technology. He was founder of the Center for Technological Innovation where he managed the Technology Transfer Office (1984–91) and the Academic Programs Direction (1991–93). He was Director General of Technology Transfer at UNAM from 2008 to 2012. From 2000 to 2008, he was founding Director of AgroBIO Mexico, the association of the ag-biotech industry in Mexico, where he dealt with the development of a regulatory framework for agri-food biotechnology. Between 2005 and 2009 he was Manager of the Agri-food Area of the Iberoamerican Program of Science and Technology for Development (CYTED). As a researcher, he has published more than 200 academic papers in journals, books, and proceedings. He has given lectures in undergraduate and graduate programs in institutions in 17 countries. He has directed 18 college-level theses, 22 at the Master level, and 12 at the Doctoral level. He has been a consultant for private firms in Mexico, universities, institutions, and international organizations in matters related to innovation management and technology policy. He was Coordinator of a programme sponsored by IDB to develop a pilot fund to promote the innovation projects of SMEs in the State of Mexico. He has been awarded the Gabino Barreda medal to the best students of UNAM and Mexico's Best Student Medal, UNAM's Recognition for Young Researchers, and the Jesús Silva Herzog Prize of Economics Research. In 2005 he was named Doctor Honoris Causa by the Consejo Iberoamericano en Honor a la Excelencia Educativa (Iberoamerican Council for Excellence in Education). He has evaluated international programmes and projects and been referee for journals of technology management such as *Technovation*, *International Journal of Technology Management*, *Electronic Journal of Biotechnology*, *R&D Management*, and *Problemas del Desarrollo*, among others. Currently, he coordinates CamBioTec, a small spin-off firm promoting technology transfer and innovation policies.

**Andrea Sonnino** holds a degree in Agricultural Sciences from Bologna University. He was the former Chief of the Research and Extension Unit at the Food and Agriculture Organization of the United Nations (FAO). He has more than 20 years of experience in plant breeding and biotechnology, plus 20 years of experience in managing agricultural research and innovation programmes at the international level. He is currently a Special Advisor/Consultant at FAO and a Senior Scientist at the Italian National Agency for New Technologies, Energy and Sustainable Economic Development (ENEA).

**Volker Staack** is a Leading Practitioner in the advisory innovation practice for Strategy&. He works with automotive, industrial, and technology companies, helping them build competitive innovation capabilities from strategy to execution. He is a principal with PwC US, and is based in Miami. Before joining PwC, Mr Staack was the Managing Director of Management Engineers' US business and a partner with Management Engineers International Consultants. Prior to that, he spent three years at BC Components, a global electronics supplier, and formerly Philips Passive Components, where he led the capacitors division. He also worked for Philips Passive Components in Germany and the Netherlands, where he was the commercial managing director of an international business unit. He earned both his Bachelor's degree in Business Administration and his MBA from the University of Kiel (Germany).

**Daniel Vertesy** is a Research Fellow at the Competence Centre on Composite Indicators and Scoreboards (COIN) at the Joint Research Centre (JRC) of the European Commission. He is conducting and coordinating econometric and applied statistical research projects focusing on the measurement of scientific and technological research and innovation performance at various levels in support of EU policies. Prior to joining the European Commission, he worked at the United Nations University (UNU-MERIT) conducting research on sectoral innovation system dynamics and emerging aerospace industries. He holds a PhD in Innovation Studies and Development from Maastricht University and UNU-MERIT, a PhD in Economics from the Corvinus University of Budapest, and a Master's degree in International Relations from the latter university.

**Joshua Woodard** is an Assistant Professor and the Zaitz Family Faculty Fellow of Agricultural Business and Finance. His work focuses primarily on risk and policy issues in agricultural finance including risk management, banking, and insurance, with special emphases on empirical applications, spatial data analysis, weather risk, and large-scale data analysis. He also specializes in the design, analysis, and evaluation of insurance programmes, and has developed several crop insurance products currently sold in the market. He is the founder of Ag-Analytics.org, a live open data/open source data integration and automation platform. He teaches financial analytics, agricultural banking, and agricultural finance, and also oversees the Farm Credit Fellows programme. He has published in a wide variety of journals in agricultural finance and economics, risk management, and insurance, and is also an authorized Expert Reviewer Underwriter for the Federal Crop Insurance Corporation to review plans of insurance for the USDA and the Federal Crop Insurance Program. He also serves in a variety of leadership roles within professional associations. He earned his PhD in Agricultural and Consumer Economics at the University of Illinois.

