The Global Innovation Index 2012: Stronger Innovation Linkages for Global Growth

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The global economic recovery is fragile and uneven across different regions.

Most current economic forecasts by leading international economic institutions predict a slowdown of gross domestic product (GDP) growth throughout 2012 and an uncertain recovery in 2013.[1] Despite some setbacks, growth remains relatively strong in most emerging-market economies. The situation in high-income economies, however, is more precarious. Unemployment is high and growing in many of these countries. Full crisis recovery will take its time, and there are risks of a renewed degradation of the economic climate resulting in a prolonged state of uncertainty.

In this context, the economic policy debate is placing renewed emphasis on achieving an appropriate policy framework that fosters growth and employment while promoting sustainable public finances. As outlined in the Preface to this report, policies that promote innovation and structural policies fostering long-term output growth should feature prominently in these discussions. Although innovation cannot cure the most immediate financial difficulties, it is a crucial element of sustainable growth. Forward-looking measures are needed to lay the foundations for future prosperity.

The economic crisis is affecting not only investments but also the climate for innovation.[2] The effect of this downturn on innovation is complex and ambiguous, with large variations across firms, sectors, countries, and regions. On the one hand, crisis might stimulate new entrepreneurial ventures and growth areas. Past crises in the 1990s are said to have generated new strings of innovative companies and may have put entire nations—such as Finland and the Republic of Korea—on a new growth path.[3] Countries that continue to invest in innovation despite economically worsening conditions are reaping the benefits of their efforts at some point.

On the other hand, true risks exist in terms of a negative effect on innovation expenditures and outputs. Total and/or business R&D investments have declined as of 2008 or 2009 in a significant number of countries for which data are available (for example, in Canada, Israel, Lithuania, Netherlands, Spain, Sweden, and the United Kingdom, or UK).[4] Moreover, the world's top R&D investors decreased their R&D spending by 1.9% in 2009.[5] The crisis is expected to have slowed the introduction of new products or processes, primarily because of decreased demand and increased business uncertainty, including uncertainty about the size of the future market. Large multinational firms responsible for a large share of business R&D have recently accumulated large cash stocks that are not being reinvested.

Unmistakably, reductions or a streamlining of R&D expenditures in times of crisis does not have to affect research output or innovations if efficiency is improved and less promising projects are discontinued. Still, firms—in particular small and medium-sized enterprises (SMEs)—face greater difficulties in tapping external sources of funding to support their innovation investments and to finance new business ventures. The access to venture capital is still severely depressed. The number of firm creations is down in countries for which data are available.

Importantly, research and development (R&D) and innovation expenditures cannot often be stopped and subsequently picked up again simply when the economy recovers. Initial investments are sunk. Researchers deskill and PhD students without funding go into other fields. Innovation that is postponed now will also not take place later; there are hysteresis effects in innovation.

Knowing the exact effects of the economic crisis on business innovation will take time. The questions involved are too complex to be reduced to a blanket assessment of the effect of the economic slowdown on the level and geography of innovation. Moreover, such an assessment is premature and data to fully assess the impacts are only emerging.

Also, as part of their stimulus packages, in 2009 and onwards most

governments have pledged to avoid cutbacks in science and R&D or even increase spending.[6] Ideally, spending measures decided by governments need to marry short-term demand stimulus with longer-lasting growth objectives. Most governments have also identified financial or structural policies to foster new employment and growth in areas such as research, the health sector, transport, and the environment. There is now a need to monitor and assess how and whether these stimulus measures have been implemented and to determine the impacts on short-term demand and longer-term economic foundations and the society more broadly. This applies to programmes decided in 2009 and to those that are in the offing.

To support these debates, to guide polices, and to highlight good practices, metrics are required to assess innovation and related policy performance. For this purpose the GII is timely and relevant.

Stronger innovation linkages for global growth

The theme of this year's GII report, 'Stronger innovation linkages for global growth', underlines the importance of productive interactions among innovation actors—firms, the public sector, academia, and society—in modern innovation ecosystems (see also Chapter 4 of this report).

More and more attention is focused on the interplay of institutions and the interactive processes in the creation, application, and diffusion of knowledge, human capital, and technology. In particular, the transfer of scientific results and inventions and their application to societal challenges in high- and lower-income countries alike is garnering attention.

In the policy debate and the literature, emphasis is put on the increasingly collaborative nature of innovative processes. Such collaboration has been facilitated as innovation processes have become more fragmented and 'open'.[7] As studied in several chapters of this publication, the role of the Internet more generally has been crucial in introducing changes to the innovation process and to related outputs.[8] Markets for technologies that allow for knowledge diffusion have added a further boost to collaboration.[9]

Accordingly, in the last decades in high- and middle-income countries alike, various national strategies have aimed to improve the linkages between the various innovation actors, most notably the science system and higher education, the government, the private sector, and increasingly also the not-for-profit sector such as philanthropies and nongovernmental organizations.

The measurement agenda has evolved to address the *systemic dimension of innovation*[10]—that is, the activities of multiple innovation actors and linkages among them.[11] The challenge is to detect and quantify the dynamic and often informal nature of linkages and their efficacy.

This policy and measurement ambition is far from being important only to advanced economies. It is also critical in most low- and middle-income country contexts, where innovation linkages are, on average, weaker than in high-income countries. Furthermore, low- and middle-income countries have been the source of incremental innovation.[12] One challenge is to appropriately quantify the extent of this type of innovation and the required linkages.

Yet again, the GII intends to contribute to the policy and measurement debate on linkages. It does so by introducing and discussing relevant metrics that are complemented by substantive chapters that analyse this theme in the context of particular country settings (Chapter 3 on Saudi Arabia, Chapter 5 on the Golf Cooperation Council, Chapter 6 on the Russian Federation, and Chapter 7 on India) and with a focus on science-industry linkages (Chapters 4 and 8), public-private partnerships (Chapter 2), and the role of information and communication technologies and the Internet (Chapters 8, 9, and 10).

The rationale for the Global Innovation Index

The GII project was launched by INSEAD in 2007 with the simple goal of determining how to find metrics and approaches to 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 R&D expenditures.[13]

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, there is awareness that 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. 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.

The GII helps to create an environment in which innovation factors are under continual evaluation, and it provides a key tool and a rich database of detailed metrics for refining innovation policies.

The GII is not meant to be the ultimate and definitive ranking of nations 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 form of several rankings, the GII is more concerned with improving the 'journey' to better measuring and understanding innovation, and with identifying targeted policies, good practices, and other levers to foster innovation. The rich metrics can be used by individual countries—either at the level of the index and sub-indices or at the level of individual variables, such as 'the number of patent applications by resident'—to monitor performance over time and to benchmark developments against other countries in the same region or of the same income group.

As a result, and drawing on the expertise of the GII's Knowledge Partners and the prominent Advisory Board, the GII model is continually updated to reflect the improved availability of statistics and our understanding of the meaning and implications of innovation. This year particular emphasis is placed on avoiding flawed year-on-year comparisons by estimating the impact in the rankings of changes in performance on particular indicators, adjustments to the GII framework, and/or the inclusion of additional economies in the rankings.

An inclusive perspective on innovation

The GII adopts a broad notion of innovation, originally presented in the *Oslo Manual* developed by the European Communities and the OECD:[14]

> 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 evolving nature of the way innovation is perceived and understood over the last two decades.[15]

Previously, economists and policy makers focused on R&D-based technological product innovation, largely produced in-house and mostly in manufacturing industries. This type of innovation is 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 also 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 and embraces the notion of incremental innovation and 'innovation without research'. Non-R&D-innovative expenditure is an important component of reaping the rewards of technological innovation.

There is also an increasing interest in understanding how innovation takes place in low- and middle-income countries and an awareness that incremental forms of innovation can impact development.

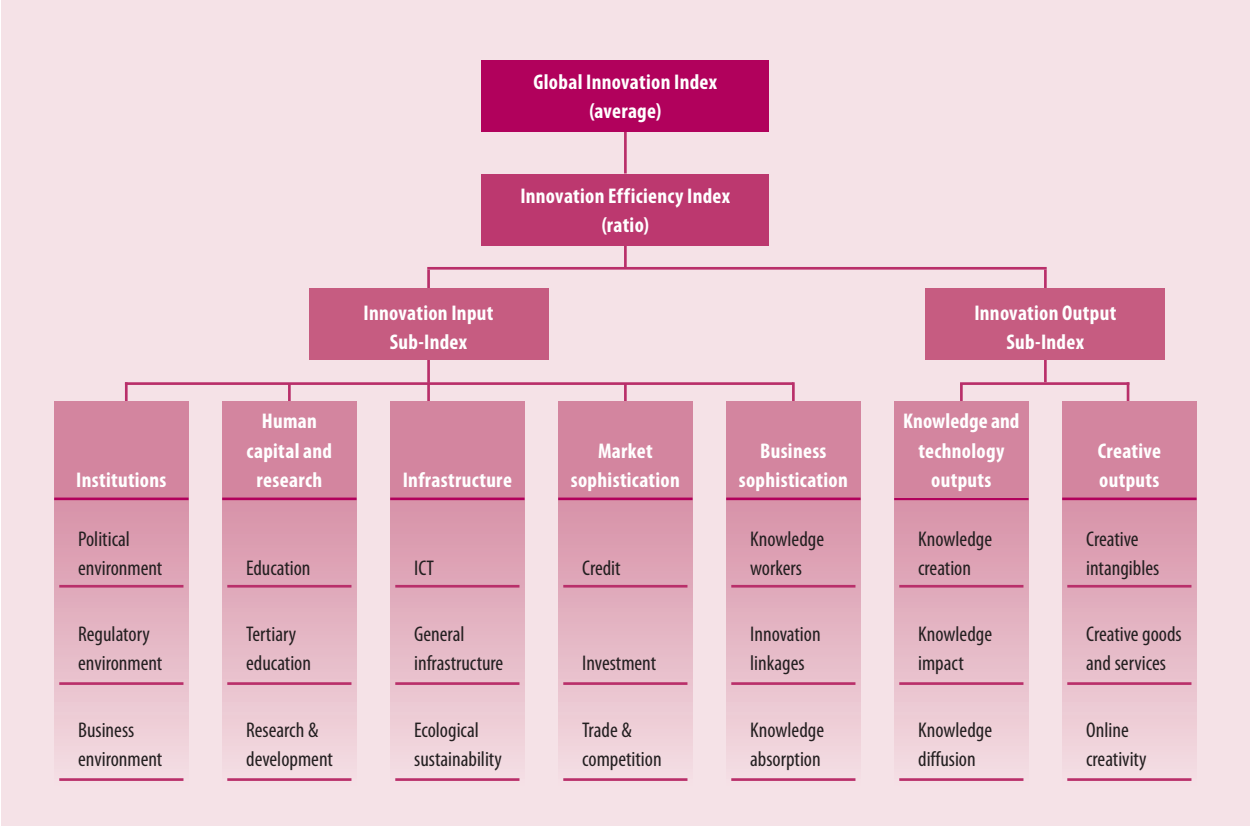
Furthermore, the process of innovation has undergone significant change. Investment in innovation-related activity has consistently intensified at the firm, country, and global levels, adding new innovation actors from outside high-income economies and also nonprofit actors. The structure of knowledge production activity is more complex and geographically dispersed than ever.

A key challenge is to find metrics that capture innovation as it happens in the world today.[16] Direct official measures that quantify innovation outputs remain extremely scarce.[17] 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. Most measures also struggle to appropriately capture the innovation outputs of a wider spectrum of innovation actors, such as the services sector, public entities, and so on.

The GII aims to move beyond the mere measurement of such simple innovation metrics. This requires 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 indicators are used for the GII. About 35% of data obtained is from 2011, 35% from 2010, 21% from 2009, and the small remainder—for certain particular variables or low-income countries—from earlier years.[18] This gives the GII good coverage of the years where the economic crisis attained its initial peak, when innovation expenditures were most severely affected, and when stimulus programmes were decided and meant to be put into action.

Figure 1: Framework of the Global Innovation Index 2012



That said, the time coverage does not allow us to capture more medium-term effects of the crisis or the stimulus programmes on innovation, some impacts of which might be very long-term (e.g., expenditures on education and public R&D). Moreover, the renewed setback of the global economy in the second half of 2011 and the current set-backs to the world economy, as well as possible new spending measures are not accounted for. These effects will naturally be at the heart of future GIIs.

The GII conceptual framework

The GII is an evolving project that builds upon previous editions of the index while incorporating newly available data and that is inspired by the latest research on the measurement of innovation. This year the GII model includes 141 economies, which represent 94.9% of the world's population and 99.4% 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 (Figure 1):

1. **Innovation Input Sub-Index:** Five input pillars 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 Input Sub-Index is the simple average of the first five pillar scores.
2. **Innovation Output Sub-Index:** Innovation outputs are the results of innovative activities within the economy. There are two output pillars: (6) Knowledge and technology outputs[19] and (7) Creative outputs. The Innovation Output Sub-Index is the simple average of the last two pillar scores. 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 Index** is the ratio of the Output Sub-Index over the Input Sub-Index. It shows how much innovation output a given country is getting for its inputs, and is a sense of efficiency of sorts.

Each pillar is divided into three sub-pillars and each sub-pillar is composed of individual indicators, for a total of 84 indicators. The GII pays special attention to providing data sources and definitions (Appendix III), technical notes (Appendix IV), and improving and making accessible metrics (Appendix II Data Tables).[20]

The GII model is revised every year in a transparent exercise to improve the way innovation is measured. This year, for example, the Infrastructure pillar was reorganized to single out ecological sustainability in a new sub-pillar. In addition, a sub-pillar on online creativity was added to the Creative outputs pillar. Adjustments to the framework made this year at the indicator level are detailed in Annex 1.

In addition, this year the GII innovates in two additional and important ways:

First, for the first time, the GII includes a detailed analysis of the underlying factors influencing year-on-year changes. An approximate assessment of changes in rankings due to performance and adjustments to the GII framework is presented in detail in Annex 2. As outlined before, this helps avoid making erroneous conclusions on the basis of simple year-on-year rankings.

Second, this year for the first time, the strengths/weaknesses of each economy were identified on the basis of the percentage of countries with scores that fall below the particular country score (please refer to the country/economy profiles in Appendix I). This relative ranking is critically helpful for policy makers and experts to understand existing successes and areas of improvement.

Discussion of results: The world's top innovators

The following analysis describes and analyses the salient features of the GII results. It does so for the global leaders in each index and the best performers within each income category (high-, upper-middle, lower-middle, and low-income groups).[21] A short discussion of the rankings at the regional level follows.[22] The detailed information can be found in the country profiles (Appendix I).

Tables 1 through 3 report on the overall GII and the Input and Output Sub-Indices, with regional and income group rankings. The rankings per pillar, with details on sub-pillar scores are provided in Annex 1.[23]

The top 10 in the Global Innovation Index

The top 10 countries in the GII 2012 edition are Switzerland, Singapore, Sweden, Finland, the UK, the Netherlands, Denmark, Hong Kong (China), Ireland, and the United States of America (USA). In contrast to current worries in the policy debate, which focuses largely on the crisis of the euro, Europe stands out with 7 out of 10 countries. While nine out the top 10 countries were already in this top league in 2011, Ireland joins the top group for the first time. Canada is the only country leaving the top 10.

Switzerland maintains its 2011 position as number 1. It makes it to the top 10 on all four indices and on all pillars except Institutions (13th), where it shows relative weaknesses in its business environment, as captured by its relatively poor showing in the ease of starting a business and of resolving insolvency. A knowledge-based economy of 7.8 million people with one of the highest GDP per capita, its high degree of innovation efficiency (5th) allows Switzerland to translate its robust innovation capabilities into innovation outputs. Switzerland ranks 1st on the Output Sub-Index and its two pillars, Knowledge and technology outputs and Creative outputs. The quality of its scientific and research institutions, coupled with numerous scientific and technical publications, good linkages between academia and firms, and a skilled labour force stand out. Switzerland also ranks 1st in national patent applications by residents and through the Patent Cooperation Treaty (PCT).

The runner-up, **Sweden,** retains its 2011 position and comes in 1st among Nordic and European Union (EU) countries in the GII and its two sub-indices. It ranks 3rd on inputs and 2nd on outputs, with strengths on all seven pillars. The country ranks 1st in Infrastructure, demonstrating a vigorous use of information and communication technologies (ICT) and coming in at 2nd place in ecological sustainability, with the highest score on ISO 14001 environmental certificates issued in 2011. It also ranks 7th in R&D and 2nd in Knowledge and technology outputs—1st among EU countries—with scientific research institutions of quality, a high level of gross expenditure on R&D (3.6% of GDP), and a high rate of patenting and scientific publications.

