

# The Global Competitiveness Index 4.0 Methodology and Technical Notes

This Appendix presents the methodology and detailed structure of the Global Competitiveness Index 4.0 (Section A); provides information about each of the indicators included in the Index (Section B); presents the methodology used to impute missing data points and reports the imputed values by indicator (Section C); presents the methodology used to compute progress scores (Section D); and details the computation of the 2017 (“backcast”) GCI 4.0 scores (Section E).

## A. COMPUTATION AND COMPOSITION OF THE GCI 4.0

The computation of the Global Competitiveness Index 4.0 (GCI) is based on successive aggregations of scores, from the indicator level (the most disaggregated level) to the overall GCI score (the highest level). At every aggregation level, each aggregated measure is computed by taking the average (i.e. arithmetic mean) of the scores of its components, with a few exceptions described in Section B. The overall GCI score is the average of the twelve pillars.

For individual indicators, prior to aggregation raw values are transformed into a progress score ranging from 0 to 100, with 100 being the ideal state. See Section D for more details.

In the list below, weights are rounded to one decimal place, but full precision is used in the computation.

Weight (%) within  
immediate parent category

### ENABLING ENVIRONMENT

(not used in calculation)<sup>1</sup>

<b>Pillar 1: Institutions.....</b>	<b>8.3%</b>
<b>A. Security.....</b>	<b>14.3%</b>
1.01 Business costs of organized crime	
1.02 Homicide rate	
1.03 Terrorism incidence	
1.04 Reliability of police services	
<b>B. Social capital .....</b>	<b>14.3%</b>
1.05 Social capital	
<b>C. Checks and balances.....</b>	<b>14.3%</b>
1.06 Budget transparency	
1.07 Judicial independence	
1.08 Efficiency of legal framework in challenging regulations	
1.09 Freedom of the press	

<sup>1</sup> For presentation and analysis purposes, the 12 pillars are also organized into four overarching components—Enabling environment, Human capital, Markets, and Innovation ecosystem—but these components do not enter into the computation of the GCI.

**D. Public-sector performance ..... 14.3%**

- 1.10 Burden of government regulation
- 1.11 Efficiency of legal framework in settling disputes
- 1.12 E-Participation
- 1.13 Future orientation of government

**E. Transparency ..... 14.3%**

- 1.14 Incidence of corruption

**F. Property rights ..... 14.3%**

- 1.15 Property rights
- 1.16 Intellectual property protection
- 1.17 Quality of land administration

**G. Corporate governance ..... 14.3%**

- 1.18 Strength of auditing and accounting standards
- 1.19 Conflict of interest regulation
- 1.20 Shareholder governance

**Pillar 2: Infrastructure ..... 8.3%****A. Transport infrastructure ..... 50%<sup>2</sup>**

- I. Road ..... 25%
  - 2.01 Quality of road network
  - 2.02 Quality of road infrastructure
- II. Rail ..... 25%
  - 2.03 Railroad density
  - 2.04 Efficiency of train services
- III. Air ..... 25%
  - 2.05 Airport connectivity
  - 2.06 Efficiency of air transport services
- IV. Sea ..... 25%
  - 2.07 Liner shipping connectivity<sup>3</sup>
  - 2.08 Efficiency of seaport services

**B. Utility infrastructure ..... 50%**

- I. Electricity ..... 50%
  - 2.09 Electricity access
  - 2.10 Electricity quality
- II. Water ..... 50%
  - 2.11 Exposure to unsafe drinking water
  - 2.12 Reliability of water supply

**Pillar 3: ICT adoption<sup>4</sup> ..... 8.3%**

- 3.01 Mobile-cellular telephone subscriptions
- 3.02 Mobile-broadband subscriptions
- 3.03 Fixed-broadband internet subscriptions
- 3.04 Fiber internet subscriptions
- 3.05 Internet users

2 For economies where there is no regular train service or where the network covers only a negligible portion of the territory, the Transport infrastructure sub-pillar corresponds to the average score of the Road, Air and Sea components. Assessment of the existence of a network was conducted by the World Economic Forum based on various sources.

3 For landlocked countries, this indicator is not included in the computation and the Sea component score corresponds to the score of Indicator 2.08.

4 In computing the score of this pillar, indicator 3.02 is not directly used in the calculation. Instead the ratio of indicator 3.02 to indicator 3.01 is used, as an approximation of the share of mobile-cellular telephone subscriptions that have broadband capability. The same approach is used for indicator 3.04, as a way to approximate the share of fixed broadband connections that are optical fiber subscriptions. In both cases, the ratios are converted onto 0-100 scale and used in the computation. See Section D for more details.

**Pillar 4: Macroeconomic stability ..... 8.3%**

- 4.01 Inflation
- 4.02 Debt dynamics

**HUMAN CAPITAL**

(not used in calculation)

**Pillar 5: Health ..... 8.3%**

- 5.01 Healthy life expectancy

**Pillar 6: Skills ..... 8.3%****A. Current workforce ..... 50%**

- I. Education of current workforce ..... 50%
  - 6.01 Mean years of schooling
- II. Skills of current workforce ..... 50%
  - 6.02 Extent of staff training
  - 6.03 Quality of vocational training
  - 6.04 Skillset of graduates
  - 6.05 Digital skills among active population
  - 6.06 Ease of finding skilled employees

**B. Future workforce ..... 50%**

- I. Education of future workforce ..... 50%
  - 6.07 School life expectancy
- II. Skills of future workforce ..... 50%
  - 6.08 Critical thinking in teaching
  - 6.09 Pupil-to-teacher ratio in primary education

**MARKETS**

(not used in calculation)

**Pillar 7: Product market ..... 8.3%****A. Domestic market competition ..... 50%**

- 7.01 Distortive effect of taxes and subsidies on competition
- 7.02 Extent of market dominance
- 7.03 Competition in services

**B. Trade openness ..... 50%**

- 7.04 Prevalence of non-tariff barriers
- 7.05 Trade tariffs
- 7.06 Complexity of tariffs
- 7.07 Border clearance efficiency
- 7.08 Service trade openness

**Pillar 8: Labour market ..... 8.3%****A. Flexibility ..... 50%**

- 8.01 Redundancy costs
- 8.02 Hiring and firing practices
- 8.03 Cooperation in labour-employer relations
- 8.04 Flexibility of wage determination
- 8.05 Active labour policies
- 8.06 Workers' rights
- 8.07 Ease of hiring foreign labour
- 8.08 Internal labour mobility

**B. Meritocracy and incentivization.....50%**

- 8.09 Reliance on professional management
- 8.10 Pay and productivity
- 8.11 Female participation in labour force
- 8.12 Labour tax rate

**Pillar 9: Financial system ..... 8.3%****A. Depth.....50%**

- 9.01 Domestic credit to private sector
- 9.02 Financing of SMEs
- 9.03 Venture capital availability
- 9.04 Market capitalization
- 9.05 Insurance premiums

**B. Stability.....50%**

- 9.06 Soundness of banks
- 9.07 Non-performing loans
- 9.08 Credit gap
- 9.09 Banks' regulatory capital ratio

**Pillar 10: Market size<sup>5</sup>..... 8.3%**

- 10.01 Gross domestic product
- 10.02 Imports of goods and services

**INNOVATION ECOSYSTEM**

(not used in calculation)

**Pillar 11: Business dynamism..... 8.3%****A. Administrative requirements .....50%**

- 11.01 Cost of starting a business
- 11.02 Time to start a business
- 11.03 Insolvency recovery rate
- 11.04 Insolvency regulatory framework

**B. Entrepreneurial culture .....50%**

- 11.05 Attitudes toward entrepreneurial risk
- 11.06 Willingness to delegate authority
- 11.07 Growth of innovative companies
- 11.08 Companies embracing disruptive ideas

**Pillar 12: Innovation capability<sup>6</sup> ..... 8.3%****A. Interaction and diversity**

- 12.01 Diversity of workforce
- 12.02 State of cluster development
- 12.03 International co-inventions
- 12.04 Multistakeholder collaboration

**B. Research and development**

- 12.05 Scientific publications
- 12.06 Patent applications
- 12.07 R&D expenditures
- 12.08 Research institutions prominence index

**C. Commercialization**

- 12.09 Buyer sophistication
- 12.10 Trademark applications

<sup>5</sup> The score of this pillar corresponds to the natural logarithm of the sum of GDP and imports, both valued at purchasing power parity (PPP). Valuation of imports at PPP is estimated by multiplying the share of exports (indicator 10.02) by the value of GDP (indicator 10.01).

