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.

Table 1: Changes to the Global Innovation Index framework

GII 2014		Adjustment	GII 2015	
1.1.3	Press Freedom Index*	Deleted		
2.3.1	Researchers, headcounts/mn pop.	Methodology changed	2.3.1	Researchers, FTE/mn pop.
4.3.2	Non-agricultural mkt access weighted tariff, %	Deleted		
4.3.3	Intensity of local competition	Number changed	4.3.2	Intensity of local competition
5.1.4	GERD performed by business enterprise, %	Methodology changed	5.1.4	GERD financed by business enterprise, %
5.1.5	GMAT test takers/mn pop. 20–34	Replaced	5.1.5	Females employed with advanced degrees, % total employed

* Currently searching for a better variable to capture the openness of an economy to innovation.

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 the pillar or 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); and the International Telecommunication Union (ITU) as well as private organizations such as the International Organization for Standardization (ISO); IHS Global Insight; QS Quacquarelli Symonds Ltd; ZookNIC Inc; Google; and PwC to obtain the best available data on innovation measurement globally.

Although the rationale for the adjustments made to the GII framework is explained in detail in Annex 1, Table 1 provides a summary of these changes for quick reference. A total of six indicators were modified this year: three indicators were deleted or replaced, two underwent methodological changes (new computation methodology at the source), and one changed its indicator number as a result of the framework adjustments.

The statistical audit performed by the Joint Research Centre (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, but 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;

Table 2: Changes in GDP PPP$ values

Economy	GDP PPP$ per former ICP	GDP PPP$ per revised ICP	Change
Zimbabwe	7.40	25.92	246%
Zambia	25.45	57.08	124%
United Arab Emirates	269.82	570.57	111%
Nigeria	478.53	972.65	103%
Myanmar	111.12	221.48	99%
Indonesia	1,284.78	2,511.44	95%
Jordan	40.02	76.11	90%
Mongolia	17.03	31.78	87%
Algeria	284.68	522.31	83%
Kuwait	154.23	276.31	79%
Sudan	89.97	151.69	69%
Bahrain	34.96	58.28	67%
Egypt	551.44	909.82	65%
Saudi Arabia	927.76	1,527.73	65%
Oman	94.86	155.46	64%
Yemen	62.61	102.33	63%
Kazakhstan	243.56	395.46	62%

- 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 significant shifts in the results for several countries. The methodologies underpinning indicators 3.1.3 Government Online Service Index and 3.1.4 E-Participation Index,[1] both computed by the United Nations, have been revised.

Similarly, the World Bank's International Comparison Programme (ICP) has revised the methodology used to compute the purchasing power parity (PPP) conversion factor. This factor is used to compute the GDP in PPP current international dollars (PPP$ GDP), a scaling factor used to enable country comparisons for variables 3.3.3, 4.2.4, 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. 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.

As a result, PPP estimates are not comparable with those published in previous editions and, in some countries, they differ significantly. Table 2 details those countries that were most affected by the revised PPP values, using the 2013 reference year as an example.

Because of a larger revised PPP$ GDP figure, some of the GII scores for the variables scaled by this factor have decreased for those countries, partly affecting their rankings in these variables.[2] However, in some

instances an economy's numerator for these variables has actually decreased from last year to this year, which can be another, unrelated reason for a lower score. The impact of the PPP$ GDP revision in the overall GII rankings is negligible.

Missing values

When it comes to country coverage, the objective is to include as many economies as possible. To be included in the GII, economies must have a minimum data coverage of 48 indicators out of 79 (60%) and 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.

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. However, eradicating missing values can have an initial negative affect on an economy's GII ranking (this can be viewed as a structural break in the time series). Over time, these results are smoothed out and the effect is a more positive and accurate ranking.

For several economies, the number of missing data points remains very high. Table 3 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 4 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.

Table 3: GII economies with the most missing values

Economy	Number of missing values
Seychelles	31
Angola	31
Togo	31
Gambia	30
Uzbekistan	30
Myanmar	30
Sudan	30
Cabo Verde	29
Lesotho	29
Burundi	29
Fiji	28
Swaziland	28
Niger	28
Guinea	28
Guyana	27
Bhutan	27
Nicaragua	27
Barbados	26
Bosnia and Herzegovina	24
Cambodia	23
Malawi	23
Honduras	23
Zimbabwe	23
Yemen	23
Rwanda	22
Cameroon	22
Côte d'Ivoire	22
Nepal	22
United Arab Emirates	21
Trinidad and Tobago	21
Mali	21
Tajikistan	21
Zambia	21
Kuwait	20
Jamaica	20
Burkina Faso	20

Table 4: GII economies with the fewest missing values

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

Notes

1 The Government Online Service Index this year focuses more on e-participation in particular, and on the presence of open data initiatives on government websites, than it did in previous editions. The 2014 version of the E-Government Survey expanded the assessment of e-participation so as to include also the use of e-government programmes to engage citizens in public policy making and implementation. The survey was updated to improve the accuracy of the information collected on e-consultation and e-decision-making initiatives. New questions and updates were also made to better assess data publishing and sharing by government agencies; the availability of information on the citizens' rights to access government information; the provision of outcome on feedback received from citizens concerning the improvement of its online services; and the provision of tools in order to obtain public opinion for public policy deliberation through social media, online polls, petition tools, voting tools, online-bulletin boards, and online discussion forums.

2 Notable instances of decreased scores include Bahrain (for indicator 7.1.1), Indonesia (3.3.3, 6.2.4), Jordan (7.1.1), Kazakhstan (7.1.1), Saudi Arabia (3.3.3, 6.1.4), Sudan (3.3.3), and United Arab Emirates (3.3.3).