Singapore comes in 3rd on the GII this year, maintaining its 2011 position and leading the rankings among Asian economies. Its innovation capabilities rank 1st in the world, with a well-trained student body, a robust research community, a skilled labour force, sophisticated financial and commercial markets, and a business community

Table 1: Global Innovation Index rankings

Country/Economy	Score (0–100)	Rank	Income	Rank	Region	Rank
Switzerland	68.2	**1**	HI	**1**	EUR	**1**
Sweden	64.8	2	HI	2	EUR	2
Singapore	63.5	3	HI	3	SEAO	**1**
Finland	61.8	4	HI	4	EUR	3
United Kingdom	61.2	5	HI	5	EUR	4
Netherlands	60.5	6	HI	6	EUR	5
Denmark	59.9	7	HI	7	EUR	6
Hong Kong (China)	58.7	8	HI	8	SEAO	2
Ireland	58.7	9	HI	9	EUR	7
United States of America	57.7	10	HI	10	NAC	**1**
Luxembourg	57.7	11	HI	11	EUR	8
Canada	56.9	12	HI	12	NAC	2
New Zealand	56.6	13	HI	13	SEAO	3
Norway	56.4	14	HI	14	EUR	9
Germany	56.2	15	HI	15	EUR	10
Malta	56.1	16	HI	16	EUR	11
Israel	56.0	17	HI	17	NAWA	**1**
Iceland	55.7	18	HI	18	EUR	12
Estonia	55.3	19	HI	19	EUR	13
Belgium	54.3	20	HI	20	EUR	14
Korea, Rep.	53.9	21	HI	21	SEAO	4
Austria	53.1	22	HI	22	EUR	15
Australia	51.9	23	HI	23	SEAO	5
France	51.8	24	HI	24	EUR	16
Japan	51.7	25	HI	25	SEAO	6
Slovenia	49.9	26	HI	26	EUR	17
Czech Republic	49.7	27	HI	27	EUR	18
Cyprus	47.9	28	HI	28	NAWA	2
Spain	47.2	29	HI	29	EUR	19
Latvia	47.0	30	UM	**1**	EUR	20
Hungary	46.5	31	HI	30	EUR	21
Malaysia	45.9	32	UM	2	SEAO	7
Qatar	45.5	33	HI	31	NAWA	3
China	45.4	34	UM	3	SEAO	8
Portugal	45.3	35	HI	32	EUR	22
Italy	44.5	36	HI	33	EUR	23
United Arab Emirates	44.4	37	HI	34	NAWA	4
Lithuania	44.0	38	UM	4	EUR	24
Chile	42.7	39	UM	5	LCN	**1**
Slovakia	41.4	40	HI	35	EUR	25
Bahrain	41.1	41	HI	36	NAWA	5
Croatia	40.7	42	HI	37	EUR	26
Bulgaria	40.7	43	UM	6	EUR	27
Poland	40.4	44	HI	38	EUR	28
Montenegro	40.1	45	UM	7	EUR	29
Serbia	40.0	46	UM	8	EUR	30
Oman	39.5	47	HI	39	NAWA	6
Saudi Arabia	39.3	48	HI	40	NAWA	7
Mauritius	39.2	49	UM	9	SSF	**1**
Moldova, Rep.	39.2	50	LM	**1**	EUR	31
Russian Federation	37.9	51	UM	10	EUR	32
Romania	37.8	52	UM	11	EUR	33
Brunei Darussalam	37.7	53	HI	41	SEAO	9
South Africa	37.4	54	UM	12	SSF	2
Kuwait	37.2	55	HI	42	NAWA	8
Jordan	37.1	56	UM	13	NAWA	9
Thailand	36.9	57	UM	14	SEAO	10
Brazil	36.6	58	UM	15	LCN	2
Tunisia	36.5	59	UM	16	NAWA	10
Costa Rica	36.3	60	UM	17	LCN	3
Lebanon	36.2	61	UM	18	NAWA	11
Macedonia, FYR	36.2	62	UM	19	EUR	34
Ukraine	36.1	63	LM	2	EUR	35
India	35.7	64	LM	3	CSA	**1**
Colombia	35.5	65	UM	20	LCN	4
Greece	35.3	66	HI	43	EUR	36
Uruguay	35.1	67	UM	21	LCN	5
Mongolia	35.0	68	LM	4	SEAO	11
Armenia	34.5	69	LM	5	NAWA	12
Argentina	34.4	70	UM	22	LCN	6
Georgia	34.3	71	LM	6	NAWA	13

Table 1: Global Innovation Index rankings *(continued)*

Country/Economy	Score (0–100)	Rank	Income	Rank	Region	Rank
Bosnia and Herzegovina	34.2	72	UM	23	EUR	37
Namibia	34.1	73	UM	24	SSF	3
Turkey	34.1	74	UM	25	NAWA	14
Peru	34.1	75	UM	26	LCN	7
Viet Nam	33.9	76	LM	7	SEAO	12
Guyana	33.7	77	LM	8	LCN	8
Belarus	32.9	78	UM	27	EUR	38
Mexico	32.9	79	UM	28	LCN	9
Belize	32.5	80	LM	9	LCN	10
Trinidad and Tobago	32.5	81	HI	44	LCN	11
Swaziland	32.0	82	LM	10	SSF	4
Kazakhstan	31.9	83	UM	29	CSA	2
Paraguay	31.6	84	LM	11	LCN	12
Botswana	31.4	85	UM	30	SSF	5
Dominican Republic	30.9	86	UM	31	LCN	13
Panama	30.9	87	UM	32	LCN	14
Morocco	30.7	88	LM	12	NAWA	15
Azerbaijan	30.4	89	UM	33	NAWA	16
Albania	30.4	90	UM	34	EUR	39
Jamaica	30.2	91	UM	35	LCN	15
Ghana	29.6	92	LM	13	SSF	6
El Salvador	29.5	93	LM	14	LCN	16
Sri Lanka	29.1	94	LM	15	CSA	3
Philippines	29.0	95	LM	16	SEAO	13
Kenya	28.9	96	LI	1	SSF	7
Senegal	28.8	97	LM	17	SSF	8
Ecuador	28.5	98	UM	36	LCN	17
Guatemala	28.4	99	LM	18	LCN	18
Indonesia	28.1	100	LM	19	SEAO	14
Fiji	27.9	101	LM	20	SEAO	15
Rwanda	27.9	102	LI	2	SSF	9
Egypt	27.9	103	LM	21	NAWA	17
Iran, Islamic Rep.	27.3	104	UM	37	CSA	4
Nicaragua	26.7	105	LM	22	LCN	19
Gabon	26.5	106	UM	38	SSF	10
Zambia	26.4	107	LM	23	SSF	11
Tajikistan	26.4	108	LI	3	CSA	5
Kyrgyzstan	26.4	109	LI	4	CSA	6
Mozambique	26.3	110	LI	5	SSF	12
Honduras	26.3	111	LM	24	LCN	20
Bangladesh	26.1	112	LI	6	CSA	7
Nepal	26.0	113	LI	7	CSA	8
Bolivia, Plurinational St.	25.8	114	LM	25	LCN	21
Zimbabwe	25.7	115	LI	8	SSF	13
Lesotho	25.7	116	LM	26	SSF	14
Uganda	25.6	117	LI	9	SSF	15
Venezuela, Bolivarian Rep.	25.4	118	UM	39	LCN	22
Mali	25.4	119	LI	10	SSF	16
Malawi	25.4	120	LI	11	SSF	17
Cameroon	25.0	121	LM	27	SSF	18
Burkina Faso	24.6	122	LI	12	SSF	19
Nigeria	24.6	123	LM	28	SSF	20
Algeria	24.4	124	UM	40	NAWA	18
Benin	24.4	125	LI	13	SSF	21
Madagascar	24.2	126	LI	14	SSF	22
Uzbekistan	23.9	127	LM	29	CSA	9
Tanzania, United Rep.	23.9	128	LI	15	SSF	23
Cambodia	23.4	129	LI	16	SEAO	16
Gambia	23.3	130	LI	17	SSF	24
Ethiopia	23.3	131	LI	18	SSF	25
Syrian Arab Rep.	23.1	132	LM	30	NAWA	19
Pakistan	23.1	133	LM	31	CSA	10
Côte d'Ivoire	22.6	134	LM	32	SSF	26
Angola	22.2	135	LM	33	SSF	27
Togo	20.5	136	LI	19	SSF	28
Burundi	20.5	137	LI	20	SSF	29
Lao PDR	20.2	138	LM	34	SEAO	17
Yemen	19.2	139	LM	35	NAWA	20
Niger	18.6	140	LI	21	SSF	30
Sudan	16.8	141	LM	36	SSF	31

Note: World Bank Income Group Classification (April 2012): LI = low income; LM = lower-middle income; UM = upper-middle income; and HI = high income. Regions are based on the United Nations Classification (20 September 2011): EUR = Europe; NAC = Northern America; LCN = Latin America and the Caribbean; CSA = Central and Southern Asia; SEAO = South East Asia and Oceania; NAWA = Northern Africa and Western Asia; and SSF = Sub-Saharan Africa.

Table 2: Innovation Input Sub-Index rankings

Country/Economy	Score (0–100)	Rank	Income	Rank	Region	Rank
Singapore	74.9	**1**	HI	**1**	SEAO	**1**
Hong Kong (China)	72.0	2	HI	2	SEAO	2
Sweden	68.8	3	HI	3	EUR	**1**
Switzerland	68.0	4	HI	4	EUR	2
United Kingdom	68.0	5	HI	5	EUR	3
Finland	67.5	6	HI	6	EUR	4
Ireland	67.4	7	HI	7	EUR	5
Denmark	67.4	8	HI	8	EUR	6
United States of America	66.3	9	HI	9	NAC	**1**
Canada	65.8	10	HI	10	NAC	2
Norway	64.0	11	HI	11	EUR	7
New Zealand	63.4	12	HI	12	SEAO	3
Australia	63.4	13	HI	13	SEAO	4
Luxembourg	63.0	14	HI	14	EUR	8
Netherlands	62.9	15	HI	15	EUR	9
Korea, Rep.	61.8	16	HI	16	SEAO	5
Israel	61.5	17	HI	17	NAWA	**1**
Japan	61.3	18	HI	18	SEAO	6
Iceland	60.8	19	HI	19	EUR	10
Belgium	60.3	20	HI	20	EUR	11
Austria	59.5	21	HI	21	EUR	12
France	59.1	22	HI	22	EUR	13
Germany	58.8	23	HI	23	EUR	14
Estonia	57.4	24	HI	24	EUR	15
Cyprus	56.4	25	HI	25	NAWA	2
Spain	56.0	26	HI	26	EUR	16
Malta	55.3	27	HI	27	EUR	17
United Arab Emirates	55.2	28	HI	28	NAWA	3
Malaysia	54.2	29	UM	**1**	SEAO	7
Qatar	54.1	30	HI	29	NAWA	4
Czech Republic	53.3	31	HI	30	EUR	18
Slovenia	53.2	32	HI	31	EUR	19
Portugal	51.9	33	HI	32	EUR	20
Italy	51.5	34	HI	33	EUR	21
Bahrain	51.4	35	HI	34	NAWA	5
Latvia	51.4	36	UM	2	EUR	22
Hungary	51.2	37	HI	35	EUR	23
Lithuania	50.2	38	UM	3	EUR	24
Saudi Arabia	49.2	39	HI	36	NAWA	6
Slovakia	47.3	40	HI	37	EUR	25
Poland	47.1	41	HI	38	EUR	26
Oman	46.9	42	HI	39	NAWA	7
Chile	46.8	43	UM	4	LCN	**1**
Croatia	46.4	44	HI	40	EUR	27
South Africa	46.4	45	UM	5	SSF	**1**
Brunei Darussalam	45.8	46	HI	41	SEAO	8
Bulgaria	45.5	47	UM	6	EUR	28
Montenegro	45.0	48	UM	7	EUR	29
Mauritius	44.7	49	UM	8	SSF	2
Greece	44.0	50	HI	42	EUR	30
Romania	43.9	51	UM	9	EUR	31
Macedonia, FYR	43.2	52	UM	10	EUR	32
Mongolia	42.8	53	LM	**1**	SEAO	9
Botswana	42.8	54	UM	11	SSF	3
China	42.7	55	UM	12	SEAO	10
Namibia	42.4	56	UM	13	SSF	4
Peru	42.3	57	UM	14	LCN	2
Colombia	42.3	58	UM	15	LCN	3
Thailand	42.1	59	UM	16	SEAO	11
Russian Federation	42.0	60	UM	17	EUR	33
Kuwait	42.0	61	HI	43	NAWA	8
Lebanon	41.8	62	UM	18	NAWA	9
Georgia	41.7	63	LM	2	NAWA	10
Tunisia	41.5	64	UM	19	NAWA	11
Serbia	41.5	65	UM	20	EUR	34
Bosnia and Herzegovina	41.4	66	UM	21	EUR	35
Kazakhstan	41.4	67	UM	22	CSA	**1**
Uruguay	40.3	68	UM	23	LCN	4
Brazil	40.2	69	UM	24	LCN	5
Mexico	39.8	70	UM	25	LCN	6
Costa Rica	39.8	71	UM	26	LCN	7

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

Country/Economy	Score (0–100)	Rank	Income	Rank	Region	Rank
Jordan	39.7	72	UM	27	NAWA	12
Armenia	39.1	73	LM	3	NAWA	13
Trinidad and Tobago	39.0	74	HI	44	LCN	8
Panama	38.7	75	UM	28	LCN	9
Argentina	38.7	76	UM	29	LCN	10
Jamaica	38.2	77	UM	30	LCN	11
Ukraine	38.0	78	LM	4	EUR	36
Moldova, Rep.	37.8	79	LM	5	EUR	37
Belarus	37.7	80	UM	31	EUR	38
Turkey	37.5	81	UM	32	NAWA	14
Albania	37.4	82	UM	33	EUR	39
Viet Nam	37.0	83	LM	6	SEAO	12
Fiji	37.0	84	LM	7	SEAO	13
Azerbaijan	36.8	85	UM	34	NAWA	15
Guyana	36.7	86	LM	8	LCN	12
Belize	36.6	87	LM	9	LCN	13
Morocco	36.6	88	LM	10	NAWA	16
Kenya	36.6	89	LI	**1**	SSF	5
Kyrgyzstan	35.5	90	LI	2	CSA	2
Ghana	35.1	91	LM	11	SSF	6
Lesotho	34.8	92	LM	12	SSF	7
Dominican Republic	34.6	93	UM	35	LCN	14
El Salvador	34.6	94	LM	13	LCN	15
Rwanda	34.3	95	LI	3	SSF	8
India	34.0	96	LM	14	CSA	3
Iran, Islamic Rep.	33.9	97	UM	36	CSA	4
Guatemala	33.7	98	LM	15	LCN	16
Swaziland	33.7	99	LM	16	SSF	9
Uzbekistan	33.2	100	LM	17	CSA	5
Algeria	33.0	101	UM	37	NAWA	17
Nicaragua	32.9	102	LM	18	LCN	17
Paraguay	32.6	103	LM	19	LCN	18
Egypt	32.5	104	LM	20	NAWA	18
Honduras	31.8	105	LM	21	LCN	19
Philippines	31.7	106	LM	22	SEAO	14
Mozambique	31.7	107	LI	4	SSF	10
Bolivia, Plurinational St.	31.3	108	LM	23	LCN	20
Ecuador	31.2	109	UM	38	LCN	21
Malawi	30.8	110	LI	5	SSF	11
Tajikistan	30.8	111	LI	6	CSA	6
Gabon	30.7	112	UM	39	SSF	12
Indonesia	30.6	113	LM	24	SEAO	15
Senegal	30.4	114	LM	25	SSF	13
Sri Lanka	30.3	115	LM	26	CSA	7
Madagascar	30.2	116	LI	7	SSF	14
Tanzania, United Rep.	29.7	117	LI	8	SSF	15
Bangladesh	29.5	118	LI	9	CSA	8
Cambodia	29.5	119	LI	10	SEAO	16
Burkina Faso	29.5	120	LI	11	SSF	16
Uganda	29.4	121	LI	12	SSF	17
Zambia	28.9	122	LM	27	SSF	18
Syrian Arab Rep.	28.6	123	LM	28	NAWA	19
Ethiopia	28.4	124	LI	13	SSF	19
Cameroon	28.3	125	LM	29	SSF	20
Venezuela, Bolivarian Rep.	28.1	126	UM	40	LCN	22
Nepal	28.0	127	LI	14	CSA	9
Gambia	27.8	128	LI	15	SSF	21
Lao PDR	27.3	129	LM	30	SEAO	17
Zimbabwe	27.0	130	LI	16	SSF	22
Mali	27.0	131	LI	17	SSF	23
Benin	26.7	132	LI	18	SSF	24
Angola	26.3	133	LM	31	SSF	25
Nigeria	26.1	134	LM	32	SSF	26
Togo	25.4	135	LI	19	SSF	27
Niger	25.4	136	LI	20	SSF	28
Burundi	25.3	137	LI	21	SSF	29
Yemen	25.2	138	LM	33	NAWA	20
Côte d'Ivoire	24.5	139	LM	34	SSF	30
Pakistan	24.3	140	LM	35	CSA	10
Sudan	23.3	141	LM	36	SSF	31

Note: World Bank Income Group Classification (April 2012): LI = low income; LM = lower-middle income; UM = upper-middle income; and HI = high income. Regions are based on the United Nations Classification (20 September 2011): EUR = Europe; NAC = Northern America; LCN = Latin America and the Caribbean; CSA = Central and Southern Asia; SEAO = South East Asia and Oceania; NAWA = Northern Africa and Western Asia; and SSF = Sub-Saharan Africa.