<sup>6</sup> The score of this pillar corresponds to the average of the scores of the 10 individual indicators. Components A, B, and C are used for presentation purposes only, and do not enter the calculation.

**B. TECHNICAL NOTES AND SOURCES**

The following notes provide sources for all the individual indicators included in the GCI 4.0. The title of each indicator appears on the first line, preceded by its number to allow for quick reference. Below is a description of each indicator or, in the case of Executive Opinion Survey data, the full question and associated answers. If necessary, additional information is provided underneath.

The interactive ranking tables at <http://gcr.weforum.org> provide information about the source and period for each individual data point. Select the indicator of interest from the selector and click on the “info” icon next to each economy to access the information. For indicators not sourced from the World Economic Forum, users are urged to refer to the original source for any additional information and exceptions for certain economies and/or data points.

The data used in the computation of the GCI 4.0 2018 represent the most recent and best data available at the time when they were collected. It is possible that data were updated or revised subsequently.

**Pillar 1: Institutions****1.01 Business costs of organized crime**

Response to the survey question “In your country, to what extent does organized crime (mafia-oriented racketeering, extortion) impose costs on businesses?” [1 = to a great extent, imposes huge costs; 7 = not at all, imposes no costs] | 2017–2018 weighted average or most recent period available

Source: World Economic Forum, Executive Opinion Survey. For more details, refer to Appendix B of this report.

**1.02 Homicide rate**

Number of intentional homicides per 100,000 population. | 2016 or most recent year available

“Intentional homicide” refers to unlawful death inflicted upon a person with the intent to cause death or serious injury. More details about the methodology can be found at <https://dataunodc.un.org/crime/intentional-homicide-victims>.

Source: United Nations Office on Drugs and Crime (UNODC).

**1.03 Terrorism incidence**

Assesses the frequency and severity of terror attacks. The scale ranges from 0 (highest incidence) to 100 (no incidence). | Weighted count 2013–2017

This indicator has two components: number of terrorism-related casualties (injuries and fatalities) and the number of terrorist attacks over a five-year period, with each year assigned half the weight of the following year. Each component is normalized on a 0 to 100 scale, with 100 meaning “no casualty” and “no attack”, respectively, and then averaged.

Source: National Consortium for the Study of Terrorism and Responses to Terrorism (START).

**1.04 Reliability of police services**

Response to the survey question “In your country, to what extent can police services be relied upon to enforce law and order?” [1 = not at all; 7 = to a great extent] | 2017–2018 weighted average or most recent period available

Source: World Economic Forum, Executive Opinion Survey. For more details, refer to Appendix B of this report.

**1.05 Social capital**

Score on the Social Capital pillar of the Legatum Prosperity Index™, which assesses social cohesion and engagement, community and family networks, and political participation and institutional trust. The scale ranges from 0 (low) to 100 (high). | 2017 edition

This indicator measures national performance in three areas: social cohesion and engagement (bridging social capital), community and family networks (bonding social capital), and political participation and institutional trust (linking social capital). More details about the methodology can be found at <http://www.prosperity.com/about/methodology>.

Source: Legatum Institute.

**1.06 Budget transparency**

Represents the Open Budget Data Score, which indicates the extent to which the government publishes data related to budget and spending. The scale ranges from 0 (low transparency) to 100 (high transparency). | 2017

The score is based on the evaluation of 20 key criteria related to government practices in publishing open budget data. More details can be found at <http://www.worldbank.org/publicfinance/fmis>.

Source: The World Bank Group.

**1.07 Judicial independence**

Response to the survey question “In your country, how independent is the judicial system from influences of the government, individuals, or companies?” [1 = not independent at all; 7 = entirely independent] | 2017–2018 weighted average or most recent period available

Source: World Economic Forum, Executive Opinion Survey. For more details, refer to Appendix B of this report.

**1.08 Efficiency of legal framework in challenging regulations**

Response to the survey question “In your country, how easy is it for private businesses to challenge government actions and/or regulations through the legal system?” [1 = extremely difficult; 7 = extremely easy] | 2017–2018 weighted average or most recent period available

Source: World Economic Forum, Executive Opinion Survey. For more details, refer to Appendix B of this report.

**1.09 Freedom of the press**

Score on the World Press Freedom Index, which measures the level of freedom available to journalists. The scale ranges from 0 (good) to 100 (very bad). | 2018 edition

The index measures media independence, the quality of the infrastructure that supports the production of news, and information and acts of violence against journalists. It is based on two sources: 1) a database of the level of abuses and violence against journalists and media; and 2) an expert opinion survey on pluralism, media independence, self-censorship, transparency and infrastructure in each country. More details about the methodology can be found at <https://rsf.org/en/world-press-freedom-index>.

Source: Reporters Without Borders (RSF).

**1.10 Burden of government regulation**

Response to the survey question “In your country, how burdensome is it for companies to comply with public administration’s requirements (e.g., permits, regulations, reporting)?” [1 = extremely burdensome; 7 = not burdensome at all] | 2017–2018 weighted average or most recent period available

Source: World Economic Forum, Executive Opinion Survey. For more details, refer to Appendix B of this report.

**1.11 Efficiency of legal framework in settling disputes**

In your country, how easy is it for private businesses to challenge government actions and/or regulations through the legal system? [1 = extremely difficult; 7 = extremely easy] | 2017–2018 weighted average or most recent period available

Source: World Economic Forum, Executive Opinion Survey. For more details, refer to Appendix B of this report.

**1.12 E-Participation**

Score on the E-Participation Index, which assesses the use of online services to facilitate the provision of information by governments to citizens. The scale ranges from 0 to 1 (best). | 2018

The E-Participation Index measures 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 (“e-decision making”). More details about the methodology can be found at <https://publicadministration.un.org>.

Source: United Nations, Department of Economic and Social Affairs (UNDESA).

**1.13 Future orientation of government**

Average of the responses to the following four Executive Opinion Survey questions: 1) “In your country, how fast is the legal framework of your country in adapting to digital business models (e.g. e-commerce, sharing economy, fintech, etc.)?” [1 = not fast at all; 7 = very fast]; 2) “In your country, to what extent does the government ensure a stable policy environment for doing business?”; 3) “In your country, to what extent does the government respond effectively to change (e.g. technological changes, societal and demographic trends, security and economic challenges)?”; and 4) “In your country, to what extent does the government have a long-term vision in place?”. For the last three questions, the answer ranges from 1 (not at all) to 7 (to a great extent). | 2017–2018 weighted average or most recent period available

Source: World Economic Forum, Executive Opinion Survey. For more details, refer to Appendix B of this report.

**1.14 Incidence of corruption**

Score on the Corruption Perceptions Index, which measures perceptions of corruption in the public sector. This is a composite indicator, and the scale ranges from 0 (highly corrupt) to 100 (very clean). | 2016

The index aggregates data from a number of different sources that provide perceptions of business people and country experts of the level of corruption in the public sector. More details can be found at <https://www.transparency.org/cpi>.

Source: Transparency International.

**1.15 Property rights**

Response to the survey question “In your country, to what extent are property rights, including financial assets, protected?” [1 = not at all; 7 = to a great extent] | 2017–2018 weighted average or most recent period available

Source: World Economic Forum, Executive Opinion Survey. For more details, refer to Appendix B of this report.

**1.16 Intellectual property protection**

Response to the survey question “In your country, to what extent is intellectual property protected?” [1 = not at all; 7 = to a great extent] | 2017–2018 weighted average or most recent period available

Source: World Economic Forum, Executive Opinion Survey. For more details, refer to Appendix B of this report.

**1.17 Quality of land administration**

Score on the quality of land administration index, which assesses the reliability of infrastructure, transparency of information, geographic coverage, land dispute resolution and equal access to property rights. The scale ranges from 0 to 30 (best). | 2017

More details about the methodology can be found at <http://www.doingbusiness.org/Methodology>.

Source: The World Bank Group.

**1.18 Strength of auditing and reporting standards**

Response to the survey question “In your country, how strong are financial auditing and reporting standards?” [1 = extremely weak; 7 = extremely strong] | 2017–2018 weighted average or most recent period available

Source: World Economic Forum, Executive Opinion Survey. For more details, refer to Appendix B of this report.

**1.19 Conflict of interest regulation**

Score on the extent of conflict of interest regulation index, which measures the protection of shareholders against directors’ misuse of corporate assets for personal gain. The scale ranges from 0 to 10 (best). | 2017

The index assesses three dimensions of regulation that address conflicts of interest: 1) transparency of related-party transactions, 2) shareholders’ ability to sue and hold directors liable for self-dealing, and 3) access to evidence and allocation of legal expenses in shareholder litigation. More details about the methodology can be found at <http://www.doingbusiness.org/Methodology>.