**Sacha Wunsch-Vincent** is Senior Economist at the World Intellectual Property Organization (WIPO). He joined WIPO in 2010 to help set up WIPO's economics work program under the Chief Economist. At WIPO, he is one of the main authors of the *World Intellectual Property Report* and Co-Editor of the *Global Innovation Index*. Before joining WIPO, he was an Economist and then Project Co-Leader at the OECD Directorate for Science, Technology, and Industry for seven years. Prior to that he was the Swiss National Science Fellow at the Berkeley Center for Law and Technology (University of California, Berkeley) and the Washington, DC-based Peterson Institute for International Economics. He has served as advisor to organizations such as the World Bank and the World Economic Forum, and has testified before national parliaments. Dr Wunsch-Vincent sits on several editorial boards and is reviewer to a number of publications such as the *Science and Engineering Indicators* report of the US National Science Foundation. He has published a series of peer-reviewed and other journal articles and is the author of several books, notably the recent *The Informal Economy in Developing Nations: Hidden Engine of Innovation?* published by Cambridge University Press. He holds a Master of International Economics from MERIT, University of Maastricht, and a PhD in Economics from the University of St. Gallen, Switzerland. He teaches International Economics at Sciences Po Paris.

Innovation is now widely recognized as a central driver of economic growth and development. The Global Innovation Index (GII) aims to capture the multi-dimensional facets of innovation by providing a rich database of detailed metrics for 127 economies, which represent 92.5% of the world's population and 97.6% of global GDP. As Ban Ki-moon, the eighth Secretary-General of the United Nations, noted at the UN Economic and Social Council in 2013, the GI is a *'unique tool for refining innovation policies . . . for providing an accurate picture on the role of science, technology and innovation in sustainable development'*.

The GI 2017 marks the 10th edition of the GI, providing data and insights gleaned from tracking innovation across the globe for more than a decade. The GI was created to measure and understand which economies and regions respond best to the challenges of innovation, and has helped to shape the innovation agendas of nations since 2007. For more than 10 years, the agriculture and food sector has faced growing global demand and increased competition for limited natural resources. Within the agricultural and food systems, innovation is indispensable to achieving sustainable productivity growth; this innovation must be a priority and include organizational change, cooperation along the value chain, public and private investment in R&D, adaptation and adoption of new innovations, and education. A review of how innovation and technology trends and the enabling environments in which these systems operate and evolve will be essential to the success of this endeavour, creating an urgent need for improved metrics and indicators. The analysis in this year's edition, *The Global Innovation Index 2017: Innovation Feeding the World*, is dedicated to this theme, paving the way for improved strategies and policy making to foster innovation in food systems.

Launched by INSEAD in 2007, today the GI is co-published by Cornell University, INSEAD, and the World Intellectual Property Organization (WIPO), a specialized agency of the United Nations. The 2017 edition of the GI draws on the expertise of its Knowledge Partners: the Confederation of Indian Industry, PricewaterhouseCoopers (PwC) and Strategy&, and the National Confederation of Industry (CNI) and Serviço Brasileiro de Apoio às Micro e Pequenas Empresas (Sebrae), as well as an Advisory Board of eminent international experts. For the seventh consecutive year, the Joint Research Centre (JRC) of the European Commission audited the GI calculations.

The GI is concerned primarily with improving the journey towards a better way to measure and understand innovation and with identifying targeted policies and good practices that foster innovation. Written in a nontechnical language, the GI appeals to diverse groups including policy makers, business leaders, academics, and organizations of civil society.

The full report can be downloaded at [www.globalinnovationindex.org](http://www.globalinnovationindex.org).