Table 3: Innovation Output Sub-Index rankings

Country/Economy	Score (0–100)	Rank	Income	Rank	Region	Rank
Switzerland	68.5	**1**	HI	**1**	EUR	**1**
Sweden	60.7	2	HI	2	EUR	2
Netherlands	58.2	3	HI	3	EUR	3
Malta	57.0	4	HI	4	EUR	4
Finland	56.1	5	HI	5	EUR	5
United Kingdom	54.5	6	HI	6	EUR	6
Germany	53.7	7	HI	7	EUR	7
Estonia	53.3	8	HI	8	EUR	8
Denmark	52.5	9	HI	9	EUR	9
Luxembourg	52.4	10	HI	10	EUR	10
Singapore	52.0	11	HI	11	SEAO	**1**
Iceland	50.6	12	HI	12	EUR	11
Israel	50.5	13	HI	13	NAWA	**1**
Ireland	49.9	14	HI	14	EUR	12
New Zealand	49.9	15	HI	15	SEAO	2
United States of America	49.1	16	HI	16	NAC	**1**
Norway	48.8	17	HI	17	EUR	13
Belgium	48.3	18	HI	18	EUR	14
China	48.1	19	UM	**1**	SEAO	3
Canada	48.0	20	HI	19	NAC	2
Austria	46.7	21	HI	20	EUR	15
Slovenia	46.6	22	HI	21	EUR	16
Czech Republic	46.1	23	HI	22	EUR	17
Korea, Rep.	45.9	24	HI	23	SEAO	4
Hong Kong (China)	45.5	25	HI	24	SEAO	5
France	44.4	26	HI	25	EUR	18
Latvia	42.6	27	UM	2	EUR	19
Japan	42.0	28	HI	26	SEAO	6
Hungary	41.9	29	HI	27	EUR	20
Moldova, Rep.	40.7	30	LM	**1**	EUR	21
Australia	40.4	31	HI	28	SEAO	7
Cyprus	39.3	32	HI	29	NAWA	2
Portugal	38.7	33	HI	30	EUR	22
Chile	38.5	34	UM	3	LCN	**1**
Spain	38.5	35	HI	31	EUR	23
Serbia	38.5	36	UM	4	EUR	24
Lithuania	37.8	37	UM	5	EUR	25
Malaysia	37.6	38	UM	6	SEAO	8
Italy	37.5	39	HI	32	EUR	26
India	37.3	40	LM	2	CSA	**1**
Qatar	36.9	41	HI	33	NAWA	3
Bulgaria	35.8	42	UM	7	EUR	27
Slovakia	35.4	43	HI	34	EUR	28
Montenegro	35.3	44	UM	8	EUR	29
Croatia	34.9	45	HI	35	EUR	30
Jordan	34.6	46	UM	9	NAWA	4
Ukraine	34.2	47	LM	3	EUR	31
Mauritius	33.8	48	UM	10	SSF	**1**
Russian Federation	33.8	49	UM	11	EUR	32
Poland	33.6	50	HI	36	EUR	33
United Arab Emirates	33.6	51	HI	37	NAWA	5
Brazil	33.0	52	UM	12	LCN	2
Costa Rica	32.8	53	UM	13	LCN	3
Kuwait	32.4	54	HI	38	NAWA	6
Oman	32.1	55	HI	39	NAWA	7
Thailand	31.8	56	UM	14	SEAO	9
Romania	31.7	57	UM	15	EUR	34
Tunisia	31.6	58	UM	16	NAWA	8
Viet Nam	30.8	59	LM	4	SEAO	10
Bahrain	30.8	60	HI	40	NAWA	9
Turkey	30.7	61	UM	17	NAWA	10
Paraguay	30.6	62	LM	5	LCN	4
Lebanon	30.6	63	UM	18	NAWA	11
Guyana	30.6	64	LM	6	LCN	5
Swaziland	30.4	65	LM	7	SSF	2
Argentina	30.2	66	UM	19	LCN	6
Uruguay	30.0	67	UM	20	LCN	7
Armenia	29.8	68	LM	8	NAWA	12
Brunei Darussalam	29.7	69	HI	41	SEAO	11
Saudi Arabia	29.4	70	HI	42	NAWA	13
Macedonia, FYR	29.2	71	UM	21	EUR	35

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

Country/Economy	Score (0–100)	Rank	Income	Rank	Region	Rank
Colombia	28.7	72	UM	22	LCN	8
South Africa	28.5	73	UM	23	SSF	3
Belize	28.4	74	LM	9	LCN	9
Belarus	28.1	75	UM	24	EUR	36
Sri Lanka	28.0	76	LM	10	CSA	2
Dominican Republic	27.3	77	UM	25	LCN	10
Senegal	27.2	78	LM	11	SSF	4
Mongolia	27.1	79	LM	12	SEAO	12
Bosnia and Herzegovina	26.9	80	UM	26	EUR	37
Georgia	26.8	81	LM	13	NAWA	14
Greece	26.5	82	HI	43	EUR	38
Philippines	26.3	83	LM	14	SEAO	13
Trinidad and Tobago	26.0	84	HI	44	LCN	11
Ecuador	25.9	85	UM	27	LCN	12
Mexico	25.9	86	UM	28	LCN	13
Namibia	25.9	87	UM	29	SSF	5
Peru	25.8	88	UM	30	LCN	14
Indonesia	25.5	89	LM	15	SEAO	14
Morocco	24.7	90	LM	16	NAWA	15
El Salvador	24.5	91	LM	17	LCN	15
Zimbabwe	24.4	92	LI	**1**	SSF	6
Ghana	24.1	93	LM	18	SSF	7
Azerbaijan	24.0	94	UM	31	NAWA	16
Nepal	24.0	95	LI	2	CSA	3
Zambia	24.0	96	LM	19	SSF	8
Mali	23.8	97	LI	3	SSF	9
Albania	23.3	98	UM	32	EUR	39
Egypt	23.3	99	LM	20	NAWA	17
Panama	23.1	100	UM	33	LCN	16
Guatemala	23.1	101	LM	21	LCN	17
Nigeria	23.1	102	LM	22	SSF	10
Venezuela, Bolivarian Rep.	22.8	103	UM	34	LCN	18
Bangladesh	22.6	104	LI	4	CSA	4
Kazakhstan	22.4	105	UM	35	CSA	5
Gabon	22.2	106	UM	36	SSF	11
Jamaica	22.1	107	UM	37	LCN	19
Benin	22.0	108	LI	5	SSF	12
Tajikistan	22.0	109	LI	6	CSA	6
Pakistan	21.8	110	LM	23	CSA	7
Cameroon	21.7	111	LM	24	SSF	13
Uganda	21.7	112	LI	7	SSF	14
Rwanda	21.5	113	LI	8	SSF	15
Kenya	21.3	114	LI	9	SSF	16
Mozambique	21.0	115	LI	10	SSF	17
Honduras	20.9	116	LM	25	LCN	20
Iran, Islamic Rep.	20.8	117	UM	38	CSA	8
Côte d'Ivoire	20.7	118	LM	26	SSF	18
Nicaragua	20.4	119	LM	27	LCN	21
Bolivia, Plurinational St.	20.3	120	LM	28	LCN	22
Botswana	19.9	121	UM	39	SSF	19
Malawi	19.9	122	LI	11	SSF	20
Burkina Faso	19.8	123	LI	12	SSF	21
Fiji	18.9	124	LM	29	SEAO	15
Gambia	18.7	125	LI	13	SSF	22
Madagascar	18.2	126	LI	14	SSF	23
Angola	18.1	127	LM	30	SSF	24
Ethiopia	18.1	128	LI	15	SSF	25
Tanzania, United Rep.	18.0	129	LI	16	SSF	26
Syrian Arab Rep.	17.6	130	LM	31	NAWA	18
Kyrgyzstan	17.3	131	LI	17	CSA	9
Cambodia	17.3	132	LI	18	SEAO	16
Lesotho	16.5	133	LM	32	SSF	27
Algeria	15.8	134	UM	40	NAWA	19
Burundi	15.8	135	LI	19	SSF	28
Togo	15.6	136	LI	20	SSF	29
Uzbekistan	14.7	137	LM	33	CSA	10
Yemen	13.1	138	LM	34	NAWA	20
Lao PDR	13.1	139	LM	35	SEAO	17
Niger	11.9	140	LI	21	SSF	30
Sudan	10.3	141	LM	36	SSF	31

Note: World Bank Income Group Classification (April 2012): LI = low income; LM = lower-middle income; UM = upper-middle income; and HI = high income. Regions are based on the United Nations Classification (20 September 2011): EUR = Europe; NAC = Northern America; LCN = Latin America and the Caribbean; CSA = Central and Southern Asia; SEAO = South East Asia and Oceania; NAWA = Northern Africa and Western Asia; and SSF = Sub-Saharan Africa.

proactive at adopting the latest technologies (1st on knowledge absorption). This year, in addition, Singapore reaches 3rd place on the Knowledge and technological outputs pillar, up from position 15 in 2011, with clear improvements on two main indicators: growth rate of labour productivity (2nd) and FDI net outflows (4th). It also tops the rankings at position 1 in 10 indicators: government effectiveness, cost of redundancy dismissal, government's online service, applied tariff rate, imports and exports of goods and services, employment in knowledge-intensive services, royalty and license fees payments, high-tech exports, and ICT and organizational models creation.

Finland reaches 4th position this year, up one position from 5th in 2011. Finland has strengths across the board, with a particularly strong institutional framework (6th) and a skilled labour force (1st in the EU, 3rd globally) engaged in research and patenting. Finland tops the rankings in political environment and five indicators, notably the state of cluster development, royalty and license fees receipts, and computer and communications service exports. Finland's relative weakness is in Market sophistication, where it ranks 26th.

The United Kingdom (UK) occupies the 5th rank in 2012. Although its performance has improved since last year, when it ranked 10th, the UK benefitted to a large extent from adjustments made to the GII framework (refer to Annex 2). It gained 11 positions in Infrastructure because of its excellent 10th position in ecological sustainability (a pillar introduced this year) and it tops the rankings in three indicators that are also new this year: cost of redundancy dismissal, ease of getting credit, and generic top-level domains (TLDs). It also has strong institutions and sophisticated financial markets (ranking 1st on credit and 3rd on investment). Its excellent 8th position in Knowledge and technology outputs is the result of a good balance between the creation of knowledge through patenting and scientific and technical research (13th), the economic impact of these activities in the domestic economy (11th, although labour productivity has still not fully recovered from the crisis), and diffusion abroad of the latest technologies (16th). While it ranks 3rd in Market sophistication, its 57th rank in trade and competition is of concern.

The Netherlands ranks 6th, up from 9th in 2011, and with a clear relative advantage in outputs, where it is ranked 3rd. The country does less well in inputs, however, achieving a 15th position resulting in a 9th place in innovation efficiency. The Netherlands has made particularly strong use of ICT, with top 10 rankings in press freedom, ICT access, government's online service, online e-participation, computer software spending, and all four indicators included in online creativity, a sub-pillar introduced this year to Creative outputs: generic top-level domains (gTLDs), country-code top-level domains (ccTLDs), edits on Wikipedia, and video uploads on YouTube. One area where there is room for improvement is Human capital and research (34th), and more specifically a 66th rank in tertiary education. In spite of a relatively good level of enrolment (ranked 24th, at 62.7%), its scores in the remaining indicators are rather low: 14.0% of graduates in science and engineering (83rd), 3.8% of inbound mobility (37th), and a 1.1% of gross tertiary outbound enrolment (69th).

Denmark ranks 7th, down from 6th in 2011. Its institutions are assessed as the most transparent and business friendly in the world (1st). A prepared and well-funded research community (the country ranks 5th on R&D) leads to high degrees of patenting via the PCT and of publishing in scientific and technical journals. An area that deserves attention is its 38th position in tertiary education, a poor result pointing up several areas of concern: with only 19.6% of tertiary graduates in science and engineering and a gross tertiary outbound enrolment of 1.6%, Denmark ranks 57th and 55th globally. With a high level of ICT use (6th), it is one of the leading economies in terms of registrations of Internet TLDs (6th for generic and 3rd for country-code TLDs). One alarming sign, however, is that Denmark is one of the 15 economies in the sample with scores going down on all four indices.

Hong Kong (China) is ranked 8th, a drop of four places from its 4th position in 2011. Its main strength is still on the input side (2nd). Its rank in innovation outputs (25th) is lower than it was in 2011 because of a relatively low ranking in Knowledge and technology outputs (34th), which echoes a relatively low ranking in Human capital and research (26th). In all remaining Input pillars, Hong Kong (China) is ranked among the top 10, with a record of 14 indicators in the very top positions in a range of domains, but notably in a series of indicators showing an extremely dynamic economy: ICT access, efficiency in energy use, market capitalization, value of stocks traded, imports and exports of goods and services, high-tech imports, FDI net inflows and outflows, and new businesses creation.

Ireland is ranked 9th, up four positions from 13th place in 2011. Ireland has been particularly good at prioritizing those areas that convert

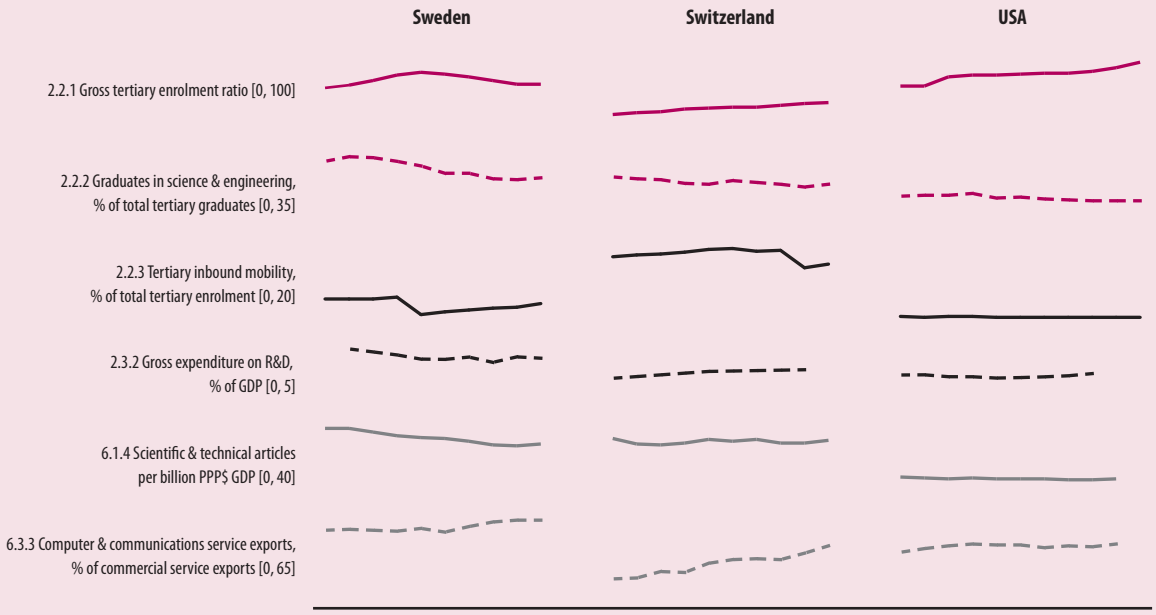
Box 1: A spotlight on the United States of America's innovation ranking

The central role of the USA for global innovation hardly needs underlining: its universities, its research institutions, its innovation clusters, and its firms are world class and continue to be a magnet and a model for other countries.

Yet when time series are considered for indicators included in the GII, the relative performance of the USA—compared, for instance, with those of Switzerland and Sweden—offers a contrast from the accepted view (Figure 1.1):

1. Over the 2000–11 period, the USA presents a relative advantage in school life expectancy and tertiary enrolment, together with a greater capacity to recover from cyclical declines in labour productivity.
2. In other areas, the performance of the USA is closer to that of Switzerland and Sweden. For example, the percentage of R&D financed by the business sector has been steady at close to 70% in the USA and Switzerland, with a slight but steady decline in Sweden. For venture capital deals and strategic alliance deals the three countries also show comparable performances.
3. Yet, in some cases, although the USA has seen its figures improve in absolute terms, the rate of improvement is lower than that of these two innovation leaders, explaining the country's relative slippage in the GII rankings. This is the situation for royalty and license fees receipts as a percentage of GDP (with respect to Sweden only, data are not available for Switzerland) and for computer and communication service exports as a percentage of total commercial service exports.
4. Finally, in a series of indicators, the USA has been facing a weaker performance. This is particularly evident in specific areas, mostly those linked to education and the tapping of global talent, and to research, patenting, and scientific publications.

Figure 1.1: Sparklines for selected indicators, 2000–10



Note: Refer to Appendix III, Sources and Definitions, for details regarding each indicator.

it into an attractive destination for investments. With good scores in Institutions (4th), Human capital and research (7th), access to credit (4th) and investor's protection (5th), it ranks 4th in venture capital deals, and 1st in exports of goods and services.[24] Ireland is also particularly good at both assimilating and disseminating knowledge through top 10 positions in all eight indicators included in sub-pillars knowledge absorption and knowledge creation (ranking 2nd in both sub-pillars), and is the only country in that situation: royalty and license fees payments/receipts, high tech imports/exports, communication and computer services exports/imports, and FDI net inflows/outflows. On a less positive note, Ireland is in dire need of investments in infrastructure (35th), particularly in ICT (43rd) and general infrastructure (49th), less so in ecological sustainability (22nd). Its ranking in Creative outputs is also relatively low (38th).

The United States of America (USA) ranks 10th, down from 7th place in 2011 (Box 1). Its drop in the rankings is the result of a relatively poorer performance on the output side, where it comes in at 16th in 2012, down from 5th in 2011. Its bright areas are in Market (2nd) and Business sophistication (9th). In Knowledge and technology outputs, the USA has improved its ranking only in FDI net outflows (from position 27 to 22, with an increase from 1.90% to 2.41% of GDP), maintaining its positions in PCT applications (14th), computer software spending (7th), and royalty & license fees receipts (9th), with deteriorating positions in the remaining five indicators. The USA position fell to 84th in creative intangibles (trademark registrations, ICT in organizational models) and to 27th in creative goods and services. Yet its 33rd ranking in Creative outputs (down from 24th in 2011) is sustained by its 20th position in online creativity, a sub-pillar introduced this year to the GII framework. The major area of concern for the USA, however, is a relatively lower ranking in Human capital and research (22nd, down from 13th in 2011). Gross tertiary enrolment increased from 82.9 to 94.8% (ranked 2nd), but the USA is ranked 74th in graduates in science and engineering, 42nd in tertiary inbound mobility, and 119th in gross tertiary outbound enrolment—a weakness revealed only this year (last year the data were not available). This result is very topical in the light of current discussions on the dropping openness of the USA to outside students and workforce talent.

The top 10 in the Innovation Input Sub-Index

The top 10 economies on the Innovation Input Sub-Index are Singapore, Hong Kong (China), Sweden, Switzerland, the UK, Finland, Ireland, Denmark, the USA, and Canada. Nine of these countries were in the top 10 in 2011. The USA entered the list this year, while Luxembourg moved from 9th position in 2011 to 14th position this year. All except Canada are in the GII top 10 (discussed above).