Source: The World Bank Group.

**1.20 Shareholder governance**

Score on the extent of shareholder governance index, which measures shareholders’ rights in corporate governance. The scale ranges from 0 to 10 (best). | 2017

The index assesses three dimensions of good governance: 1) shareholders’ rights and role in major corporate decisions, 2) governance safeguards protecting shareholders from undue board control and entrenchment, and 3) corporate transparency on ownership stakes, compensation, audits and financial prospects. More details about the methodology can be found at <http://www.doingbusiness.org/Methodology>.

Source: The World Bank Group.

**Pillar 2: Infrastructure****2.01 Quality of road network**

Score on the Road Quality Index, which measures average speed and straightness of a driving itinerary connecting the 10 or more largest cities that together account for at least 15% of the economy’s total population. The scale ranges from 0 to 100 (excellent). | 2016

The Road Quality Index, developed by the World Economic Forum, comprises two elements: 1) a measure of the average speed of a driving itinerary connecting the 10 or more largest cities in an economy accounting for at least 15% of the economy’s total population; and 2) a measure of road straightness. The itinerary was not optimized and connects the cities from the largest to the smallest. Any leg involving a ferry was excluded from the average speed calculation. As a first step to the identification of cities to include in the itinerary, pairwise distances (“as the crow flies”) were calculated, and when the distance was less than 20 kilometres, the smallest city in the pair was excluded. The road straightness corresponds to the ratio of the sum of driving distances between each city in the journey to the sum of crow fly distances between each city in the journey. For this component, legs involving a ferry were included. The APIs of Google Directions and Open Street Map were used to compute the itinerary. The Geonames database was used for city populations and coordinates. For more information about this indicator, please contact [gcp@weforum.org](mailto:gcp@weforum.org).

Source: World Economic Forum’s calculations.

**2.02 Quality of road infrastructure**

Response to the survey question “In your country, what is the quality (extensiveness and condition) of road infrastructure?” [1 = extremely poor—among the worst in the world; 7 = extremely good—among the best in the world] | 2017–2018 weighted average or most recent period available

Source: World Economic Forum, Executive Opinion Survey. For more details, refer to Appendix B of this report.

**2.03 Railroad density**

Kilometres of railroad per 1,000 square kilometres of land. | 2016

Source: The World Bank Group.

**2.04 Efficiency of train services**

Response to the survey question “In your country, how efficient (i.e. frequency, punctuality, speed, price) are train transport services?” [1 = extremely inefficient, among the worst in the world; 7 = extremely efficient, among the best in the world] | 2017–2018 weighted average or most recent period available

Source: World Economic Forum, Executive Opinion Survey. For more details, refer to Appendix B of this report.

**2.05 Airport connectivity**

Represents the IATA airport connectivity indicator, which measures the degree of integration of a country within the global air transport network. | 2018

For each airport, the number of available seats to each destination is weighted by the size of the destination airport (in terms of number of passengers handled). The weighted totals are then summed for all destinations, then for all airports in the country to produce a score. The log transformation of the raw value is raised to a cubic power before converting it to the 0 to 100 score.

Source: International Air Transport Association (IATA).

**2.06 Efficiency of air transport services**

Response to the survey question “In your country, how efficient (i.e. frequency, punctuality, speed, price) are air transport services?” [1 = extremely inefficient, among the worst in the world; 7 = extremely efficient, among the best in the world] | 2017–2018 weighted average or most recent period available

Source: World Economic Forum, Executive Opinion Survey. For more details, refer to Appendix B of this report.

**2.07 Liner shipping connectivity**

Score on the Liner Shipping Connectivity Index, which assesses a country’s connectivity to global shipping networks. The index uses an open scale, with the benchmark score of 100 corresponding to the most connected country in 2004 (China). | 2017

The index is based on five components of the maritime transport sector: the number of ships, their container-carrying capacity, the maximum vessel size, the number of services and the number of companies that deploy container ships in a country’s ports.

Source: United Nations Conference on Trade and Development (UNCTAD).

**2.08 Efficiency of seaport services**

Response to the survey question “In your country, how efficient (i.e. frequency, punctuality, speed, price) are seaport services (ferries, boats) (for landlocked countries: assess access to seaport services)?” [1 = extremely inefficient, among the worst in the world; 7 = extremely efficient, among the best in the world] | 2017–2018 weighted average or most recent period available

Source: World Economic Forum, Executive Opinion Survey. For more details, refer to Appendix B of this report.

**2.09 Electricity access**

Percentage of population with access to electricity. | 2016 estimate

Electricity access entails a household having initial access to sufficient electricity to power a basic bundle of energy services— at a minimum, several lightbulbs, task lighting (such as a flashlight), phone.

Source: International Energy Agency (IEA).

**2.10 Electricity quality**

Electric power transmission and distribution losses as a percentage of domestic supply. | 2015 estimate

Source: International Energy Agency (IEA).

**2.11 Exposure to unsafe drinking water**

Risk-weighted percentage of population exposed to unsafe drinking water. | 2016

This indicator is reported as a summary exposure value (SEV): it measures a population’s exposure to unsafe drinking water, taking into account the extent of exposure by risk level and the severity of that risk’s contribution to disease burden. The indicator takes the value 0 when no excess risk for a population exists and the value 1 when the population is at the highest level of risk.

Source: Institute for Health Metrics and Evaluation (IHME).

**2.12 Reliability of water supply**

Response to the survey question “In your country, how reliable is the water supply (lack of interruptions and flow fluctuations)?” [1 = extremely unreliable; 7 = extremely reliable] | 2017–2018 weighted average or most recent period available

Source: World Economic Forum, Executive Opinion Survey. For more details, refer to Appendix B of this report.

**Pillar 3: ICT adoption****3.01 Mobile-cellular telephone subscriptions**

Number of mobile-cellular telephone subscriptions per 100 population. | 2016

This indicator includes post-paid subscriptions, active prepaid accounts (i.e. that have been active during the past three months), and all mobile-cellular subscriptions that offer voice communications.

Source: International Telecommunications Union (ITU).

**3.02 Mobile-broadband subscriptions**

Number of active mobile-broadband subscriptions per 100 population. | 2016

This indicator includes standard mobile-broadband subscriptions and dedicated mobile-broadband data subscriptions to the public internet.

Source: International Telecommunications Union (ITU).

**3.03 Fixed-broadband internet subscriptions**

Number of fixed-broadband internet subscriptions per 100 population. | 2016

This indicator refers to the number of subscriptions for high-speed access to the public internet (a TCP/IP connection), including cable modem, DSL, fiber, and other fixed (wired)-broadband technologies—such as Ethernet, LAN and broadband over powerline communications.

Source: International Telecommunications Union (ITU).

**3.04 Fiber internet subscriptions**

Fiber-to-the-home/building internet subscriptions per 100 population. | 2016

This indicator refers to the number of internet subscriptions using fiber-to-the-home or fiber-to-the-building at downstream speeds equal to or greater than 256 kb/s. This should include subscriptions where fiber goes directly to the subscriber’s premises or fiber-to-the-building subscriptions that terminate no more than two metres from an external wall of the building. Fiber-to-the-cabinet and fiber-to-the-node are excluded.

Source: World Economic Forum calculations based on International Telecommunications Union (ITU).

**3.05 Internet users**

Percentage of individuals who used the internet from any location and for any purpose, irrespective of the device and network used, in the last three months. | 2016

Source: International Telecommunications Union (ITU).

**Pillar 4: Macroeconomic stability****4.01 Inflation**

Annual percentage change in the Consumer Price Index. | 2016–2017 moving average

Inflation is normalized in a U-shaped function to capture the detrimental effects of high inflation and deflation. Countries with inflation rates between 0.5% and 4% receive the highest possible score of 100. Outside this range, scores decrease linearly as the distance between the optimal value and the actual value increases.

Source: International Monetary Fund (IMF).