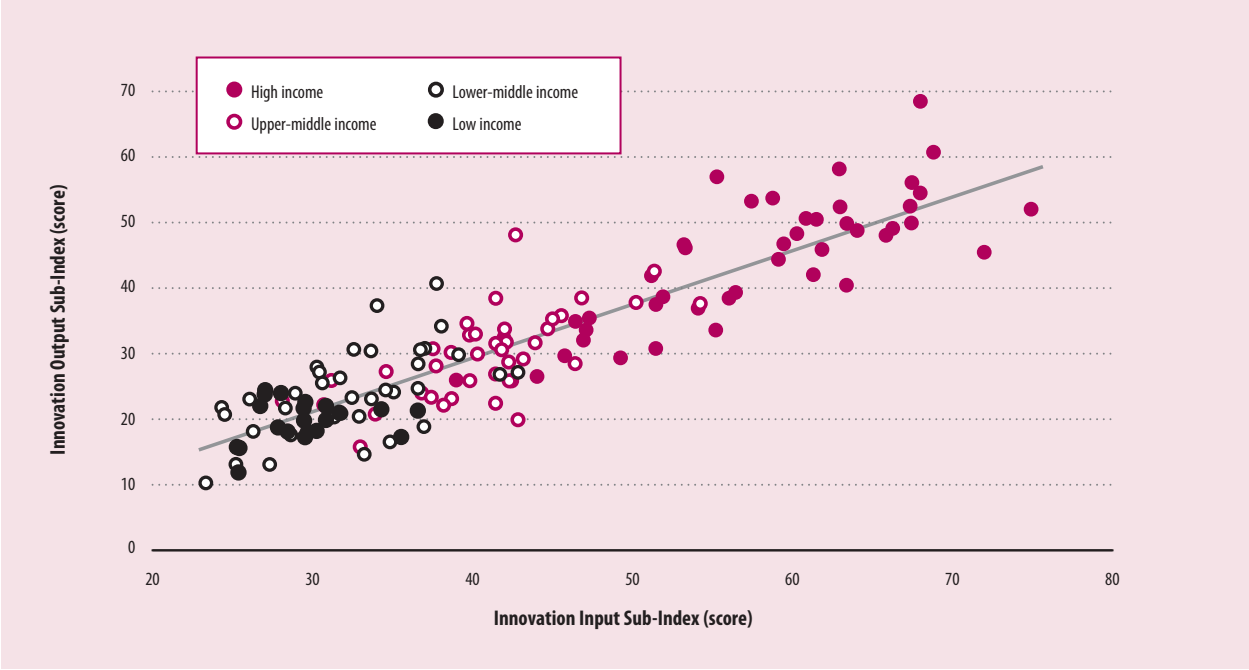
Canada, in Northern America, ranks 12th in the GII but 10th in the Input Sub-Index. Down from 8th position in the GII, it is the only economy that dropped out of the top 10 this year, with its rankings falling on all four indices (Input drops from 8th to 10th, Output from 10th to 20th, Efficiency from 54th to 74th). Canada has many strengths but it does not translate its excellent ranks in institutions (2nd) and Market sophistication (7th) into innovation outputs. The priorities at the education and research level (25th) do not seem to go in the direction of fomenting innovation and exchanges, as shown by a percentage of graduates in science and engineering of only 21.1% (ranked 47th) and a gross tertiary outbound enrolment of 2.0% (47th), leading to a rank of merely 22nd in Knowledge and technology outputs. In general infrastructure Canada does very well (4th), but it has been slow at assimilating ICTs (16th), and an 87th position in efficiency in energy use as well as a slow incorporation of ISO 14001 environmental standards lead to a position of 77th in ecological sustainability. In that sense, the figures mirror accurately the current debate—which deplores the low levels of support for R&D in many parts of the Canadian private sector, faltering skills, and a weakening position on innovation.

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 on enabling environments are rewarded with increased innovation outputs (Figure 2).

The top 10 countries in the Innovation Output Sub-Index are Switzerland, Sweden, the Netherlands, Malta, Finland, the UK, Germany, Estonia, Denmark, and Luxembourg. Seven of these countries had reached the top 10 in 2011; Malta, Estonia, and Luxembourg join the group this year, while the USA, Israel, and Canada drop to 16th, 13th, and 20th

Figure 2: Innovation Output Sub-Index vs. Innovation Input Sub-Index



Note: Countries/economies are classified according to the World Bank Income Group Classification (April 2012).

positions, respectively. Six of the top 10 Output countries are in the GII top 10 (discussed above).

Luxembourg is ranked 11th in the GII, up six positions from 17th place in 2011, with the highest jump in the EU from an improved performance (Annex 2). It ranks 14th in the Input Sub-Index and 10th in the Output Sub-Index (up from 25th in 2011), and 29th in Efficiency. Luxembourg's profile is that of a sophisticated service economy, with strengths across the board. It is particularly open to exchanges with the rest of the world at all levels: it tops the rankings at 1st place in imports and exports of goods and services, FDI net inflows and outflows, and tertiary inbound and outbound mobility. While the country's credit (112th) and investment (100th) regimes are found wanting, this has not stopped the flow of credit and investments: Luxembourg ranks 10th in domestic credit to private sector (at 185.4% of GDP) and 4th in market capitalization (at 183.5 % of GDP). Another strength comes from the assimilation of ICTs by businesses and society. Elementary education requires attention, however: while ranking 90th and 63rd in current expenditure on education and in public expenditure per pupil alone might not be of great concern, considering the high GDP per capita of Luxembourg by which the data are scaled, the 60th spot in school life expectancy (13.5 years) and the results of the PISA exam (ranked 33rd) are more worrisome.

Germany ranks 15th, down from 12th in 2011. The country's loss of three positions is entirely due to adjustments made to the model (as opposed to a deteriorating performance, Annex 2). With a population of 81.4 million (the most populous country in the EU), its strengths are in the Output Sub-Index again this year (7th). Ranking 23rd in the Input Sub-Index, it places 11th in Efficiency. Its rank of 16th in Human capital and research is only partially reliable (the only pillar affected by such a problem) because Germany has missing data in four key indicators. This does not affect the sub-pillar on R&D, in which it ranks 11th globally and which translates into a 12th position in Knowledge and technology outputs with ranks within the top 20 on all but one of the indicators included in knowledge creation and knowledge diffusion. It also places in the top 10 in registration of top-level domains. Its major weaknesses are in innovation linkages (where it ranks 55th globally; see, however, the discussion in Chapter 4 on the weak nature of these indicators) and in three domains that are deeply cyclical and therefore affected by the global economic crisis: gross capital formation (ranked 116th at 17.3% of GDP), imports of goods & services (69th at 41.4% of GDP), FDI net inflows (96th at 1.4% of GDP), and creation of new businesses (57th).

Box 2: Stability at the top

One salient feature of this year's Global Innovation Index (GII) is the stability we can perceive at the top of the rankings. The top 3 are the same as they were in 2011: Switzerland, Sweden, and Singapore. Nine of the top 10 are repeated, with Ireland replacing Canada, which dropped from position 8 to 12. Seventeen of last year's top 20 economies are included in that select list this year: Malta, Estonia, and Belgium joined in, while the Republic of Korea, Austria, and Japan left the top 20 to drop to positions 21, 22, and 25, respectively.[1]

Unsurprisingly, the GII top 20 are all high-income economies. In this income group, only five economies (of a total of 44) exhibit relatively weak performances on the GII: Saudi Arabia (48th), Brunei Darussalam (53rdt), Kuwait (55th), Greece (66th), and Trinidad and Tobago (81st).

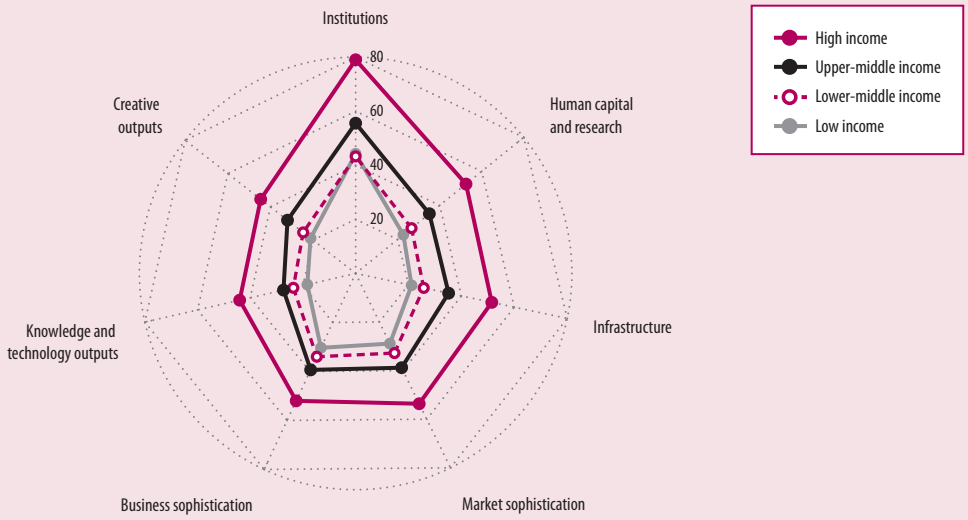
Altogether, this year's GII confirms that rankings are strongly correlated with income levels. Most importantly, on average, high-income countries outpace developing countries by a wide margin across the board in terms of scores (Figure 2.1). This margin itself explains a large part of the stability at the top of the rankings.

Yet this phenomenon can be seen in a positive and encouraging light: scores at lower levels of income are more 'concentrated', so to speak, implying that marginal improvements in one or two domains or strengths revealed by data recently made available or by adjustments to the GII framework can have a significant impact on rankings (details in Annex 2). The major jumps in the rankings this year over 2011 are in Brunei Darussalam (by 24 positions); Swaziland (by 23); Tajikistan (by 15); Zambia (by 14); Rwanda and Zimbabwe (both by 13); Oman (by 12); Serbia, Morocco, Nicaragua, and Algeria (all by 11); and Peru (by 10).

Note

1. More analysis is needed to determine the change of rankings for Japan and the Republic of Korea, because model changes have impacted these economies particularly strongly.

Figure 2.1: Average scores by income group and by pillar (0–100)



Note: Countries/economies are classified according to the World Bank Income Group Classification (April 2012).

Malta is ranked 16th in the GII 2012 and is 1st among the 16 countries added to the GII this year. Malta achieves 4th position in the Output Sub-Index. Its 1st rank in creative goods and services, with good scores across all indicators, is in large measure the reflection of its appeal as a tourist destination, which has a direct impact on the production and consumption of recreation and culture. Although labour productivity is still low at 0.5% (ranked 99th), Malta achieves 5th and 6th positions in new businesses and the adoption of certificates of conformance with the ISO 9001 quality standard, leading to 10th position in knowledge impact. The country's two major strengths, however, are its 3rd and 6th positions in knowledge absorption and diffusion. The major areas of concern are its low rankings in Human capital and research and in investment.

Estonia ranks 19th (18th among GII 2011 countries), up from 23rd in 2011 and 8th in the Output Sub-Index. After averaging an 8.3% growth in GDP in 2000–07, Estonia experienced two years of recession, with a drop in GDP of 14.3% in 2009 but an estimated 7.6% growth in 2011.[25] In its GII results, the country shows real strength on the outputs side and is firmly placed at the frontier of innovation learners and leaders, outperforming all countries with similar income levels in per capita PPP$: it ranks 8th on the efficiency ratio, 13th on Knowledge and technology outputs, and 9th on Creative outputs. The leverage there comes from two sub-pillars: first, Estonia places 18th in knowledge creation. Second, the country places 2nd in knowledge impact, reflecting the dynamism of its economy with a growth rate of labour productivity of 8.6% (ranked 4th), and taking 7th place in the establishment of new businesses and the 12th position in the adoption of the ISO 9001 quality standard. Another area of relative strength is its high level of adoption of the latest technologies and online creativity, with a 1st position in Wikipedia and 12th on YouTube video uploads. A deeper financial market and improved innovation linkages will be needed for Estonia to benefit fully from its strong output positions.

Top performers by income group

Identifying the underlying conditions of a country and comparing performances among its peers is vital to a good understanding of the implications of a country's ranking in the GII. This report attempts to abide by this underlying principle by assessing results on the basis of the development stages of countries (captured by the World Bank income classifications). High-income top performers are discussed in detail in the previous section (Box 2).

Upper-middle-income countries (40 economies)

Among upper-middle-income countries, the best performers in the GII 2012 are Latvia (30th), Malaysia (32nd), China (34th), Lithuania (38th), Chile (39th), Bulgaria (43rd), Montenegro (45th), Serbia (46th), Mauritius (49th), and the Russian Federation (51st).

In the Input Sub-Index, the best performers are Malaysia (29th), Latvia (36th), Lithuania (38th), Chile (43rd), South Africa (45th), Bulgaria (47th), Montenegro (48th), Mauritius (49th), Romania (51st), and the former Yugoslav Republic of Macedonia (52nd).

In the Output Sub-Index, the best performers are China (19th), Latvia (27th), Chile (34th), Serbia (36th), Lithuania (37th), Malaysia (38th), Bulgaria (42nd), Montenegro (44th), Jordan (46th), and Mauritius (48th).

Latvia is ranked 30th (29th among GII 2011 economies), up from 36th place in 2011 and topping the rankings among upper-middle-income countries. As for Estonia, this is commendable because Latvia was one of the countries hardest hit by the economic crisis, subject to three recession years in 2008–10 and the biggest drop in GDP in the world in 2009 (–17.7%), but it has been steadily recovering since. Latvia places in the top 30 positions in the Output Sub-Index (27th), Institutions (30th), Market sophistication (22nd), and Creative outputs (21st). It displays relative weaknesses in the Input Sub-Index (where it places 36th), Human capital and research (50th), Infrastructure (38th), Business sophistication (53th), and Knowledge and technology outputs (37th). It is the only upper-middle-income country in the top 30 this year, also a result of the fact that it recently dropped in classification from high income to upper-middle income in the 2011 World Bank classification.

Malaysia comes first among upper-middle-income economies in Asia, ranking 32nd (31st among GII 2011 countries, the same rank as in 2011). Its major strengths are in Market and Business sophistication (where it ranks 14th and 11th, respectively), while it needs to make improvements in its institutional framework (55th) and in Human capital and research (42nd) to move up in the rankings. Regarding the latter, deficiencies are found at the primary and secondary levels mainly (74th), in contrast to a highly competent tertiary education system (10th globally, 3rd in Asia) that has attracted foreign students (with a tertiary inbound mobility of 5.8%,

Malaysia ranks 27th globally). In R&D, Malaysia does less well (48th), although the involvement of the private sector in financing and performing R&D is noteworthy (at levels above 84%, it ranks 1st globally on both). Malaysia is also good at adopting the latest technologies, as demonstrated by its 6th rank in Knowledge absorption, driven by its 1st position in high-tech imports.

For second year in a row, **China** shows several strengths (Box 3). China ranks 34th (33rd among GII 2011 countries), down from 29th in 2011. It reached 1st place in the Efficiency Index, 55th in the Input Sub-Index, and 19th in the Output Sub-Index. With a population of 1.3 billion and a GDP per capita of PPP$ 8,394.1, its performance is remarkable. China was particularly affected by the adjustments made to the GII framework. Had the 2011 model been kept intact, China would have improved its ranking (Annex 2). China's rankings improved on two pillars: Business sophistication (from 29th to 28th/27th position among GII 2011 economies) and Knowledge and technology outputs (from 9th to 5th position). On the latter—which includes knowledge creation (patents, utility models, scientific publications), knowledge impact (growth in labour productivity, new businesses, and so on), and knowledge diffusion (royalty receipts, high-tech exports, computer and communication services exports, FDI outflows)—China is outpaced only by Switzerland, Sweden, Singapore, and Finland. China dropped six places in the rankings on infrastructure (to 39th position); the addition of a new sub-pillar on ecological sustainability, however, is not to blame (there China ranks 37th); the culprit is rather a fall on the ICT sub-pillar, from 59th to 73rd/70th among 2011 economies. This weakness is echoed by a low score on the new sub-pillar 7.3, online creativity, where China ranks 120th.

Lower-middle-income countries (36 economies)

Among lower-middle-income countries, the best performers in the GII are the Republic of Moldova (50th), Ukraine (63rd), India (64th), Mongolia (68th), Armenia (69th), Georgia (71st), Viet Nam (76th), Guyana (77th), Belize (80th), and Swaziland (82nd).

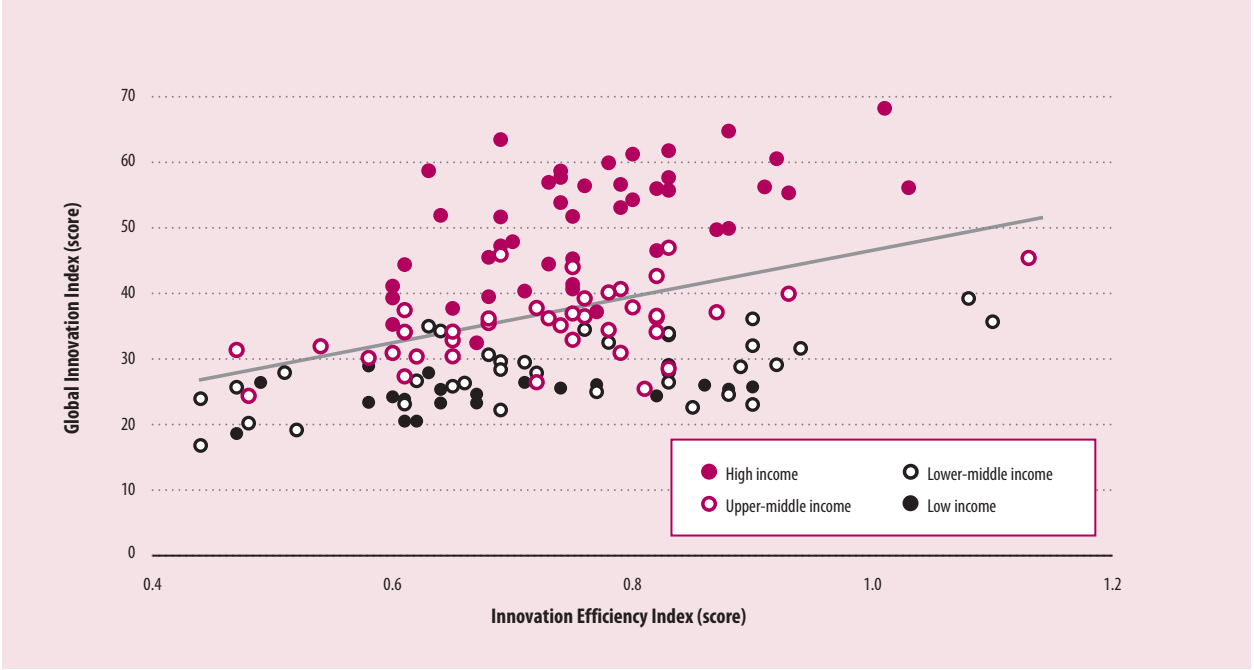
In the Input Sub-Index, the best performers are Mongolia (53rd), Georgia (63rd), Armenia (73rd), Ukraine (78th), the Republic of Moldova (79th), Viet Nam (83rd), Fiji (84th), Guyana (86th), Belize (87th), and Morocco (88th).

In the Output Sub-Index, the best performers are the Republic of Moldova (30th), India (40th), Ukraine (47th), Viet Nam (59th), Paraguay (62nd), Guyana (64th), Swaziland (65th), Armenia (68th), and Belize (74th).

The Republic of Moldova is ranked 50th (48th among GII 2011 countries), down from 39th in 2011. It replaced China as 1st among lower-middle-income economies in the GII this year because China is now classified as upper-middle-income, but it had already been 2nd in 2011. Moldova has been somewhat affected by the adjustments made to the GII model, but the country also shows signs of a worsening performance (Annex 2), probably linked to a recession in 2009 (with a 6% drop in GDP). With the lowest GDP per capita in Europe, this landlocked transition economy comes before Ukraine (63rd), the only other lower-middle-income country in Europe. Moldova has a relative advantage in innovation outputs (30th, 1st among lower-middle-income economies), ranking 3rd in efficiency, with relative strengths on four intellectual property (IP) indicators: patent and utility model applications at the domestic level (15th and 1st), and trademark registrations, both at the domestic level and at the Madrid system (4th in both). However, it ranks 73rd in patenting at the PCT. Its worst showings are in Business sophistication (104th) and Market sophistication (96th, the last in Europe), with relative weaknesses in the quality of scientific research institutions and trade and transport infrastructure, venture capital deals, and on areas related to innovation linkages: R&D financed by business, university/industry research collaboration, development of clusters, and joint-venture/strategic alliance deals.

Mongolia is ranked 68th (66th among GII 2011 countries), up from 68th position in 2011 and 1st among lower-middle-income economies in the Input Sub-Index. This landlocked Asian country of 2.8 million people achieves prominence in the Input Sub-Index (53), coming in at only 79th place in the Output Sub-Index. Mongolia's GDP has been growing at an impressive pace: after an average GDP growth of 8.2% in 2002–08, it was mildly hit by the global crisis with a recession year in 2009 (a 1.27% decline in GDP) recovering in 2010. It now has very promising growth prospects of a mind-blowing 14.6% on average in the period 2011–14.[26] Although the GII country profile is just a snapshot at a given point in time, it includes several metrics that reflect this success story: Mongolia ranks 1st in microfinance gross loans (at 14.8% GDP), 11th in firms offering formal training (61.2%), and 3rd in FDI net inflows (at 23.5% of GDP). In a series of count variables scaled by GDP in PPP$ to account for different stages in development and

Figure 3: Global Innovation Index vs. Innovation Efficiency Index



Note: Countries/economies are classified according to the World Bank Income Group Classification (April 2012).

to avoid improperly biasing results to the detriment of countries with large young or ageing populations, Mongolia does remarkably well. For example, it takes 1st place in utility model applications by residents (127 in 2010) and in trademark registrations at the national office (3,510 in 2010). Mongolia's main deficits are in ecological sustainability, R&D, cluster development, knowledge diffusion, and creative goods and services.

Low-income countries (21 economies)

Among low-income economies, the top 5 are Kenya (96th), Rwanda (102nd), Tajikistan (108th), Kyrgyzstan (109th), and Mozambique (110th) in the GII; Kenya (89th), Kyrgyzstan (90th), Rwanda (95th), Mozambique (107th), and Malawi (110th) in the Input Sub-Index; and Zimbabwe (92nd), Nepal (95th), Mali (97th), Bangladesh (104th), and Benin (108th) in the Output Sub-Index.

Kenya is ranked 96th (91st among GII 2011 countries), down from 89th in 2011. Kenya came in 3rd among low-income economies in 2011, after Ghana and Kyrgyzstan; since Ghana this year joined the upper-middle-income group, Kenya tops the GII and the Input rankings among low-income economies. It benefits from an average annual growth of GDP (US$) of 4.8% for the period 2004–11, with a forecasted growth of 6.1% for 2012–17.[27] For the second year in a row, this low-income country of 40.9 million people shows noteworthy relative strengths in Human capital and research (72nd), Market sophistication (41st), and Business sophistication (66th). Kenya's institutional framework (103rd) is particularly worrisome, however, especially in areas crucial to the investments required for growth and innovation: political stability, rule of law, ease of starting a business, and the tax burden (including tax rates and formalities). Its ranking in Infrastructure (120th) is also weak, including a 104th position in the adoption of ICTs (its best showing at the sub-pillar level).

Zimbabwe is ranked 115th (106th among GII 2011 countries), up from 119th in 2011, and it leads the Output Sub-Index among lower-middle-income economies. With the second-lowest GDP per capita of the 141 economies, after Burundi, the positions in the Output Sub-Index (92nd) and the Efficiency ratio (13th) of this landlocked economy are indeed promising. These results are driven by relatively good records on the areas traditionally linked to innovation, namely Human capital and research (71st), Business sophistication (50th), and Knowledge and technology outputs (70th), showing that Zimbabwe is prioritizing those areas that will give it a better edge

Table 4: Innovation Efficiency Index rankings: Top 10

Rank	Country/Economy	Efficiency Score	Input Rank	Output Rank	Income Group	Rank	Region Group	Rank	Population (US$ millions)	GDP per capita (current PPP$)
1	China	1.13	55	19	UM	**1**	SEAO	**1**	1,348.1	8,394.1
2	India	1.10	96	40	LM	**1**	CSA	**1**	1,206.9	3,703.5
3	Moldova, Rep.	1.08	79	30	LM	2	EUR	**1**	3.6	3,383.0
4	Malta	1.03	27	4	HI	**1**	EUR	2	0.4	25,782.7
5	Switzerland	1.01	4	**1**	HI	2	EUR	3	7.8	43,508.6
6	Paraguay	0.94	103	62	LM	3	LCN	**1**	6.5	5,548.9
7	Serbia	0.93	65	36	UM	2	EUR	4	7.4	10,661.3
8	Estonia	0.93	24	8	HI	3	EUR	5	1.3	20,182.1
9	Netherlands	0.92	15	3	HI	4	EUR	6	16.7	42,330.7
10	Sri Lanka	0.92	115	76	LM	4	CSA	2	20.5	5,609.4

Note: World Bank Income Group Classification (April 2012): LI = low income; LM = lower-middle income; UM = upper-middle income; and HI = high income. Regions are based on the United Nations Classification (20 September 2011): EUR = Europe; NAC = Northern America; LCN = Latin America and the Caribbean; CSA = Central and Southern Asia; SEAO = South East Asia and Oceania; NAWA = Northern Africa and Western Asia; and SSF = Sub-Saharan Africa.

in the innovation race. Deficiencies in all other areas are, however, just as noteworthy: Input Sub-Index (130th), Institutions (141th, the lowest globally), Infrastructure (139th), Market sophistication (118th), and Creative outputs (112th).

The Innovation Efficiency Index

While the GII is calculated as the average of the Input and Output Sub-Indices, the Innovation Efficiency Index is calculated as the ratio of the Output over the Input Sub-Index. The relationship between the GII and the efficiency ratio is positive, as expected, implying that more efficient countries achieve, on average, better GII scores (Figure 3).

The top 10 countries in the Innovation Efficiency Index are countries particularly good at surmounting relative weaknesses on their Input Sub-Indices, with robust output results: China, India, the Republic of Moldova, Malta, Switzerland, Paraguay, Serbia, Estonia, Netherlands, and Sri Lanka. The first three were already in the top 10 in efficiency in 2011; Côte d'Ivoire, Nigeria, Pakistan, Sweden, Brazil, Argentina, and Bangladesh moved out. This year not a single low-income economy is included (Table 4).

The Innovation Efficiency Index is designed to be neutral to the countries' stages of development, and the data indeed reflect this. That said, the analysis by income group for efficiency ratios is particularly crucial, because economies might reach a relatively high efficiency ratio **because of particularly low Input scores.** The over-representation of the efficiency ratio in the media in 2011 out of the proper context—namely GII scores—was unfortunate, with analysts jumping to the conclusion that countries with high efficiency ratios were to be commended when in effect these high ratios often reflected blatant deficiencies in the input side and a performance in the GII well below that of countries with similar GDP per capita. Efficiency ratios must be analysed jointly with GII, Input, and Output scores, and with development stages of countries/economies in mind. Efficiency ratios are reported by income group for that reason (Tables 5a through 5d).

Among high-income economies (Table 5a), European countries take up the first 20 positions, with the exception of Israel (12th), New Zealand (16th), and Kuwait (19th). South East Asia and Oceania present mixed results. The USA and Canada are ranked 26th and 28th. With the exception of Kuwait, GCC countries place at the bottom of the rankings in efficiency. The lesson is that making available large sums of money for innovation inputs does not guarantee a high level of outputs. Only 39% of high-income economies have better rankings on outputs than on inputs.

Among upper-middle-income countries (Table 5b), some show a capacity to achieve more innovation outputs from less favourable conditions: China, Latvia, Chile, Serbia, and Lithuania make it to the top 40 globally on outputs, surmounting lower positions on capabilities. Of these, Chile and Lithuania have actually reversed the situation they had in 2011. In this income group, 55% of countries have better rankings in the Output Sub-Index than in the Input Sub-Index.

The same analysis among lower-middle-income countries (Table 5c) leads to encouraging results. Four of the top 10 countries in the Efficiency Index come from this income group. In fact, India and the Republic of Moldova are in the top 40 in the Output Sub-Index. Within this income group, 64% of countries have better rankings in outputs than in inputs.

Among low-income countries (Table 5d), 43% have better showings in output than in inputs, and none is in the top 10 on efficiency. While middle-income countries show, in average, better rankings in

Table 5a: Innovation Efficiency Index rankings (high-income countries/economies)

Rank	Country/Economy	Efficiency Score	Efficiency Rank	Input Rank	Output Rank	Difference	Region Group	Rank	Population (US$ millions)	GDP per capita (current PPP$)
1	Malta	1.03	4	27	4	23	EUR	2	0.4	25,782.7
2	Switzerland	1.01	5	4	**1**	3	EUR	3	7.8	43,508.6
3	Estonia	0.93	8	24	8	16	EUR	5	1.3	20,182.1
4	Netherlands	0.92	9	15	3	12	EUR	6	16.7	42,330.7
5	Germany	0.91	11	23	7	16	EUR	7	81.4	37,935.5
6	Sweden	0.88	18	3	2	1	EUR	9	9.4	40,613.8
7	Slovenia	0.88	20	32	22	10	EUR	10	2.0	29,179.1
8	Czech Republic	0.87	22	31	23	8	EUR	11	10.5	25,933.8
9	Iceland	0.83	28	19	12	7	EUR	12	0.3	38,079.6
10	Luxembourg	0.83	29	14	10	4	EUR	13	0.5	84,829.3
11	Finland	0.83	30	6	5	1	EUR	14	5.4	36,723.3
12	Israel	0.82	38	17	13	4	NAWA	2	7.6	31,004.6
13	Hungary	0.82	41	37	29	8	EUR	16	10.0	19,647.1
14	United Kingdom	0.80	44	5	6	–1	EUR	18	62.6	35,974.4
15	Belgium	0.80	45	20	18	2	EUR	19	11.0	37,677.4
16	New Zealand	0.79	47	12	15	–3	SEAO	5	4.4	27,966.8
17	Austria	0.79	48	21	21	0	EUR	20	8.4	41,805.1
18	Denmark	0.78	52	8	9	–1	EUR	23	5.5	37,741.9
19	Kuwait	0.77	54	61	54	7	NAWA	4	3.7	40,740.2
20	Norway	0.76	58	11	17	–6	EUR	24	5.0	53,376.2
21	Croatia	0.75	63	44	45	–1	EUR	26	4.4	18,338.5
22	France	0.75	64	22	26	–4	EUR	27	63.2	35,048.8
23	Slovakia	0.75	65	40	43	–3	EUR	28	5.4	23,384.1
24	Portugal	0.75	67	33	33	0	EUR	30	10.7	23,204.5
25	Korea, Rep.	0.74	69	16	24	–8	SEAO	7	49.0	31,753.5
26	United States of America	0.74	70	9	16	–7	NAC	**1**	312.9	48,147.2
27	Ireland	0.74	71	7	14	–7	EUR	31	4.6	39,507.9
28	Canada	0.73	74	10	20	–10	NAC	2	34.4	40,457.6
29	Italy	0.73	75	34	39	–5	EUR	32	60.6	30,165.5
30	Poland	0.71	80	41	50	–9	EUR	34	38.1	20,136.9
31	Cyprus	0.70	82	25	32	–7	NAWA	9	0.8	29,100.3
32	Singapore	0.69	83	**1**	11	–10	SEAO	8	5.3	59,937.0
33	Spain	0.69	87	26	35	–9	EUR	35	46.1	30,622.2
34	Japan	0.69	88	18	28	–10	SEAO	10	127.9	34,362.1
35	Oman	0.68	90	42	55	–13	NAWA	10	3.1	26,272.4
36	Qatar	0.68	91	30	41	–11	NAWA	11	1.8	102,891.2
37	Trinidad and Tobago	0.67	97	74	84	–10	LCN	15	1.3	20,301.4
38	Brunei Darussalam	0.65	104	46	69	–23	SEAO	11	0.4	49,517.8
39	Australia	0.64	107	13	31	–18	SEAO	12	22.5	40,836.4
40	Hong Kong (China)	0.63	110	2	25	–23	SEAO	14	7.2	49,342.0
41	United Arab Emirates	0.61	121	28	51	–23	NAWA	16	5.4	48,597.7
42	Greece	0.60	124	50	82	–32	EUR	39	11.2	27,624.3
43	Bahrain	0.60	125	35	60	–25	NAWA	17	1.1	27,368.4
44	Saudi Arabia	0.60	127	39	70	–31	NAWA	18	28.2	24,056.7

Note: World Bank Income Group Classification (April 2012): LI = low income; LM = lower-middle income; UM = upper-middle income; and HI = high income. Regions are based on the United Nations Classification (20 September 2011): EUR = Europe; NAC = Northern America; LCN = Latin America and the Caribbean; CSA = Central and Southern Asia; SEAO = South East Asia and Oceania; NAWA = Northern Africa and Western Asia; and SSF = Sub-Saharan Africa.

outputs, this is not the case for high- and low-income economies.

Learning to innovate: The GII scores in light of income levels

Figure 4, new this year, illustrates most of the findings and points made in the discussion and presents the GII scores in a completely new light, plotted against GDP per capita in PPP$ (in natural logs). When stages in development of countries are considered, overachievers and underperformers are revealed.

The economies that appear close to the trend line show the performance results expected from their level of development. A majority of economies are in this category, including the USA, Japan, the Russian Federation, Brazil, Indonesia, Nigeria, and Bangladesh. The farther up and above the trend line a country is, the better its innovation performance compared with that of its peers with the same GDP per capita in PPP$. Bubbles outlined in black correspond to the efficient innovators (the majority are situated above the trend line), while the bubbles outlined in red are those countries in the lower half of the Innovation Efficiency Index.

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

Note: 'Efficient innovators' are countries/economies with Innovation Efficiency ratios ≥ 0.74; 'Inefficient innovators' have ratios < 0.74; the trend line is a polynomial of degree four.