## 4.02 Debt dynamics

**Index measuring the change in public debt-to-GDP ratio, weighted by a country's credit rating and debt level in relation to its GDP. | Difference between the 2017 and 2018 expected values of the debt-to-GDP ratio**

This indicator is a category-based min-max normalization of the debt change. The debt change is the difference between the 2017 and 2018 of the debt to GDP ratio expected values. To transform the debt change value into a 0 to 100 score, each country is assigned to a specific category that determines the value boundaries. Categories are based on three criteria: general credit rating, government debt to GDP level for the year 2017, and country classification (1 if country is considered advanced, 0 otherwise according to IMF's classification). The general credit rating for each country is computed as the average of Fitch, Standard and Poor's (S&P) and Moody's credit ratings. A country's rating is considered "investment grade 1" for S&P's grades AAA to A, Moody's grades Aaa to A1, and Fitch's grades AAA to A. A country's rating is considered "investment grade 2" for S&P's grades A- to BBB-, Moody's grades A- to Baa1, and Fitch's grades A- to BBB+. A country's rating is considered "speculative" for S&P's grades BB+ to CCC+, Moody's grades Ba3 to Caa2, and Fitch's grades BBB- to B-. A country credit rating is considered "default" for S&P's grade SD, Moody's grades Caa1 and C, and Fitch's grades CC and RD. Based on these criteria, 12 cases are identified: i) if a country's average rating is "investment grade 1" and its debt to GDP level is less than 60%, its debt change is normalized to 100; ii) if a country's average rating is "investment grade 1" and its debt to GDP level is less than 110%, its debt change is normalized to a score between 90 and 100; iii) if a country's average rating is graded as "investment grade 1" and its debt to GDP level is greater than 110%, its debt change is normalized to a score between 80 and 90; iv) if the average credit rating is rated as "investment grade 2" and the debt level is lower than 110%, its debt change is normalized to a score between 70 and 80; v) if the average credit rating is "investment grade 2" and the debt level is greater than 110%, its debt change is normalized to a score between 60 and 70; vi) if the average credit rating is "speculative", the debt level is less than 110%, and the country classification is "advanced", its debt change is normalized to a score between 50 and 60; vii) if the average credit rating is "speculative", the debt level is greater than 110%, and the country classification is "advanced", its debt change is normalized to a score between 40 and 50; viii) if the average credit rating is "speculative", the debt level is less than 60%, and the country classification is "developing", its debt change is normalized to a score between 40 and 50; ix) if the average credit rating is "speculative", the debt level is greater than 60%, and the country classification is "developing", its debt change is normalized to a score between 30 and 40; x) if the average credit rating is "default", the debt change is normalized to a score between 0 and 30; xi) if a country does not receive a credit rating from any rating agency and its debt level is below 60%, its debt change is normalized to a score between 40 and 50; and xii) if a country does not receive a credit rating from a rating agency and its debt is above 60% of GDP, its debt change is normalized to a score between 30 and 40. To determine the final value of the debt dynamics indicator within the assigned boundaries, we've calculated the normalized debt change, which ranges from a minimum observed value of 0 and the maximum observed value of 20. As part of the normalization process, we assigned a score equivalent to the minimum value of each bracket if the debt change was 20% or higher; assigned the maximum value of the bracket if the debt change was 0% or lower; and assigned a score between the two values if the debt change was between 0% and 20%.

Source: World Economic Forum; calculations based on data from International Monetary Fund and the rating agencies Fitch, Moody's, and Standard and Poor's.

## Pillar 5: Health

### 5.01 Healthy life expectancy

Number of years that a newborn can expect to live in good health, taking into account mortality and disability. | 2016 estimate

More details about the methodology can be found at <http://www.healthdata.org/research-article/gbd-2015-dalys-hale>.

Source: Institute for Health Metrics and Evaluation (IHME).

## Pillar 6: Skills

### 6.01 Mean years of schooling

Average number of completed years of education of a country's population aged 25 years and older, excluding years spent repeating individual grades. | 2015

Sources: United Nations Educational, Scientific and Cultural Organization (UNESCO); Wittgenstein Centre for Demography and Global Human Capital.

### 6.02 Extent of staff training

Response to the survey question "In your country, to what extent do companies invest in training and employee development?" [1 = not at all; 7 = to a great extent] | 2017–2018 weighted average or most recent period available

Source: World Economic Forum, Executive Opinion Survey. For more details, refer to Appendix B of this report.

### 6.03 Quality of vocational training

Response to the survey question "In your country, how do you assess the quality of vocational training?" [1 = extremely poor among the worst in the world; 7 = excellent among the best in the world] | 2017–2018 weighted average or most recent period available

Source: World Economic Forum, Executive Opinion Survey. For more details, refer to Appendix B of this report.

### 6.04 Skillset of graduates

Average score of the following two Executive Opinion Survey questions: "In your country, to what extent do graduating students from secondary education possess the skills needed by businesses?" and "In your country, to what extent do graduating students from university possess the skills needed by businesses?" In each case, the answer ranges from 1 (not at all) to 7 (to a great extent). | 2017–2018 weighted average or most recent period available

Source: World Economic Forum, Executive Opinion Survey. For more details, refer to Appendix B of this report.

### 6.05 Digital skills among active population

Response to the survey question "In your country, to what extent does the active population possess sufficient digital skills (e.g. computer skills, basic coding, digital reading)?" [1 = not at all; 7 = to a great extent] | 2017–2018 weighted average or most recent period available

Source: World Economic Forum, Executive Opinion Survey. For more details, refer to Appendix B of this report.

### 6.06 Ease of finding skilled employees

Response to the survey question "In your country, to what extent can companies find people with the skills required to fill their vacancies?" [1 = not at all; 7 = to a great extent] | 2017–2018 weighted average or most recent period available

Source: World Economic Forum, Executive Opinion Survey. For more details, refer to Appendix B of this report.

**6.07 School life expectancy**

Total number of years of schooling (primary through tertiary) that a child of school entrance age can expect to receive. | 2015

This indicator assumes that the probability of a person being enrolled in school at any particular future age is equal to the current enrolment ratio at that age. More details about the methodology can be found at <http://uis.unesco.org/en/glossary>.

Source: United Nations Educational, Scientific and Cultural Organization (UNESCO).

**6.08 Critical thinking in teaching**

Response to the survey question “In your country, how do you assess the style of teaching?” [1 = frontal, teacher based, and focused on memorizing; 7 = encourages creative and critical individual thinking] | 2017–2018 weighted average or most recent period available

Source: World Economic Forum, Executive Opinion Survey. For more details, refer to Appendix B of this report.

**6.09 Pupil-to-teacher ratio in primary education**

Average number of pupils per teacher, based on headcounts of both pupils and teachers. | 2016

Source: The World Bank Group.

**Pillar 7: Product market****7.01 Distortive effect of taxes and subsidies on competition**

Response to the survey question “In your country, to what extent do fiscal measures (subsidies, tax breaks, etc.) distort competition?” [1 = distort competition to a great extent; 7 = do not distort competition at all] | 2017–2018 weighted average or most recent period available

Source: World Economic Forum, Executive Opinion Survey. For more details, refer to Appendix B of this report.

**7.02 Extent of market dominance**

Response to the survey question “In your country, how do you characterize corporate activity?” [1 = dominated by a few business groups; 7 = spread among many firms]. | 2017–2018 weighted average or most recent period available

Source: World Economic Forum, Executive Opinion Survey. For more details, refer to Appendix B of this report.

**7.03 Competition in services**

Average of the scores of the three components of the following Executive Opinion Survey question: “In your country, how competitive is the provision of the following services: (a) professional services (legal services, accounting, engineering, etc.); (b) retail services; and (c) network sector (telecommunications, utilities, postal, transport, etc.)?” In each case, the answer ranges from 1 (not at all competitive) to 7 (extremely competitive). | 2017–2018 weighted average or most recent period available

Source: World Economic Forum, Executive Opinion Survey. For more details, refer to Appendix B of this report.

**7.04 Prevalence of non-tariff barriers**

Response to the survey question “In your country, to what extent do non-tariff barriers (e.g. health and product standards, technical and labelling requirements, etc.) limit the ability of imported goods to compete in the domestic market?” [1 = strongly limit; 7 = do not limit at all] | 2017–2018 weighted average or most recent period available

Source: World Economic Forum, Executive Opinion Survey. For more details, refer to Appendix B of this report.

**7.05 Trade tariffs**

Measured as the weighted average applied tariff rate, expressed in percentage points. | 2017

The weighted mean applied tariff is the average of effectively applied rates weighted by the product import shares corresponding to each partner country. Applied tariffs are considered to be the tariff rates applied by a customs administration on imported goods. They are the rates published by national customs authorities for duty administration purposes.

Source: International Trade Centre (ITC).

**7.06 Complexity of tariffs**

Score on an index that measures the complexity of a country's tariff regime. The index ranges from 1 (very complex) to 7 (not complex). | 2017

Tariff complexity is assessed on four criteria: tariff dispersion, the prevalence of tariff peaks, the prevalence of specific tariffs and the number of distinct tariffs. This index is calculated as the simple average of the normalized score of these four criteria.

Source: International Trade Centre (ITC).

**7.07 Border clearance efficiency**

Assesses the effectiveness and efficiency of the clearance process by customs and other border control agencies in the eight major trading partners of each country. The scale ranges from 1 (worst) to 5 (best). | 2018

More details about the methodology can be found at <https://ipi.worldbank.org/about>.

Source: The World Bank Group; Turku School of Economics.

**7.08 Service trade openness**

Score on the Services Trade Restrictiveness Index (STRI), which assesses the overall openness of the service sector of a country. The scale ranges from 0 (completely open) to 100 (completely closed). | 2011

The STRI measures openness for five major services sectors (financial services, telecommunications, retail distribution, transportation and professional services) and three modes of supply (cross-border supply of services, supply of services through commercial presence or FDI and temporary presence of natural persons). More details about the methodology can be found at <http://iresearch.worldbank.org/servicetrade/aboutData.htm#MeasuringRestrictions>.

Source: The World Bank Group.

**Pillar 8: Labour market****8.01 Redundancy costs**

Measures the cost of advance notice requirements and severance payments due when terminating a redundant worker, expressed in weeks of salary. | 2017

The average value of notice requirements and severance payments applicable to a worker with 1 year of tenure, 5 years of tenure, and 10 years of tenure is considered.

Source: The World Bank Group.

**8.02 Hiring and firing practices**

Response to the survey question “In your country, to what extent do regulations allow for the flexible hiring and firing of workers?” [1 = not at all; 7 = to a great extent] | 2017–2018 weighted average or most recent period available

Source: World Economic Forum, Executive Opinion Survey. For more details, refer to Appendix B of this report.

**8.03 Cooperation in labour-employer relations**

Response to the survey question “In your country, how do you characterize labour-employer relations?” [1 = generally confrontational; 7 = generally cooperative] | 2017–2018 weighted average or most recent period available

Source: World Economic Forum, Executive Opinion Survey. For more details, refer to Appendix B of this report.

**8.04 Flexibility of wage determination**

Response to the survey question “In your country, how are wages generally set?” [1 = by a centralized bargaining process; 7 = by each individual company] | 2017–2018 weighted average or most recent period available

Source: World Economic Forum, Executive Opinion Survey. For more details, refer to Appendix B of this report.

**8.05 Active labour policies**

Response to the survey question “In your country, to what extent do labour market policies help unemployed people to reskill and find new employment (including skills matching, retraining, etc.)?” [1 = not at all; 7 = to a great extent] | 2017–2018 weighted average or most recent period available

Source: World Economic Forum, Executive Opinion Survey. For more details, refer to Appendix B of this report.

**8.06 Workers’ rights**

Score adapted from the ITUC Global Rights Index, which measures the level of protection of internationally recognized core labour standards. The scale of this indicator ranges from 1 (no protection) to 7 (high protection). | 2017

Dimensions of labour protection include civil rights, the right to bargain collectively, the right to strike, the right to associate freely, and access to due process rights. The indicator does not consider firing regulations. More details about the methodology of the Global Rights Index can be found at <https://survey.ituc-csi.org/ITUC-Global-Rights-Index.html>.

Sources: International Trade Union Confederation (ITUC); World Economic Forum.

**8.07 Ease of hiring foreign labour**

Response to the survey question “In your country, how restrictive are regulations related to the hiring of foreign labour?” [1 = highly restrictive; 7 = not restrictive at all] | 2017–2018 weighted average or most recent period available

Source: World Economic Forum, Executive Opinion Survey. For more details, refer to Appendix B of this report.

**8.08 Internal labour mobility**

Response to the survey question “In your country, to what extent do people move to other parts of the country for professional reasons?” [1 = not at all; 7 = to a great extent] | 2017–2018 weighted average or most recent period available

Source: World Economic Forum, Executive Opinion Survey. For more details, refer to Appendix B of this report.

**8.09 Reliance on professional management**

Response to the survey question “In your country, who holds senior management positions in companies?” [1 = usually relatives or friends without regard to merit; 7 = mostly professional managers chosen for merit and qualifications] | 2017–2018 weighted average or most recent period available

Source: World Economic Forum, Executive Opinion Survey. For more details, refer to Appendix B of this report.

**8.10 Pay and productivity**

Response to the survey question “In your country, to what extent is pay related to employee productivity?” [1 = not at all; 7 = to a great extent] | 2017–2018 weighted average or most recent period available

Source: World Economic Forum, Executive Opinion Survey. For more details, refer to Appendix B of this report.

**8.11 Female participation in labour force**

Illustrates the ratio of the percentage of women aged 15–64 participating in the labour force as wage and salaried workers to the percentage of men aged 15–64 participating in the labour force as wage and salaried workers. | 2017

Wage and salaried workers (employees) are those workers who hold the type of jobs defined as “paid employment jobs,” where the incumbents hold explicit (written or oral) or implicit employment contracts that give them a basic remuneration that is not directly dependent upon the revenue of the unit for which they work.

Sources: International Labour Organization (ILO); World Economic Forum.

**8.12 Labour tax rate**

Labour tax and contributions are the amount of taxes (at any level—federal, state, or local) and mandatory contributions on labour paid by the business, expressed as a percentage of commercial profits. | 2016

This measure includes government-mandated contributions paid by the employer to a required private pension fund or workers’ insurance fund. More details about this indicator can be found at <http://www.doingbusiness.org/Methodology/Paying-Taxes>.

Source: The World Bank Group.

**Pillar 9: Financial system****9.01 Domestic credit to private sector**

The total value of financial resources provided to the private sector, expressed as a percentage of GDP. | 2014–2016 moving average

This indicator is computed as the sum of loans, purchases of non-equity securities, trade credits and other accounts receivable that establish a claim for repayment provided by financial corporations to firms and households.

Source: The World Bank Group.

**9.02 Financing of SMEs**

Response to the survey question “In your country, to what extent can small- and medium-sized enterprises (SMEs) access finance they need for their business operations through the financial sector?” [1 = not at all; 7 = to a great extent] | 2017–2018 weighted average or most recent period available

Source: World Economic Forum, Executive Opinion Survey. For more details, refer to Appendix B of this report.

**9.03 Venture capital availability**

Response to the survey question “In your country, how easy is it for start-up entrepreneurs with innovative but risky projects to obtain equity funding?” [1 = extremely difficult; 7 = extremely easy] | 2017–2018 weighted average or most recent period available

Source: World Economic Forum, Executive Opinion Survey. For more details, refer to Appendix B of this report.

**9.04 Market capitalization**

The total value of listed domestic companies, expressed as a percentage of GDP. | 2014–2016 moving average

Calculated as the share price of all listed domestic companies multiplied by the number of their outstanding shares. 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.

**9.05 Insurance premiums**

Life and non-life insurance premium volumes, expressed as a percentage of GDP. | 2013–2015 moving average

Computed as the sum of life and non-life insurance premium volume divided by GDP. The premium volume is the insurer's direct premiums earned (if property/casualty) or received (if life/health) during the previous calendar year.

Source: The World Bank Group.

**9.06 Soundness of banks**

Response to the survey question “In your country, how do you assess the soundness of banks?” [1 = extremely low banks may require recapitalization; 7 = extremely high banks are generally healthy with sound balance sheets] | 2017–2018 weighted average or most recent period available

Source: World Economic Forum, Executive Opinion Survey. For more details, refer to Appendix B of this report.

**9.07 Non-performing loans**

The ratio of the value of nonperforming loans divided by the total value of the loan portfolio of all banks operating in a country. | 2016

Defaulting loans are payments of interest and principal past due by 90 days or more. The loan amount recorded as nonperforming includes the gross value of the loan as recorded on the balance sheet, not just the amount that is overdue.

Source: International Monetary Fund (IMF).

**9.08 Credit gap**

Measures the difference between the credit-to-GDP ratio and its long-term trend. | 2016

Computed as the difference between the latest “Domestic credit to private sector (as a percentage of GDP)” and its trend. Following the methodology from Bank of International Settlements, the trend value is calculated by applying a Hodrick–Prescott filter to the 15-year time series of the “Domestic credit to private sector (% of GDP)” indicator. More details about the methodology can be found at [https://www.bis.org/publ/qtrpdf/r\\_qt1403g.htm](https://www.bis.org/publ/qtrpdf/r_qt1403g.htm).

Source: World Economic Forum; calculations based on The World Bank Group data.