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

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

Table 5b: Innovation Efficiency Index rankings (upper-middle-income countries/economies)

Rank	Country/Economy	Efficiency Score	Efficiency Rank	Input Rank	Output Rank	Difference	Region Group	Rank	Population (US$ millions)	GDP per capita (current PPP$)
1	China	1.13	**1**	55	19	36	SEAO	**1**	1,348.1	8,394.1
2	Serbia	0.93	7	65	36	29	EUR	4	7.4	10,661.3
3	Jordan	0.87	21	72	46	26	NAWA	**1**	6.3	5,900.3
4	Ecuador	0.83	31	109	85	24	LCN	3	15.0	8,335.1
5	Latvia	0.83	33	36	27	9	EUR	15	2.2	15,448.1
6	Costa Rica	0.82	35	71	53	18	LCN	4	4.7	11,562.2
7	Chile	0.82	37	43	34	9	LCN	5	17.4	16,171.9
8	Brazil	0.82	39	69	52	17	LCN	6	194.9	11,845.8
9	Turkey	0.82	40	81	61	20	NAWA	3	72.2	14,615.5
10	Venezuela, Bolivarian Rep.	0.81	42	126	103	23	LCN	7	29.8	12,407.2
11	Russian Federation	0.80	43	60	49	11	EUR	17	142.4	16,687.4
12	Dominican Republic	0.79	46	93	77	16	LCN	8	10.1	9,289.2
13	Bulgaria	0.79	49	47	42	5	EUR	21	7.5	13,562.9
14	Montenegro	0.78	50	48	44	4	EUR	22	0.6	11,228.2
15	Argentina	0.78	51	76	66	10	LCN	9	40.9	17,376.1
16	Tunisia	0.76	59	64	58	6	NAWA	6	10.7	9,557.5
17	Mauritius	0.76	60	49	48	1	SSF	10	1.3	15,015.7
18	Thailand	0.75	61	59	56	3	SEAO	6	64.3	9,693.4
19	Lithuania	0.75	62	38	37	1	EUR	25	3.3	18,769.5
20	Belarus	0.75	66	80	75	5	EUR	29	9.4	14,948.0
21	Uruguay	0.74	68	68	67	1	LCN	11	3.4	15,469.7
22	Lebanon	0.73	73	62	63	–1	NAWA	7	4.0	15,597.0
23	Gabon	0.72	76	112	106	6	SSF	12	1.5	16,021.5
24	Romania	0.72	77	51	57	–6	EUR	33	21.4	12,357.9
25	Malaysia	0.69	84	29	38	–9	SEAO	9	28.7	15,579.0
26	Colombia	0.68	92	58	72	–14	LCN	14	46.1	10,155.3
27	Macedonia, FYR	0.68	93	52	71	–19	EUR	36	2.1	10,369.5
28	Azerbaijan	0.65	100	85	94	–9	NAWA	13	9.1	10,216.7
29	Mexico	0.65	101	70	86	–16	LCN	17	109.7	15,121.4
30	Bosnia and Herzegovina	0.65	102	66	80	–14	EUR	37	3.9	8,174.1
31	Albania	0.62	112	82	98	–16	EUR	38	3.2	7,780.2
32	South Africa	0.61	116	45	73	–28	SSF	22	50.6	10,977.1
33	Iran, Islamic Rep.	0.61	118	97	117	–20	CSA	7	75.9	12,258.2
34	Peru	0.61	119	57	88	–31	LCN	20	30.0	10,000.7
35	Namibia	0.61	120	56	87	–31	SSF	24	2.1	7,276.4
36	Panama	0.60	126	75	100	–25	LCN	21	3.6	13,595.2
37	Jamaica	0.58	130	77	107	–30	LCN	22	2.7	9,003.8
38	Kazakhstan	0.54	131	67	105	–38	CSA	8	16.5	13,060.0
39	Algeria	0.48	136	101	134	–33	NAWA	20	36.7	7,210.3
40	Botswana	0.47	139	54	121	–67	SSF	30	1.9	16,279.5

Note: World Bank Income Group Classification (April 2012): LI = low income; LM = lower-middle income; UM = upper-middle income; and HI = high income. Regions are based on the United Nations Classification (20 September 2011): EUR = Europe; NAC = Northern America; LCN = Latin America and the Caribbean; CSA = Central and Southern Asia; SEAO = South East Asia and Oceania; NAWA = Northern Africa and Western Asia; and SSF = Sub-Saharan Africa.

- Among the innovation leaders we find high-income countries such as Switzerland, the Nordic countries, Singapore, the UK, the Netherlands, New Zealand, Malta, Israel, and Estonia. These economies have succeeded in creating well-linked innovation ecosystems where investments in human capital thrive in fertile and stable innovation infrastructures to create impressive levels of innovation outputs.
- The group of innovation learners, grouped to the left, includes Latvia, Malaysia, China, Republic of Moldova, Jordan, Ukraine, India, Mongolia, Armenia, Georgia, Viet Nam, Swaziland, and Ghana. These middle-income economies demonstrate rising levels of innovation results because of improvements in institutional frameworks, a skilled labour force with an expansion of tertiary education, better innovation infrastructures, a deeper integration with global credit investment, and trade markets and a relatively sophisticated business community compared with other middle-income economies—even if progress on these dimensions is not uniform across all segments of the country.
- Innovation underperformers, grouped below the trend line, include a mix of economies in different stages of development. Most resource-rich economies

Table 5c: Innovation Efficiency Index rankings (lower-middle-income countries/economies)

Rank	Country/Economy	Efficiency Score	Efficiency Rank	Input Rank	Output Rank	Difference	Region Group	Rank	Population (US$ millions)	GDP per capita (current PPP$)
1	India	1.10	2	96	40	56	CSA	**1**	1,206.9	3,703.5
2	Moldova, Rep.	1.08	3	79	30	49	EUR	**1**	3.6	3,383.0
3	Paraguay	0.94	6	103	62	41	LCN	**1**	6.5	5,548.9
4	Sri Lanka	0.92	10	115	76	39	CSA	2	20.5	5,609.4
5	Swaziland	0.90	12	99	65	34	SSF	**1**	1.2	5,179.1
6	Ukraine	0.90	14	78	47	31	EUR	8	45.6	7,198.9
7	Pakistan	0.90	15	140	110	30	CSA	3	175.3	2,791.8
8	Senegal	0.89	16	114	78	36	SSF	3	13.4	1,893.4
9	Nigeria	0.88	17	134	102	32	SSF	4	160.3	2,589.0
10	Côte d'Ivoire	0.85	24	139	118	21	SSF	6	22.7	1,571.8
11	Indonesia	0.83	25	113	89	24	SEAO	2	240.5	4,668.1
12	Guyana	0.83	26	86	64	22	LCN	2	0.8	7,541.4
13	Viet Nam	0.83	27	83	59	24	SEAO	3	89.3	3,354.8
14	Philippines	0.83	32	106	83	23	SEAO	4	95.8	4,111.1
15	Zambia	0.83	34	122	96	26	SSF	7	13.6	1,612.9
16	Belize	0.78	53	87	74	13	LCN	10	0.3	8,275.2
17	Cameroon	0.77	55	125	111	14	SSF	9	20.9	2,256.3
18	Armenia	0.76	57	73	68	5	NAWA	5	3.3	5,395.3
19	Egypt	0.72	78	104	99	5	NAWA	8	79.4	6,504.6
20	El Salvador	0.71	81	94	91	3	LCN	12	5.9	7,595.3
21	Angola	0.69	85	133	127	6	SSF	13	19.6	5,911.0
22	Ghana	0.69	86	91	93	–2	SSF	14	24.3	3,081.6
23	Guatemala	0.69	89	98	101	–3	LCN	13	14.7	5,033.2
24	Morocco	0.68	94	88	90	–2	NAWA	12	32.2	5,069.8
25	Honduras	0.66	99	105	116	–11	LCN	16	8.2	4,350.1
26	Bolivia, Plurinational St.	0.65	103	108	120	–12	LCN	18	10.6	4,843.2
27	Georgia	0.64	106	63	81	–18	NAWA	14	4.5	5,430.3
28	Mongolia	0.63	109	53	79	–26	SEAO	13	2.8	4,509.7
29	Nicaragua	0.62	114	102	119	–17	LCN	19	5.9	3,185.4
30	Syrian Arab Rep.	0.61	115	123	130	–7	NAWA	15	21.2	5,078.8
31	Yemen	0.52	132	138	138	0	NAWA	19	25.1	2,520.7
32	Fiji	0.51	133	84	124	–40	SEAO	16	0.9	4,624.5
33	Lao PDR	0.48	135	129	139	–10	SEAO	17	6.6	2,659.2
34	Lesotho	0.47	137	92	133	–41	SSF	28	2.6	1,425.1
35	Uzbekistan	0.44	140	100	137	–37	CSA	10	28.6	3,293.7
36	Sudan	0.44	141	141	141	0	SSF	31	32.7	2,981.1

Note: World Bank Income Group Classification (April 2012): LI = low income; LM = lower-middle income; UM = upper-middle income; and HI = high income. Regions are based on the United Nations Classification (20 September 2011): EUR = Europe; NAC = Northern America; LCN = Latin America and the Caribbean; CSA = Central and Southern Asia; SEAO = South East Asia and Oceania; NAWA = Northern Africa and Western Asia; and SSF = Sub-Saharan Africa.

are in this category, including, in the Middle East, Qatar, the United Arab Emirates (UAE), and Kuwait (Bahrain, Oman, and Saudi Arabia to a much lesser extent) as well as Brunei Darussalam, the Bolivarian Republic of Venezuela, and Algeria. Also in this category we find Greece, which is undergoing a debt and economic crisis. By decreasing level of income per capita, Trinidad and Tobago, Botswana, Gabon, the Islamic Republic of Iran, Angola, Syria, Sudan, and Yemen are also in this category; the lower-middle-income economies typically lack adequate innovation infrastructures, while some upper-middle-income countries fall in this category because of poor linkages across the elements of the innovation ecosystems.

Figure 4 also seems to indicate that countries might develop their innovation capabilities and results in stages. It may be necessary to reach some critical level regarding institutions, skills of the labour force, infrastructure, and market and business sophistication for innovation activities to get underway, with a multiplier effect in terms of innovation outputs (stage 1).

In stage 2, innovation results increase because of sound institutions, increased R&D, the development of clusters, supply chains in interaction with global markets, and entrepreneurship. Often these developments do not reach the entire territory or population, implying that input scores are still relatively low at the national scale. Innovation linkages are crucial at that level: firms, governments, and academic sectors need to collaborate to develop pockets of wealth, clusters, and niche

Table 5d: Innovation Efficiency Index rankings (low-income countries/economies)

Rank	Country/Economy	Efficiency Score	Efficiency Rank	Input Rank	Output Rank	Difference	Region Group	Rank	Population (US$ millions)	GDP per capita (current PPP$)
1	Zimbabwe	0.90	13	130	92	38	SSF	2	12.6	471.7
2	Mali	0.88	19	131	97	34	SSF	5	13.8	1,328.1
3	Nepal	0.86	23	127	95	32	CSA	4	28.5	1,328.1
4	Benin	0.82	36	132	108	24	SSF	8	9.9	1,491.5
5	Bangladesh	0.77	56	118	104	14	CSA	5	166.7	1,697.3
6	Uganda	0.74	72	121	112	9	SSF	11	35.2	1,305.4
7	Tajikistan	0.71	79	111	109	2	CSA	6	7.8	2,039.9
8	Gambia	0.67	95	128	125	3	SSF	15	1.8	2,116.6
9	Burkina Faso	0.67	96	120	123	–3	SSF	16	15.0	1,456.7
10	Mozambique	0.66	98	107	115	–8	SSF	17	22.0	1,085.9
11	Malawi	0.64	105	110	122	–12	SSF	18	16.2	852.7
12	Ethiopia	0.64	108	124	128	–4	SSF	19	86.8	1,092.7
13	Rwanda	0.63	111	95	113	–18	SSF	20	10.2	1,318.5
14	Burundi	0.62	113	137	135	2	SSF	21	8.4	430.0
15	Togo	0.61	117	135	136	–1	SSF	23	7.1	892.8
16	Tanzania, United Rep.	0.61	122	117	129	–12	SSF	25	42.2	1,505.7
17	Madagascar	0.60	123	116	126	–10	SSF	26	21.9	943.2
18	Cambodia	0.58	128	119	132	–13	SEAO	15	14.4	2,286.1
19	Kenya	0.58	129	89	114	–25	SSF	27	40.9	1,750.8
20	Kyrgyzstan	0.49	134	90	131	–41	CSA	9	5.5	2,380.8
21	Niger	0.47	138	136	140	–4	SSF	29	15.1	795.3

Note: World Bank Income Group Classification (April 2012): LI = low income; LM = lower-middle income; UM = upper-middle income; and HI = high income. Regions are based on the United Nations Classification (20 September 2011): EUR = Europe; NAC = Northern America; LCN = Latin America and the Caribbean; CSA = Central and Southern Asia; SEAO = South East Asia and Oceania; NAWA = Northern Africa and Western Asia; and SSF = Sub-Saharan Africa.

products and services that will allow the rest of society to progress.

In stage 3, input rankings start improving because of a better integration of segments of society that were previously kept at the margins of development: wages increase, cities and villages become more populated at the expense of rural subsistence communities, education becomes affordable for greater segments of society, women enter the labour force, and so on. The same phenomena that lead to the demographic transition apply, with the added spin that markets start playing an even greater role in parallel to societal progress, with a multiplier effect. Innovation learners are found in stages 2 and 3; in addition, hysteresis effects in innovation might explain the steepness of the curve.

In stage 4, where we find the innovation leaders, both innovation capabilities and results stabilize at a high level in an equilibrium that is more the result of demographics, market size, and comparative advantages (services, trade, and so on) than of failed policies or planned strategies. The challenge is to avoid complacency and the risk of an ever-shrinking scientific and creative community that could imperil future growth.

Regional rankings

Leaders in their respective regions in the GII are the same as in 2011: Switzerland in Europe (1st), Singapore in South East Asia and Oceania (3rd), the USA in Northern America (10th), Israel in Northern Africa and Western Asia (17th), Chile in Latin America and the Caribbean (39th), Mauritius in Sub-Saharan Africa (49th), and India in Central and Southern Asia (64th).

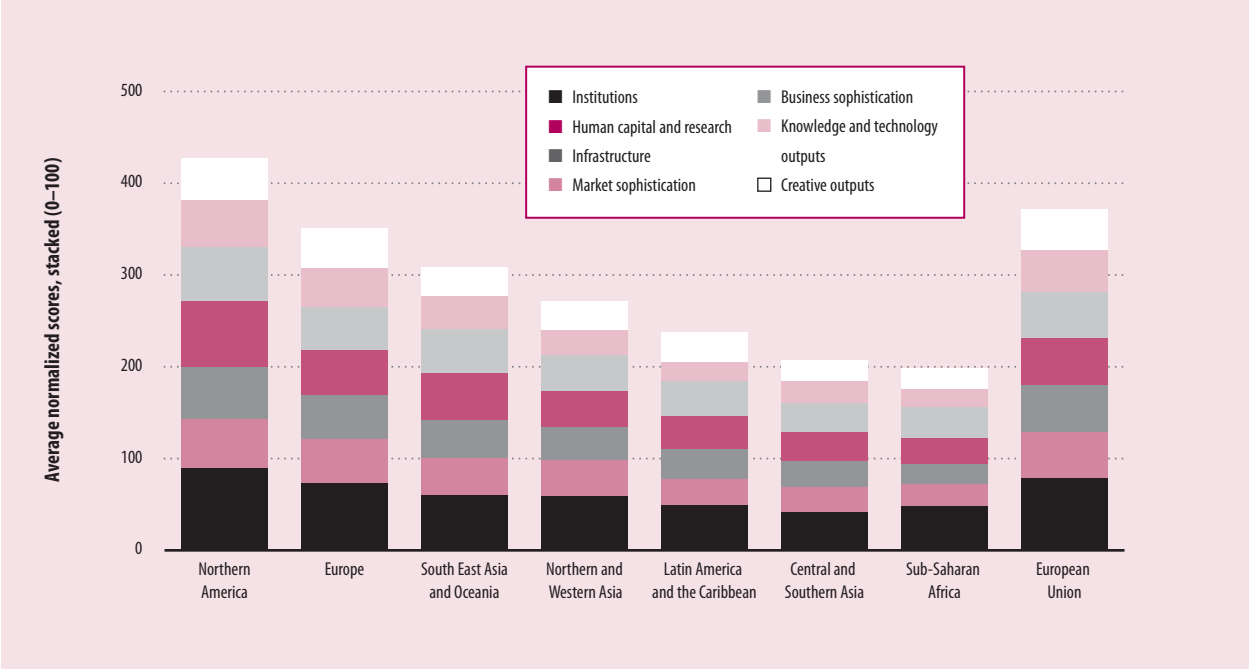
This section discusses regional and sub-regional trends, with snapshots for some countries leading in the rankings.

Following the insights illustrated by Figure 4, this year the regional rankings are discussed on the basis of that figure, in increasing order of average GDP per capita, to clearly showcase those economies that are outperforming their peers in the innovation race (except for the USA and Canada in Northern America, discussed above and in Box 1). To further put the discussion of rankings in perspective, Figure 5 presents in a bar graph the average pillar scores by region and Table 6 presents a heatmap with the scores for the top 10 and average scores by income and regional groups.

Sub-Saharan Africa (31 economies)

The first four countries in the region have seen clear improvements in their rankings. Despite these encouraging developments, only two countries—Mauritius and South Africa—remain in the upper half of the rankings, and 23 are placed at the bottom (rankings of 100 or plus). Mauritius, South Africa, Namibia, Swaziland, Ghana, Kenya, Senegal, Rwanda, and Zimbabwe have relatively good performances, while Botswana, Gabon, Angola, and Sudan are underperforming.

Figure 5: Average scores for selected country groups



Note: Countries/economies are classified according to the United Nations Classification (20 September 2011). European Union overlaps (it includes 26 European countries, and Cyprus in Western Asia).

In **Eastern and Northern Africa,** the rankings are led by Mauritius (49th), followed by Kenya (96th), Rwanda (102nd), Zambia (107th), Mozambique (110th), Zimbabwe (115th), Uganda (117th), Malawi (120th), Madagascar (126th), the United Republic of Tanzania (128th), Ethiopia (131st), Burundi (137th), and Sudan (141st).