**9.09 Banks' regulatory capital ratio**

Banks' regulatory capital ratio. | 2013–2015 moving average

This indicator measures the capital adequacy of deposit takers. It is a ratio of total banks' regulatory capital (shareholders' equity, disclosed and undisclosed reserves, revaluation reserves, general provisions and other instruments) to total banks' assets, weighted according to the risk of these assets. A log transformation is applied to the raw score before it is normalized to a 0 to 100 scale.

Source: The World Bank Group.

**Pillar 10: Market size****10.01 Gross domestic product**

Gross domestic product (GDP) valued at purchasing power parity in billions of international dollars (constant 2011 prices). | 2017

Source: International Monetary Fund (IMF).

**10.02 Imports of goods and services**

Imports of goods and services, expressed as a percentage of GDP. | 2017

This indicator illustrates the value of all goods and other market services received from the rest of the world, as a percentage of the country's GDP. Imports include the value of merchandise, freight, insurance, transport, travel, royalties, license fees and other services, such as communication, construction, financial, information, business, personal, and government services. They exclude compensation of employees and investment income (formerly called factor services) and transfer payments.

Sources: World Trade Organization (WTO); International Monetary Fund (IMF).

**Pillar 11: Business dynamism****11.01 Cost of starting a business**

Expressed as a percentage of the economy's income per capita. | 2017

The costs include all official fees and fees for legal or professional services if such services are required by law or commonly used in practice. Fees for purchasing and legalizing company books are included if these transactions are required by law. Although value-added tax registration can be counted as a separate procedure, value-added tax is not part of the incorporation cost. More details of the methodology can be found at <http://www.doingbusiness.org/Methodology/Starting-a-Business>.

Source: The World Bank Group.

**11.02 Time to start a business**

Number of calendar days needed to complete the procedures to legally operate a business. | 2017

The measure captures the median duration that incorporation lawyers or notaries indicate is necessary in practice to complete a procedure with minimum follow-up with government agencies and no unofficial payments. If a procedure can be sped up at additional cost, the fastest procedure, independent of cost, is chosen. More details about the methodology can be found at <http://www.doingbusiness.org/Methodology/Starting-a-Business>.

Source: The World Bank Group.

**11.03 Insolvency recovery rate**

Recorded as cents on the dollar recovered by secured creditors through judicial reorganization, liquidation or debt enforcement (foreclosure or receivership) proceedings. | 2017

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 the hotel furniture. More details about the methodology can be found at <http://www.doingbusiness.org/Methodology/Resolving-Insolvency>.

Source: The World Bank Group.

**11.04 Insolvency regulatory framework**

Score on an index that measures the adequacy and integrity of the legal framework applicable to liquidation and reorganization proceedings. Scores range from 0 to 16, with higher values indicating insolvency legislation that is better designed for rehabilitating viable firms and liquidating nonviable ones. | 2017  
The index is calculated as the sum of the scores on the commencement of proceedings index, management of debtor's assets index, reorganization proceedings index and creditor participation index.

Source: The World Bank Group.

**11.05 Attitudes toward entrepreneurial risk**

Response to the survey question "In your country, to what extent do people have an appetite for entrepreneurial risk?" [1 = not at all; 7 = to a great extent] | 2017–2018 weighted average or most recent period available

Source: World Economic Forum, Executive Opinion Survey. For more details, refer to Appendix B of this report.

**11.06 Willingness to delegate authority**

Response to the survey question "In your country, to what extent does senior management delegate authority to subordinates?" [1 = not at all; 7 = to a great extent] | 2017–2018 weighted average or most recent period available

Source: World Economic Forum, Executive Opinion Survey. For more details, refer to Appendix B of this report.

**11.07 Growth of innovative companies**

Response to the survey question "In your country, to what extent do new companies with innovative ideas grow rapidly?" [1 = not at all; 7 = to a great extent] | 2017–2018 weighted average or most recent period available

Source: World Economic Forum, Executive Opinion Survey. For more details, refer to Appendix B of this report.

**11.08 Companies embracing disruptive ideas**

Response to the survey question "In your country, to what extent do companies embrace risky or disruptive business ideas?" [1 = not at all; 7 = to a great extent] | 2017–2018 weighted average or most recent period available

Source: World Economic Forum, Executive Opinion Survey. For more details, refer to Appendix B of this report.

**Pillar 12: Innovation capability****12.01 Diversity of workforce**

Response to the survey question "In your country, to what extent do companies have a diverse workforce (e.g. in terms of ethnicity, religion, sexual orientation, gender)?" [1 = not at all; 7 = to a great extent] | 2017–2018 weighted average or most recent period available

Source: World Economic Forum, Executive Opinion Survey. For more details, refer to Appendix B of this report.

**12.02 State of clusters development**

Response to the survey question "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 = non-existent; 7 = widespread in many fields] | 2017–2018 weighted average or most recent period available

Source: World Economic Forum, Executive Opinion Survey. For more details, refer to Appendix B of this report.

**12.03 International co-inventions**

Number of patent family applications with co-inventors located abroad per million population. | 2012–2014 average

Computed as the sum of the patent family applications with at least one co-inventor located abroad, filed in at least two of the major five (IP5) offices in the World: the European Patent Office (EPO), the Japan Patent Office (JPO), the Korean Intellectual Property Office (KIPO), the State Intellectual Property Office of the People's Republic of China (SIPO), and the United States Patent and Trademark Office (USPTO). Data is extracted from the PATSTAT database by earliest filing date and inventor country, using fractional counts, and expressed in applications per million population. A log transformation is applied to the raw score before it is normalized to a 0 to 100 scale.

Source: Organisation for Economic Co-operation and Development (OECD).

**12.04 Multistakeholder collaboration**

Average score of the following three Executive Opinion Survey questions: "In your country, to what extent do people collaborate and share ideas within a company?" [1 = not at all; 7 = to a great extent]; "In your country, to what extent do companies collaborate in sharing ideas and innovating?" [1 = not at all; 7 = to a great extent]; "In your country, to what extent do business and universities collaborate on research and development (R&D)?" [1 = do not collaborate at all; 7 = collaborate extensively] | 2017–2018 weighted average or most recent period available

Source: World Economic Forum, Executive Opinion Survey. For more details, refer to Appendix B of this report.

**12.05 Scientific publications**

Score on an index measuring the number of publications and their citations, expressed at the country level. | 2015–2017 average

The H-index measures the number of published papers cited in other papers at least h times. The H-index reflects both the number of publications and the number of citations per publication. Only articles, reviews and conference papers are considered. The document universe is defined by those tracked by Scopus, an abstract and citation database of peer-reviewed literature: scientific journals, books and conference proceedings. A log transformation is applied to the raw score before it is normalized to a 0 to 100 scale.

Source: SCImago.

**12.06 Patent applications**

Total number of patent family applications per million population. | 2012–2014 average

Computed as the sum of the patent family applications filed in at least two of the major five (IP5) offices in the World: the European Patent Office (EPO), the Japan Patent Office (JPO), the Korean Intellectual Property Office (KIPO), the State Intellectual Property Office of the People's Republic of China (SIPO), and the United States Patent and Trademark Office (USPTO). Data are extracted from the PATSTAT database by earliest filing date and inventor country, using fractional counts, and expressed in applications per million population. A log transformation is applied to the raw score before it is normalized to a 0 to 100 scale.

Sources: Organisation for Economic Co-operation and Development (OECD).

**12.07 R&D expenditures**

Expenditures on research and development (R&D), expressed as a percentage of GDP. | 2015

Expenditures for research and development are current and capital expenditures (both public and private) on creative work undertaken systematically to increase knowledge—including knowledge of humanity, culture, and society—and the use of knowledge for new applications. R&D covers basic research, applied research and experimental development.

Source: UNESCO Institute for Statistics.

**12.08 Research institutions prominence index**

Score on an index that measures the prominence and standing of private and public research institutions. | 2017

The index is computed as the sum of the inverse ranks of all research institutions in a country included in the SCImago Institutions Rankings (SIR). A log transformation is applied to the raw score before it is normalized to a 0 to 100 scale. More details about the SIR methodology can be found at <https://www.scimagoir.com/methodology.php>.

Sources: SCImago; World Economic Forum.

**12.09 Buyer sophistication**

Response to the survey question “In your country, on what basis do buyers make purchasing decisions?” [1 = based solely on the lowest price; 7 = based on sophisticated performance attributes] | 2017–2018 weighted average or most recent period available

Source: World Economic Forum, Executive Opinion Survey. For more details, refer to Appendix B of this report.