Mauritius is ranked 49th (47th among GII 2011 countries), up from 53rd in 2011. With a net jump of six positions compared with 2011, Mauritius was affected in the rankings by the adjustments made to the GII model (Annex 2). This archipelago of 1.3 million inhabitants, with the 3rd highest GDP per capita in the region after Botswana and Gabon, gets its strengths from the Output Sub-Index (48th), Institutions (24th), and Creative outputs (31st), where it ranks 1st in the region. It has relative deficiencies in Human capital and research (70th), Infrastructure (112th), and Knowledge and technology outputs (78th). Particularly worrisome is its 101st position in elementary education; if Mauritius does not prioritize investing in education (it ranks 101st with a current expenditure on education of only 3.1% of GNI), the improvements made in tertiary education and other areas such as linkages might be short-lived.

In **Middle and Western Africa,** Ghana leads at the 92nd position, followed by Senegal (97th), Gabon (106th), Mali (119th), Cameroon (121st), Burkina Faso (122nd), Nigeria (123rd), Benin (125th), Gambia (130th), Côte d'Ivoire (134th), Angola (135th), Togo (136th), and Niger (140th). With the 2nd GDP per capita in the region (at PPP$ 16,021), the ranking of Gabon is disappointing.

Ghana epitomises the impact on a ranking of adjustments to the general framework, breaks in series, and availability of data previously missing (Annex 2). This year, Ghana is ranked 92nd (87th among GII 2011 countries), down from 70th place in 2011. This country of 24.3 million people shows a balanced profile, with rankings ranging from 73rd on Market sophistication to 107th on Infrastructure. This year a new indicator on the cost of redundancy dismissal was introduced in which it ranks 134th, implying 69 positions lost in the regulatory environment sub-pillar (54 positions lost among GII 2011 economies). Changes in sub-pillar 1.3, business environment, also affected Ghana—the country dropped 17 positions in the rankings on this sub-pillar (15 if only 2011 economies are considered). In addition, the availability of new data related to expenditure on R&D revealed some weaknesses and strengths previously not assessed for lack of data: low levels of researchers and GERD led to a 97th place in the

Table 6: Heatmap for GII top 10 economies and regional and income group averages (0–100)

Country/Economy	GII	Institutions	Human capital and research	Infrastructure	Market sophistication	Business sophistication	Input	Knowledge and technology outputs	Creative outputs	Output	Efficiency
Switzerland	68.24	87.99	57.87	60.83	69.76	63.51	67.99	71.96	65.03	68.49	1.01
Sweden	64.77	88.65	62.75	69.79	64.25	58.62	68.81	67.89	53.57	60.73	0.88
Singapore	63.47	92.51	68.25	60.60	76.30	76.88	74.91	64.91	39.17	52.04	0.69
Finland	61.78	92.83	68.20	61.96	53.56	60.74	67.46	62.87	49.34	56.10	0.83
United Kingdom	61.25	90.42	53.78	61.82	76.62	57.28	67.98	57.62	51.41	54.51	0.80
Netherlands	60.55	88.74	48.40	58.73	60.76	57.96	62.92	59.38	56.97	58.18	0.92
Denmark	59.93	95.28	62.85	56.78	66.60	55.24	67.35	51.53	53.48	52.50	0.78
Hong Kong (China)	58.72	92.60	51.54	63.38	85.52	66.87	71.98	38.36	52.57	45.47	0.63
Ireland	58.68	93.05	59.91	45.01	69.42	69.75	67.43	60.89	38.97	49.93	0.74
United States of America	57.69	85.11	53.41	56.11	76.83	59.85	66.26	56.05	42.17	49.11	0.74
Average	**36.81**	**58.07**	**36.52**	**35.76**	**40.41**	**40.60**	**42.27**	**30.28**	**32.42**	**31.35**	**0.73**
Regions											
Northern America	57.32	90.05	53.28	55.64	72.63	58.65	66.05	51.22	45.94	48.58	0.74
Europe	47.93	72.69	48.89	47.38	48.73	47.07	52.95	43.03	42.78	42.91	0.81
South East Asia and Oceania	41.16	60.33	39.46	41.93	51.30	47.45	48.09	35.96	32.51	34.23	0.71
Northern Africa and Western Asia	35.96	58.56	40.18	35.55	39.40	39.01	42.54	26.97	31.80	29.39	0.69
Latin America and the Caribbean	31.84	48.96	29.16	32.51	34.96	38.52	36.82	21.44	32.29	26.87	0.73
Central and Southern Asia	27.60	41.85	27.13	27.36	32.05	32.19	32.12	23.52	22.65	23.09	0.73
Sub-Saharan Africa	26.16	47.77	24.17	21.65	29.12	32.76	31.09	20.36	22.11	21.23	0.69
Income levels											
High income	51.02	79.03	52.53	51.49	53.63	52.01	57.74	44.02	44.57	44.30	0.76
Upper-middle income	35.24	55.57	35.09	35.16	38.80	39.37	40.80	27.39	31.98	29.68	0.73
Lower-middle income	28.31	43.29	26.61	25.75	32.77	34.00	32.49	23.65	24.63	24.14	0.74
Low income	24.61	44.25	22.72	21.15	28.88	30.36	29.47	18.35	21.16	19.76	0.67

Worst Average Best

Note: Darker shadings indicate better performances. Countries/economies are classified according to the World Bank Income Group and the United Nations Regional Classifications (April 2012 and 20 September 2011, respectively).

R&D sub-pillar. However, healthy levels of R&D financed by business (ranked 19th) and by abroad (ranked 27th) implied better showings on business sophistication. Ghana ranks 38th on high-tech imports (previously the data were not available). On pillar 6, Knowledge and technology outputs, Ghana lost 15 positions (7 among GII 2011 economies) on patent applications at the PCT (there was a break in the series, Annex 1, Box 1) and 27 (22) on scientific publications. Its performance on knowledge impact has been weak, with a low growth in labour productivity (ranked 63rd, down from 23rd last year), a 74th position in new business density, and a low rank on ISO 9001 quality certificates where it comes in at 137th place (this is a new indictor this year). Overall, however, Ghana still clearly outperforms its regional peers.

Nigeria is ranked 123rd (113th among GII 2011 countries), down from 96th in 2011. The loss of 17 positions compared with 2011 was the result both of worsening

performances on key indicators and of the effect of adjustments to the GII framework (Annex 2). This populous lower-middle income country (the most populated in the region) continues to show a relative strength on the side of the innovation results, ranked 102nd on the Output Sub-Index and 17th on the efficiency ratio (after being in the top 10 in 2011). Its main strengths are in Market sophistication (91) and Creative outputs (76).

In **Southern Africa,** South Africa is ranked 54th, followed by Namibia (73rd), Swaziland (82nd), Botswana (85th), and Lesotho (116th).

South Africa is ranked 54th (52nd among GII 2011 countries), up from 59th in 2011, in great measure because of the adjustments made to the GII model (Annex 2). It tops the regional rankings in the Input Sub-Index (45th), Infrastructure (79th), and Market sophistication (13th). It also benefits from sound Institutions (39th). Its low rankings in Human capital and research (103rd) and Business sophistication (55th) lead to relatively poor showings in Knowledge and technology outputs (61st), Creative outputs (86th), and the Output Sub-Index (73rd).

Swaziland is ranked 82nd (78th among GII 2011 countries), up from 101st in 2011, jumping 23 positions despite being slightly affected by the adjustments made to the GII framework (Annex 2). The best assets of this landlocked lower-middle-income country (the least populous in the region) are its Business sophistication (46th) and Knowledge and technology outputs (40th), which compensate for a feeble Infrastructure (136th) and deficient market conditions for credit, investment, trade and competition (123rd). Swaziland is firmly positioned among innovation learners and ranks 12th in innovation efficiency, a position sustained by a 48th position in patenting at the PCT and an 8th rank in computer and communication services exports (at 64.2% of commercial service exports). Unfortunately, lack of statistics does not allow a more complete analysis.

Botswana is ranked 85th (81st among GII 2011 countries), down from 79th in 2011. This landlocked country has the highest per capita income in the region (at PPP$ 16,279), and yet its ranking is below par. Its Input Sub-Index ranking is relatively high (54th), but does not compensate for a particularly poor ranking in Outputs (121st), leading to the lowest efficiency ratio in the region after Sudan. This is particularly puzzling as Botswana's main strengths are in its Institutions (31st), Human capital and research (62nd), and Business sophistication (67th), all areas in which relative strengths usually have a multiplier effect on the side of innovation results. Some important data points are missing, however, that would allow a more completely accurate assessment of where Botswana stands in innovation results (Annex 3).

Central and Southern Asia (8 economies)

In **Southern Asia,** India comes first (64th), followed by Sri Lanka (94th), the Islamic Republic of Iran (104th), Bangladesh (112th), Nepal (113th), and Pakistan (133rd).

India comes in 1st position in the region, ranked 64th (62nd among 2011 economies, maintaining its 2011 ranking of 62nd). With more than 1.2 billion inhabitants and a GDP per capita of PPP$ 3,703.5 (it is a lower-middle-income country), these rankings place India among the innovation learners. India has relative strength on the Output Sub-Index (ranked 40th, first in the region) over the Input Sub-Index (ranked 96th), therefore achieving a high efficiency ratio, coming 2nd after China in 2012. Its major weaknesses are its Institutions (125th), and Human capital and research (131st), while its best scores are in Market sophistication (46th), Knowledge and technology outputs (47th), and Creative outputs (34th) (see Box 3 for details of BRIC country strengths and weaknesses). With one of the most business-friendly communities being that of the ICT sector—India ranks 4th in computer and communication services exports, at 70.5% of commercial services exports—its 108th and 117th positions in ICT access and use, respectively, reflect the existence of pockets of wealth developing around niche markets and clusters (the software industry in this case), with little trickle down to the rest of society. The inverted progression in the ranking in Human capital and research, with a ranking of 113th in elementary education, 135th in tertiary education, and 55th in R&D is symptomatic of the same phenomenon.

The Islamic Republic of Iran, which comes 2nd in terms of per capita income in the region (PPP$ 12,258.2, an upper-middle-income country) has a rather poor showing at 104th position (98th among GII 2011 countries, down from 95th in 2011), reaching 97th place on the Input Sub-Index and 117th on the Output Sub-Index. Interestingly, it shows good scores on the three pillars traditionally linked to innovation: Human capital and research (ranked 54th), Business sophistication (49th), and Knowledge and technology outputs (73rd). In the latter two areas, its showing in tertiary education (24th), R&D (52nd), patent filings at the national office (23rd), and scientific and technical publications (45th) are noteworthy. Its lower scores in the remaining four

Box 3: BRIC countries show important strengths and several persistent weaknesses

China—ranked 34th in the Global Innovation Index (GII) this year—continues to display strong performance in Knowledge and technology outputs (for which its score is above the average score of the GII top 10), and in Infrastructure and Market and Business sophistication. Areas where improvements would be conducive to higher aggregate GII rankings include Institutions, Human capital and research, and Creative outputs.

The Russian Federation—51st overall this year—comes first among the BRIC countries (Brazil, Russian Federation, India, and China) in Human capital and research by a wide margin. In addition, the country displays good scores in Institutions, Infrastructure, Business sophistication, and Knowledge and technology outputs. Rankings are less satisfying for Market sophistication and Creative outputs.

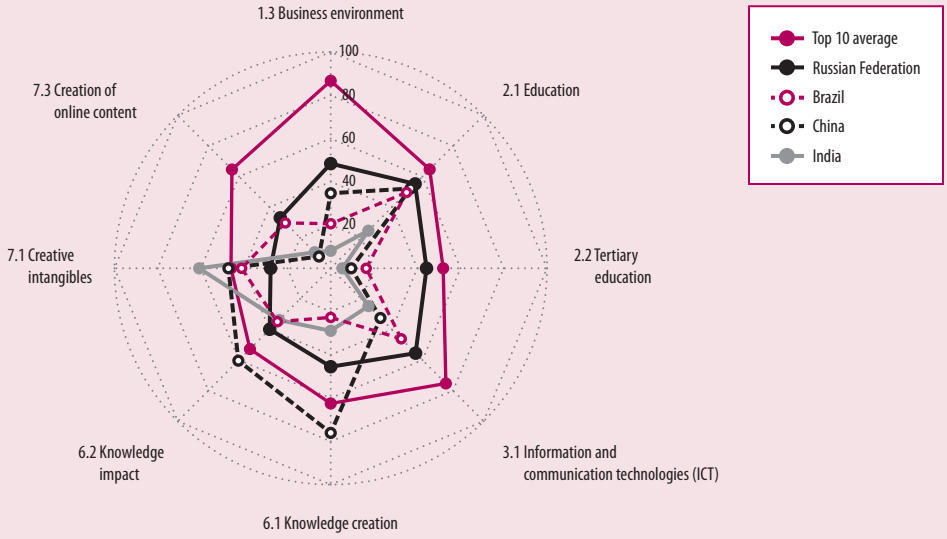
Brazil, at 58th place, offers a distribution of strengths and weaknesses similar to that of the Russian Federation in Institutions, Infrastructure, and both Market and Business sophistication. It comes far behind in Human capital and research (at a level similar to that of China), and last among BRICs in Knowledge and technology outputs. It achieves second place among BRIC countries, after India, on Creative outputs.

India ranks 64th, below Brazil, but with the best score among BRICs in Creative outputs, and it comes second among BRICs in Market sophistication, closely behind China. The innovation front in India continues to be penalized by deficits in Human capital and research, Infrastructure, and Business sophistication, where it comes last among BRICs, and in Knowledge and technology outputs, where it comes in ahead of Brazil only.

Fine-tuning this analysis, there are seven areas in which the four BRIC countries achieve very similar performances: creative goods and services, research and development (R&D), trade and competition, innovation linkages, knowledge absorption, and, to a minor extent, regulatory environment and knowledge diffusion.

There are eight domains, however, in which scores differ substantially: knowledge creation; tertiary education, business environment, elementary education, information and communication technologies (ICT), creative intangibles, and knowledge impact. Figure 3.1 illustrates the relative competitive advantages of each BRIC country in the innovation race and compares this with the average scores for the GII top 10 countries/economies.

Figure 3.1: The sub-pillars of major divergence in scores among BRIC countries



Note: Numbers refer to sub-pillars. Please refer to Appendix III, Sources and Definitions for details.

pillars, however, place it among the countries with a low performance in the region.

Bangladesh, the poorest country in the region, with a per capita income of PPP$ 1,697.3 (a low-income country), is ranked 112th (104th among GII 2011 countries), down from 97th in 2011. Ranked in the top 10 on efficiency in 2011, Bangladesh comes at 56th position in 2012. Its major strength lies in Knowledge and technology outputs, and yet it ranks 74th (69th among GII 2011 countries, losing 25 positions compared with 2011), with deteriorating positions in a majority of indicators. In Creative outputs it ranks 121st, with a particularly poor showing in online creativity (a sub-pillar added this year).

Lower-middle-income **Pakistan** is ranked 133rd (121st among GII 2011 countries), down from 105th position in 2011. With an Output Sub-Index ranking of 110 and an Input Sub-Index of 140, this country is ranked 15th on efficiency (4th in 2011). Its major drop in rankings is in the two output pillars: Knowledge and technology outputs (117th; 107th among 2011 economies, down from 98th in 2011), and Creative outputs (99th; 94th among 2011 economies, 53rd in 2011), the latter in part because of a significant impact from the addition of sub-pillar 7.3 on online creativity, in which Pakistan is ranked 105th.

In **Central Asia,** transition economies Kazakhstan (83rd), Tajikistan (108th), Kyrgyzstan (109th), and Uzbekistan (127th) are all in the bottom half of the rankings.

Kazakhstan is ranked 83rd (79th among GII 2011 countries), up from 84th in 2011. This upper-middle-income transition economy is the wealthiest in the region (PPP$ 13,060.0), yet its performance is somewhat below par. It has a relative advantage on the Input Sub-Index, where it ranks 67th (1st in the region), compared to 105th on the Output Sub-Index, showing one of the lowest efficiency ratios (ranked 131st). The world's largest landlocked economy (9th in the world by territorial area), this country shows relative strengths in Institutions (52nd), Infrastructure (58th), and Business sophistication (62nd), while it could improve its rankings on Human capital and research (85th), Market sophistication (92nd), Knowledge and technology outputs (85th), and Creative outputs (119th).

Latin America and the Caribbean (22 economies)

Latin America and the Caribbean includes only upper- and middle-income economies, except for high-income Trinidad and Tobago. The first seven countries in the regional rankings are upper-middle-income countries.

South American countries show great disparities in rankings. Chile tops the rankings at 39th place, followed by Brazil (58th), Colombia (65th), Uruguay (67th), Argentina (70th), Peru (75th), Guyana (77th), Paraguay (84th), Ecuador (98th), the Plurinational State of Bolivia (114th), and the Bolivarian Republic of Venezuela (118th).

Chile is ranked 39th (38th among GII 2011 countries), keeping its position from 2011, and the only country in the region in the top 40. Among the upper-middle-income economies, it comes in at 5th place in the GII, 4th in Inputs, and 3rd in the Output Sub-Index, after China and Latvia. Chile shows strengths across the board, with the notable exception of Human capital and research (75th), where it comes only in 6th position out of 22 in the region, a result in line with the crisis of tertiary education in the country that was highlighted in 2011. Deficiencies are particularly evident in primary and secondary education, where it ranks 78th in public expenditure per pupil over GDP per capita and 103rd in the pupil-teacher ratio. In the region, it tops the Input Sub-Index (43rd), the Output Sub-Index (34th), Institutions (29th), and Creative outputs (18th).

Brazil follows 19 positions further down the rankings, 2nd among South American countries, at position 58th (56th among GII 2011 countries), down from 47th in 2011 (Box 3). Although Brazil benefitted from the adjustments made to the GII model, it still lost a net of 9 positions compared with 2011 (Annex 2), yet it is at the level expected from its GDP per capita in PPP$. This BRIC country has its relative strength in the Output Sub-Index (52nd), although it lost 18 positions (among GII 2011 countries). With an Input Sub-Index rank of 69, it ranks only 39th on efficiency (down from a top 10 position in 2011). Particularly worrisome are its rankings in business environment (127th) tertiary education (115th), credit conditions, and trade (108th in both).