**12.10 Trademark applications**

Number of trademark applications per million population. | 2014–2016 moving average

Number of international trademark applications issued directly or through the Madrid System by country of origin per million population. The residence of the first-named applicant is used to determine the origin of an application. When there are multiple applicants, only the first one is considered. This indicator is based on the concept of “equivalent count”. That is, an application filed at a regional IP office is counted multiple times according to the number of its members. A log transformation is applied to the raw score before it is normalized to a 0 to 100 scale.

Source: World Intellectual Property Organization (WIPO).

**C. MISSING DATA IMPUTATION**

Missing values and values older than 2008 are imputed for the purpose of the calculation, with the exception of indicator 1.05 Social capital, for which missing data is not imputed. Table 1 below presents the imputation method and the imputed values by indicator. Note that the Economy Profiles and Ranking tables (available online at <http://gcr.weforum.org>) do not report imputed values.

**D. COMPUTATION OF PROGRESS SCORES AND FRONTIER VALUES**

To allow the aggregation of indicators of different nature and magnitude, each indicator entering the GCI is converted into a unit-less score, called ‘progress score’, ranging from 0 to 100 using a min-max transformation. Formally, each indicator is re-scaled according to the following formula:

$$score_{i,c} = \left( \frac{value_{i,c} - wp_i}{frontier_{i,c} - wp_i} \right) \times 100,$$

$\alpha$

where  $value_{i,c}$  is the “raw” value of country  $c$  for indicator  $i$ , worst performance ( $wp_{i,c}$ ) is the lowest acceptable value for indicator  $i$  and  $frontier_{i,c}$  corresponds to the best possible outcome. Depending on the indicator, the frontier may be a policy target or aspiration, the maximum possible value, or a number was derived from statistical analysis of the distribution (e.g. 90th or 95th percentile). If a value is below the worst performance value, its score is 0; if a value is above the frontier value, its score is capped at 100. In the case of indicators where a higher value corresponds to a worse outcome (e.g. terrorism incidence, power losses), the normalized score becomes 100 minus the expression above, so 100 always corresponds to the ideal outcome. In some cases, signalled in Section A above, a logarithmic transformation is applied to the value, prior to conversion. The following table provides the actual floor and frontier values used for the normalization of each individual indicator.

**E. BACKCASTING THE 2017 EDITION OF THE GCI 4.0**

In order to provide a point of reference against which to compare the inaugural edition of the Global Competitiveness Index 4.0, the index was computed for 2017. The ‘backcast’ edition results were produced by using the GCI 4.0 methodology, the weighted averages of the 2016 and 2017 editions of the Executive Opinion Survey (in most cases) and the values for all the other indicators from one period earlier than the period used in the 2018 edition of the GCI 4.0. For example, for indicator 1.02 Homicide rate, the GCI 4.0 uses 2016 data. For the backcast 2017 edition, the 2015 data was used. More generally, if for any given indicator and country the value used for the 2018 edition of the GCI 4.0 is from period  $t$ , for the backcast 2017 edition, the value from period  $t-1$  was used provided the value is available. In most cases, this amounts to ‘going back in the past’, to collect for each indicator the data that would have been available as of July 2017. When doing so would have led to using values older than 2015, the value used for the 2018 edition is used instead. In case the value used for the 2018 edition is from an earlier period, this value is automatically used for the backcast edition. For indicators 2.01, 2.03, 2.05, 6.01, 6.07, 9.05, and 9.10, the exact same dataset was used for both editions. As a result, the differences between the two editions are slightly underestimated.

**Table 1: GCI 4.0 imputation methodology and imputed values**

Indicator	Imputation method	Economy	Imputed value
<b>1.05 Social capital</b>	Linear regression estimation. Regressors: Mean years of schooling, Corruption Perception Index, General trust among population, and GDP (log).	Bosnia and Herzegovina	53.02
		Serbia	45.62
		Taiwan, China	54.22
<b>1.12 E-Participation</b>	Linear regression estimation. Regressors: Corruption Perception Index, Net users, and Open Budget Data score.	Hong Kong SAR	0.93
		Taiwan, China	0.94
<b>2.03 Railroad density</b>	Linear regression estimation. Regressors: Electrification rate, Road quality index, Urbanization rate, Land-locked country (binary), and regional dummies (IMF classification).	Zambia	14.45
<b>2.10 Electricity quality</b>	Linear regression estimation. Regressors: Electrification rate and GDP (log).	Burundi	26.04
		Burkina Faso	23.00
		Cape Verde	7.30
		Guinea	23.29
		Gambia, The	18.16
		Lao PDR	8.80
		Liberia	25.69
		Lesotho	20.72
		Mauritania	20.94
		Malawi	25.23
		Rwanda	21.05
		Sierra Leone	26.10
		Eswatini	9.52
		Seychelles	6.94
Chad	25.65		
Uganda	22.73		
<b>2.11 Exposure to unsafe drinking water</b>	Peer group mean. Group is defined as the combination or World Bank income group and regional dummies (IMF classification).	Hong Kong SAR	4.15
<b>Ratio of fiber internet subscriptions (indicator 3.04) to fixed-broadband internet subscriptions (indicator 3.03)</b>	Linear regression estimation. Regressors: Net users, Electrification rate, and regional dummies (IMF classification).	Benin	0.04
		Burkina Faso	0.04
		Congo, Democratic Rep.	0.02
		Cape Verde	0.20
		Egypt	0.09
		Ghana	0.15
		Guinea	0.03
		Honduras	0.01
		Haiti	0.00
		Lebanon	0.18
		Liberia	0.02
		Mali	0.05
		Mauritania	0.06
		Nicaragua	0.00
		Philippines	0.46
		Sierra Leone	0.03
		Eswatini	0.13
		Seychelles	0.22
		Tajikistan	0.32
Uganda	0.06		
<b>5.01 Healthy life expectancy</b>	Linear regression estimation. Regressors: Life expectancy, GDP (log), and regional dummies (IMF classification).	Hong Kong SAR	72.80
<b>6.09 Pupil-to-teacher ratio in primary education</b>	Linear regression estimation. Regressors: Net primary education enrollment, Gross secondary education enrollment, GDP (log), and regional dummies (IMF classification).	Montenegro	15.35
		Venezuela	22.63
<b>7.07 Border clearance efficiency</b>	Peer group mean. Group is defined as the combination or World Bank income group and regional dummies (IMF classification).	Cape Verde	2.40
		Eswatini	2.40
		Seychelles	3.34

*(Continued)*

**Table 1: GCI 4.0 imputation methodology and imputed values** (cont'd.)

Indicator	Imputation method	Economy	Imputed value
<b>7.08 Service trade openness</b>	Linear regression estimation. Regressors: Regional service trade agreements count, Service Imports-to-GDP, GDP (log), and regional dummies (IMF classification).	Angola	33.46
		United Arab Emirates	46.92
		Azerbaijan	17.80
		Benin	30.20
		Burkina Faso	30.56
		Bosnia and Herzegovina	18.16
		Brunei Darussalam	25.51
		Switzerland	12.90
		Congo, Democratic Rep.	32.47
		Cape Verde	25.74
		Cyprus	11.77
		Estonia	13.45
		Guinea	30.27
		Gambia, The	26.60
		Hong Kong SAR	29.31
		Croatia	16.02
		Haiti	17.53
		Iceland	13.15
		Israel	46.71
		Jamaica	17.56
		Lao PDR	44.60
		Liberia	27.70
		Luxembourg	10.50
		Latvia	14.66
		Moldova	14.60
		Macedonia, FYR	16.77
		Malta	32.21
		Montenegro	14.74
		Mauritania	29.32
		Norway	27.20
		Singapore	10.80
		Sierra Leone	28.57
		El Salvador	18.93
Serbia	18.73		
Slovak Republic	18.10		
Slovenia	15.08		
Eswatini	28.67		
Seychelles	23.59		
Chad	28.91		
Tajikistan	15.82		
Taiwan, China	32.00		
Yemen	43.85		
<b>8.06 Workers' rights</b>	Linear regression estimation and peer group means. Regressors: World Press Freedom Index, Ratio of wage and salaried female workers to men workers, and regional dummies (IMF classification).	Armenia	69.78
		Azerbaijan	55.29
		Brunei Darussalam	62.04
		Cape Verde	79.70
		Cyprus	86.89
		Guinea	63.81
		Gambia, The	64.67
		Kyrgyz Republic	68.66
		Luxembourg	86.98
		Malta	62.38
		Mongolia	75.16
		Malawi	76.15
		Nicaragua	65.23
Slovenia	85.51		
Seychelles	88.37		
Tajikistan	60.37		
<b>9.05 Insurance premiums</b>	Linear regression estimation. Regressors: Domestic credit to private sector, GDP (log), and regional dummies (IMF classification).	Armenia	0.63
		Congo, Democratic Rep.	0.37
		Liberia	0.37
		Montenegro	1.30
		Zimbabwe	0.37
<b>9.07 Non-performing loans</b>	Linear regression estimation. Regressors: Domestic credit to private sector, Credit gap, GDP (log), and GDP growth rate.	Haiti	10.35
		Montenegro	15.40

(Continued)

**Table 1: GCI 4.0 imputation methodology and imputed values** (*cont'd.*)

Indicator	Imputation method	Economy	Imputed value
<b>9.09 Banks' regulatory capital ratio</b>	Linear regression estimation. Regressors: Domestic credit to private sector, GDP (log), and regional dummies (IMF classification).	Angola	18.35
		Benin	20.05
		Burkina Faso	19.63
		Côte d'Ivoire	18.96
		Congo, Democratic Rep.	19.26
		Cape Verde	20.60
		Ethiopia	18.18
		Gambia, The	21.80
		Haiti	18.36
		Iran, Islamic Rep.	15.06
		Jamaica	17.86
		Lao PDR	20.71
		Liberia	21.25
		Mali	19.62
		Montenegro	21.65
		Mongolia	19.96
		Malawi	20.39
		Nicaragua	17.44
		Nepal	15.24
		Chad	20.25
Taiwan, China	14.98		
Zimbabwe	19.78		
<b>12.07 R&amp;D expenditures</b>	Linear regression estimation. Regressors: IP 5 patent applications per million population, Gross tertiary education enrollment, Mean years of schooling, and GDP (log).	Benin	0.13
		Brunei Darussalam	0.40
		Côte d'Ivoire	0.18
		Cameroon	0.29
		Guinea	0.10
		Honduras	0.29
		Haiti	0.15
		Lao PDR	0.25
		Lebanon	0.53
		Liberia	0.00
		Mauritania	0.06
		Nigeria	0.29
		Rwanda	0.12
		Sierra Leone	0.41
		Eswatini	0.18
		Seychelles	0.26
		Chad	0.04
Venezuela	0.53		
Yemen	0.11		
Zimbabwe	0.25		
<b>12.10 Trademark applications</b>	Peer group mean. Group is defined as the combination of World Bank income group and IMF regional classification.	Burundi	64.74
		Greece	8,080.30
		Guatemala	232.27
		Paraguay	908.42
		Slovenia	8,080.30
		Taiwan, China	8,080.30

Table 2: Normalization of indicators

Indicator title and units	Frontier	Worst performance	Applied transformation	Guiding principle
1.02 Homicides per 100,000 population	0.5	30	—	Winsorization
1.03 Terrorism incidence (0=very high; 100=no incidence)	100	0	—	Range of possible values
1.05 Social capital (0–100, high)	100	0	—	Range of possible values
1.06 Open Budget Data score (0–100, best)	100	0	—	Range of possible values
1.09 World Press Freedom (0=most free; 100=least free)	0	100	—	Range of possible values
1.12 E-Participation Index (0–1, best)	1	0	—	Range of possible values
1.14 Corruption Perception Index (0=highly corrupt; 100=very clean)	100	0	—	Range of possible values
1.17 Quality of land administration index (0–30, best)	30	0	—	Range of possible values
1.19 Extent of conflict of interest regulation (0–10, best)	10	0	—	Range of possible values
1.20 Extent of shareholder governance (0–10, best)	10	0	—	Range of possible values
2.01 Road quality index (0–100, best)	100	0	—	Range of possible values
2.03 Railroad density (km/1,000 km <sup>2</sup> )	40	0	—	Winsorization
2.05 Airport connectivity (score)	200	0	Cubic power of logarithm	Winsorization
2.07 Liner Shipping Connectivity Index (0–100, best)	100	0	—	Range of possible values
2.09 Electrification rate (% of population)	100	0	—	Winsorization
2.10 Electric power losses (% of output)	4	100	—	Winsorization
2.11 Exposure to unsafe drinking water (% of population)	2	100	—	Winsorization
3.01 Mobile-cellular telephone subscriptions (per 100 pop.)	120	0	—	120 is the value above which mobile broadband technology is considered sufficiently widespread not to constitute a constraint for the average user
— Ratio of mobile broadband subs. to total mobile subs.	0.9	0	Ratio of mobile broadband subscription and minimum between actual mobile broadband subscriptions and 120 (see indicator 3.01)	Winsorization
3.03 Fixed-broadband internet subscriptions (per 100 pop.)	50	0	—	50 is the value above which fixed broadband technology is considered sufficiently widespread not to constitute a constraint for the average user
— Ratio of fibre subs. to fixed-broadband subs.	0.9	0	Ratio of fiber broadband subscription and minimum between actual fixed broadband subscriptions and 50 (See indicator 3.03)	Winsorization
3.05 Internet users (% of adult population)	100	0	—	Based on ITU (International Telecommunications Union) practice
4.01 Inflation (%)	4	40	Any value between 0 and 4 is assigned a value of 0.5. Values lower than 4 are transformed into 4+ (0.5-value)	Central banks' target and winsorization
4.02 Debt dynamic (0–100, best)	100	0	—	Winsorization
5.01 Health-adjusted life expectancy (years)	72	40	—	Winsorization
6.01 Mean years of schooling (years)	15	0	—	Based on Human Development Report 2016 practice
6.07 School life expectancy (years)	18	0	—	Based on Human Development Report 2016 practice
6.09 Pupil-to-teacher ratio in primary education	10	50	—	Winsorization

(Continued)

Table 2: Normalization of indicators (cont'd.)

Indicator title and units		Frontier	Worst performance	Applied transformation	Guiding principle
7.05	Trade tariffs (%)	0	15	—	Frontier set at minimum possible value, winsorization for worst performance
7.06	Complexity of tariffs (1–7, least complex)	7	1	—	Range of possible values
7.07	Border clearance efficiency (1–5, best)	5	1	—	Range of possible values
7.08	Service Trade Restrictiveness Index (0=completely open; 100=completely closed)	0	100	—	Range of possible values
8.01	Redundancy costs (weeks of salary)	0	52	—	Frontier set at minimum possible value, winsorization for worst performance
8.06	Workers' Rights Index (0–100, best)	100	0	—	Range of possible values
8.11	Ratio of wage and salaried female workers to male workers (%)	1	0.2	—	Winsorization
8.12	Total tax on labour (%)	8	80	—	Winsorization
9.01	Domestic credit to private sector (% of GDP)	95	0	—	Winsorization for frontier, worst performance set at minimum possible value
9.04	Market capitalization (% of GDP)	100	0	—	Winsorization for frontier, worst performance set at minimum possible value
9.05	Life and non-life insurance premium (% of GDP)	6	0	—	Winsorization for frontier, worst performance set at minimum possible value
9.07	Bank nonperforming loans (% of loan portfolio value)	0.5	50	—	Winsorization
9.08	Credit gap (%)	2	40	—	Winsorization
9.09	Banks' regulatory capital ratio (% of risk-weighted assets)	17	0	Logarithmic	Winsorization for frontier, worst performance set at minimum possible value
Pillar 10	Market size	10	0	Logarithm of (GDP + imports)	Winsorization for frontier, worst performance set at minimum possible value
11.01	Cost required to start a business (% of GNI per capita)	0	200	—	Frontier set at minimum possible value, winsorization for worst performance
11.02	Time required to start a business (days)	0.5	100	—	Winsorization
11.03	Resolving Insolvency - Recovery rate (cents to the dollar)	92.9	0	—	Winsorization for frontier, worst performance set at minimum possible value
11.04	Strength of insolvency framework (0–16, best)	16	0	—	Range of possible values
12.03	IP5 international patent applications (per million pop.)	25	0	Logarithmic	Winsorization for frontier, worst performance set at minimum possible value
12.05	Scientific publications H Index	855	0	Logarithmic	Winsorization for frontier, worst performance set at minimum possible value
12.06	IP 5 patent applications (per million pop.)	230	0	Logarithmic	Winsorization for frontier, worst performance set at minimum possible value
12.07	R&D expenditures (% of GDP)	3	0	—	Winsorization for frontier, worst performance set at minimum possible value
12.08	Research institutions prominence index	0.43	0	Logarithmic	Winsorization for frontier, worst performance set at minimum possible value
12.10	Trademark applications (per million pop.)	10,890	0	Logarithmic	Winsorization for frontier, worst performance set at minimum possible value

**Note:** "Winsorization" means that the Frontier/Worst performance values are set based on percentile values of the indicator's distribution such that outliers are excluded.