The Bolivarian Republic of Venezuela is ranked 118th (108th among GII 2011 countries), down from 102 in 2011. This resource-rich economy shows relatively good rankings in Human capital and research (69th), Infrastructure (86th), Business sophistication (48th), and Creative outputs (87th) that, however, do not compensate for big deficiencies in the remaining three pillars: Institutions (140th); and Market sophistication (139th), where it ranks last in the region; and Knowledge and technology outputs (121st). With the lowest ranking in the region in the GII and in the Input Sub-Index (126th), Venezuela's performance deserves improvements.

In **Central America,** Costa Rica comes first in 60th position, followed by Mexico (79th), Belize (80th), Panama (87th), El Salvador (93rd), Guatemala (99th), Nicaragua (105th), and Honduras (111th).

Costa Rica is ranked 60th (58th among GII 2011 countries), down from 45th in 2011 (to some extent to the result of adjustments made to the GII framework, see Annex 2), and 1st in Central America. With a population of 4.7 million, it has lost its positions on all indices: Input Sub-Index (71st/69th among 2011 economies, down from 53rd), Output Sub-Index (53rd/51st down from 37th), efficiency ratio (35th/33rd, down from 29th in 2011), and yet it retains its place among innovation learners. Costa Rica presents two major impediments to the development of its full innovation potential: the conditions for credit and investment are assessed very low (ranked 88th and 131st, respectively), and indeed, the levels of domestic credit to private sector and microfinance (45.9% and 0.2% of GDP, respectively) are relatively low, as well as the level of market capitalization and of stocks traded (ranked 101st and 96th at 4.2% and 0.1% of GDP, respectively).

In the **Caribbean,** Trinidad and Tobago comes first but at the disappointing position of 81st place, which places it among countries performing least well, in addition to the fact that it is a high-income country—the only one in the region—with a relatively high per capita income. It is followed by the Dominican Republic (86th), and Jamaica (91st).

Northern Africa and Western Asia (20 economies)

Israel is ranked 17th (16th among GII 2011 countries), down from 14th in 2011. This high-income country has strong positions across the board, and ranks 17th on the Input Sub-Index, 13th on the Output Sub-Index (38th on efficiency), and 1st in the region in Human capital and research (4th), Market sophistication (9th), and Knowledge and technology outputs (10th). Although it maintained its 1st place in scientific publications and improved its ranking in computer spending, Israel has deteriorating relative positions in all the remaining indicators in Knowledge and technology outputs (ranking 6th in knowledge creation, 2nd in 2011; and 12th in knowledge diffusion, 8th in 2011). Israel is still, however, firmly positioned among the global innovation leaders.

Cyprus (EU12) is ranked 28th (27th among GII 2011 countries), up from 28th in 2011. This island of merely 0.8 million people that is now part of the European Union ranks 1st in the region in Institutions (at 15th, its best score), with additional strengths in Market sophistication (20th) and Knowledge and technology outputs (25th), the latter corresponding to a ranking of 30th (5th in the region) in Human capital and research.

The six countries of the **Gulf Cooperation Council (GCC)**—Qatar, the UAE, Bahrain, Oman, Saudi Arabia, and Kuwait—come next in the regional rankings (in that order). With populations ranging from 1.1 million (Bahrain) to 28.2 million (Saudi Arabia) and per capita incomes ranging from PPP$ 24,056.7 (Saudi Arabia) to PPP$ 102,891.2 (Qatar), these economies present distinct profiles, with, however, one common feature: particularly low rankings in Knowledge and technology outputs and efficiency (above 90th on the latter, with the exception of Kuwait, which is ranked 54th). In addition, they attain rankings that are well below those of their peers in GDP per capita. All place among the countries performing less well—especially Qatar, the UAE, and Kuwait. Chapter 5 studies recent efforts in the GCC to change the situation, which is shared with other resource-rich economies in the world, while Chapter 3 analyses in further detail the situation in Saudi Arabia.

Qatar is ranked 33rd (32nd among GII 2011 countries), down from 26th in 2011. Qatar was particularly affected by the adjustments made to the GII framework (Annex 2). This resource-rich country of 1.8 million with the highest GDP per capita in the sample (PPP$ 102,891.2) has a relative advantage in the Input Sub-Index (30th) over the Output Sub-Index (41st), with the 1st regional ranks in Business sophistication (8th) and Creative outputs (19th). Its ranking of 14th in Human capital and research is sustained by a good score in R&D that is not entirely conclusive, because it is based on a single indicator (a survey question on the quality of research institutions). Within the same pillar, low levels of expenditure in education, a low score at the PISA examination, and a tertiary enrolment ratio of merely 10% (ranked 117th) are definitely of concern. Also worrisome are an 84th position in Market sophistication, and a 77th position in Knowledge and technology outputs. With one of the lowest indicator-coverages this year (at 72%), a proper assessment of Qatar is particularly difficult (Annex 3).[28] This is also an appeal to Qatar to improve the data situation.

Northern Africa and Western Asia underwent a wave of upheavals known as the Arab Spring starting in late December 2010; for some of these countries, the upheaval is continuing. Some data points included in the GII are anterior to that period, and therefore do not accurately

reflect the situation of the countries concerned—they are, at most, indications of the situation prevailing at the moment the events erupted. It will be interesting to study the effect of these revolutions on innovation and related policies next year.

Tunisia, for example, is ranked 1st in **Northern Africa,** at position 59th (57th among GII 2011 countries), up from 66th position in 2011. Although it does better than Morocco (88th), Egypt (103rd), and Algeria (124th), it cannot be ruled out that its ranking will vary considerably in future editions of the GII.

Algeria is ranked 124th (114th among GII 2011 countries), up 11 positions from 125th in 2011, one of the best performances in the region. Its relative strength is in the Input Sub-Index (101st), which, for a country at its income level, places it among the countries with a low performance. With increased data coverage, some real strengths in areas previously reported as not available were revealed this year—notably in computer and communications service imports (ranked 3rd), computer and communications service exports (21st), foreign direct investment net outflows (75th), recreation and culture consumption (86th), and creative services exports (22nd). Algeria comes in at 134th in the Output Sub-Index, however, reaching one of the lowest efficiency ratios (ranked 136th, last in the region).

In **Western Asia,** the rankings are led by Jordan (56th), followed by Lebanon (61st), Armenia (69th), Georgia (71st), Turkey (74th), and Azerbaijan (89th) in the second half of the global rankings, with the Syrian Arab Republic (132nd) and Yemen (139th) lagging behind.

Jordan is ranked 56th (54th among GII 2011 countries), down from 41st in 2011. Its loss of 13 positions does not affect its impressive showing in the rankings as a clear innovation learner. Although its economy has been decelerating over the past two years, Jordan exhibited spectacular growth averaging 7.6% of GDP in the period 2004–09. Its fall in the rankings this year is primarily due to deteriorating positions in Market and Business sophistication as well as Knowledge and technology outputs. Jordan's 81st position in the new sub-pillar on online creativity implied a drop from 10th to 24th in Creative outputs. On a positive note, Jordan continues to improve its standing in Institutions, Human capital and research, and Infrastructure.

The Syrian Arab Republic is ranked 132nd (120th among GII 2011 countries), down from 115th in 2011. The country has experienced political and other instability since 2011. Because it is one of the countries with the lowest indicator coverage (76.2%), a complete analysis is difficult. It is, however, noteworthy that all its pillar and index rankings are in the red, its best position being 105th in Human capital and research.

South East Asia and Oceania (17 economies)

The region includes 17 economies that are very dissimilar in terms of their level of development. In particular, a few countries were particularly strongly affected by the adjustments made to the GII model: Viet Nam lost 23 positions for that reason alone; Mongolia, China, the Republic of Korea, Japan, and Indonesia were also affected (Annex 2).

Of the seven **high-income economies,** Singapore (3rd), Hong Kong (China) (8th), New Zealand (13th), the Republic of Korea (21st), Australia (23rd), and Japan (25th) cover the first six positions in the region. Singapore in addition tops the regional rankings in the Input and Output Sub-Indices, Human capital and research, Business sophistication (1st globally) and Knowledge and technology outputs, while Hong Kong (China) comes in at 1st position in the region in Market sophistication (1st globally) and Creative outputs.

The Republic of Korea is ranked at 21st (20th among GII 2011 countries), down from 16th position in 2011. It is one of the countries most affected by the new modelling choices (Annex 2), but nonetheless it continues to be firmly placed among the innovation leaders. Its scores improved in three pillars: Infrastructure (3rd, the best ranking in the region), Business sophistication (25th), and Knowledge and technology outputs (9th), with a jump of 35 positions on knowledge impact (driven essentially by a healthy growth in labour productivity and by ISO 9001 quality certificates, a new indicator). The Republic of Korea ranks 1st on the ICT sub-pillar and on six indicators including tertiary enrolment, stock market dynamism, and patent applications at the national office. In knowledge creation (patents, utility models, scientific publications), the Republic of Korea lost its 1st position in the GII 2011 to Switzerland and Sweden, to reach the 3rd position. The main negative impact on its ranking is triggered by the inclusion of the sub-pillar on online creativity, on which it ranks 48th. Coupled with a deteriorating position in trademark registrations and the assessment of the business community of its use of ICT in business and organizational models (78th in creative intangibles), this led to a ranking of 59th in creative outputs (down from 27th in 2011). Given the average reliability of these data for this Asian economy, the case of the

Box 4: A multi-speed Europe

The GII 2012 rankings confirm that European countries continue to progress at different speeds and on different levels.

Northern Europe and Switzerland continue to be strong. This group includes not only Switzerland (ranked 1st in the GII) and three Nordic countries—Sweden (3rd), Finland (4th), and Denmark (7th)—but also the United Kingdom (UK, at 5th), the Netherlands (6th), and Ireland (9th). These countries have common strengths in robust institutions and cohesive societies; well-developed infrastructures; skilled labour forces; a high level of assimilation of information and communication technologies (ICTs) and of adoption of new technologies; well-developed medium- and high-tech sectors; open economies with dynamic financial markets; and sophisticated business and academic communities involved in research, patenting, and creativity.

Other economies in Western Europe have strengths across the board. This is the case of Luxembourg (11th), Germany (15th), Belgium (20th), Austria (22nd), and France (24th), which remain in the top 30.

Southern Europe has no representative in the top 10. Malta (16th) is one of the few making it to the top 30, along with Spain and Slovenia. Southern Europe offers generally a more worrisome situation, with lower rankings by Portugal (35th), Italy (36th), Croatia (42nd), Montenegro (45th), Serbia (46th), Macedonia, FYR (62nd), Greece (66th), Bosnia and Herzegovina (72nd), and Albania (90th). Portugal, however, is one of the few countries in the South to have strongly increased business and total R&D expenditures consistently throughout the crisis, a reflection of a previously agreed strong innovation policy.[1] For some countries, notably Greece, those relatively low rankings in the GII are coupled with major problems at the macroeconomic level.

The Baltic countries were very severely hit by the crisis in 2008–09 with severe drops in their GDPs of 18% in Latvia, 15% in Lithuania, and 14% in Estonia in 2009.[2] Nonetheless, they have all increased their rankings on all four indices (GII, Input, Output, and Efficiency), sometimes also because innovation expenditures (the nominator in many variables) fell less rapidly than the plunging GDP (the denominator)—leading to an overall positive but sometimes misleading effect in the rankings. Lithuania and Latvia, for instance, have actually seen their R&D expenditures fall in absolute terms during the crisis and have not recovered to 2007 levels to this day. [3] The situation in Estonia is different, as, on average, it has seen its business and total R&D expenditures levels increase significantly between 2007 and 2010.[4]

In Eastern Europe there are some bright developments in terms of GII rankings, such as the relatively good performance of the Republic of Moldova. The Czech Republic, Hungary, and Ukraine also do relatively well. Looking again at the level of absolute business and total R&D expenditures, some countries in the East are the bright spot of Europe. Countries such as Bulgaria, Hungary, and Slovenia have seen their business and total R&D expenditures increase consistently and strongly.

Notes

1. Calculations based on Eurostat, Business enterprise R&D expenditure (BERD) by economic activity (NACE Rev. 2) and Total intramural R&D expenditure (GERD) by sectors of performance.
2. IMF, 2012.
3. Calculations based on Eurostat, Business enterprise R&D expenditure (BERD) by economic activity (NACE Rev. 2) and Total intramural R&D expenditure (GERD) by sectors of performance.
4. Calculations based on Eurostat, Business enterprise R&D expenditure (BERD) by economic activity (NACE Rev. 2) and Total intramural R&D expenditure (GERD) by sectors of performance. See also OECD, 2012, forthcoming.

Republic of Korea and its innovation performance deserve separate analysis.

With the second-highest GDP per capita in the region after Singapore, **Brunei Darussalam** is ranked 8th regionally and 53rd globally (51st among GII 2011 countries), up from 75th in 2011. Brunei Darussalam gains 24 positions for the largest jump in the rankings, mostly the result of improvements across the board, although it also benefitted from the adjustments made to the GII framework (Annex 2). Moreover, it is one of only two countries (jointly with Latvia) to have improved its ranking on all seven pillars since 2011.[29] In spite of all these encouraging results, Brunei Darussalam continues to be placed among the underperformers, following other resource-rich countries in that same situation in the Middle East and Latin America.

Among **upper-middle-income countries**, Malaysia (32nd) and China (34th) do very well (descriptions above show them to be among the best performers by income group), while Thailand ranks 57th (55th among GII 2011 countries), down from 48th position in 2011. At the bottom of the rankings we find lower-middle and low-income countries: Mongolia (68th, discussed above), Viet Nam (76th), the Philippines (95th), Indonesia (100th), Fiji (101st), Cambodia (129th), and Lao People's Democratic Republic (138th).

Viet Nam is ranked 76th (74th among GII 2011 countries), down from 51th position in 2011. Viet Nam is the second-most-affected country by adjustments made to the GII framework in 2012, to which its drop of 23 positions in the rankings is fully attributed (had the GII 2011 not been modified, Viet Nam would have kept its place in the rankings). With a per capita income of only

PPP$ 3,354.8 Viet Nam has a very good showing, however, among the innovation learners, particularly in the Output Sub-Index (59th) compared to the Input Sub-Index (83rd), and ranking 27th on efficiency. In addition, the availability of data this year for the first time on tertiary inbound and outbound mobility revealed a weakness in the tertiary sector. The main drop occurs in pillar 7 Creative outputs (from 31st to 70th (66th among 2011 economies), essentially because of a fall in trademark registrations and a relatively weak performance on the new pillar 7.3, where its best showing is on country-code top-level domains (ranked 49th).

Europe (41 countries)

Switzerland (1st) and the five **Nordic countries** Sweden (2nd), Finland (4th), Denmark (7th), Norway (14th), and Iceland (18th) have very strong performances globally as well as regionally, where they are within the top 20 globally on the GII and its two sub-indices.

Within the European Union (EU), among the 15 original EU countries **(EU15)**,[30] six are in the top 10 (Sweden, Finland, the UK, the Netherlands, Denmark, and Ireland), followed by Luxembourg and Germany. The rest of the EU15 countries—Belgium, Austria, France, and the four Mediterranean countries Spain, Portugal, Italy, and Greece—have lost key positions to some of the 12 countries that recently acceded to the EU (the EU12 group).[31]

The **EU12 group** is led by high-income countries Malta (16th), followed by Estonia in the top 20, Slovenia, the Czech Republic, and Latvia in the top 30, and Hungary, Lithuania, Slovakia, Bulgaria, Poland, and Romania.

Among **non-EU transition economies** in Europe, Croatia leads the rankings in 42nd position globally (26th in Europe), followed by Montenegro, Serbia, the Republic of Moldova, the Russian Federation, the former Yugoslav Republic of Macedonia, Ukraine, Bosnia and Herzegovina, Belarus, and Albania. See Box 4 for a review of the different paces demonstrated by Western European countries.

Ranked 51st (49th among GII 2011 countries), up seven positions from 56 in 2011, the **Russian Federation** benefitted strongly from the adjustments to the GII model (Annex 2). With a population of 142.4 million (the most populous on the continent) and a GDP per capita of PPP$ 16,687.4, this upper-middle-income country comes second among BRIC countries (Box 3), showing a relative strength in the three pillars traditionally linked to innovation activities: Human capital and research (43rd), Business sophistication (43rd), and Knowledge and technology outputs (32nd), a feature that had already appeared in 2011 (when it ranked 38th, 37th, and 34th on those three pillars).

Key messages and conclusions

1. **A new dynamic of innovation is emerging around the world regardless of the deep and persistent innovation divides between countries and regions.** In 2012, the dynamics of innovation continue to be affected by the emergence of new successful innovators. In all areas of innovation—new products, processes, business models, and policies—different parts of the world have come up with their own particular 'innovation models', including at the more localized level in developing countries. This is exemplified by the range of countries from different continents ranking in the top 20 of the Global Innovation Index (GII); it is also evident in the impressive performances of emerging economies such as China, the Republic of Moldova, Jordan, India, Mongolia, and Viet Nam, (in order of performance). Despite these positive trends, large divides persist in innovation performances across the world. The GII confirms the intuitive expectation that average rankings increase with income levels. Large innovation divides also exist across geographic regions, especially when comparing average performances across high-income countries with those of other regions, such as Africa and large parts of Asia and Latin America. Among Sub-Sahara African countries, a few—such as Mauritius and South Africa—perform well. However, many other countries—such as Botswana, Gabon, Angola, and Sudan—are lagging behind economies from other regions that have similar GDP per capita levels. The GII results, however, also confirm that small improvements in one or two dimensions can have a positive impact on innovation and related rankings for low-ranked economies.
2. **Three groups of countries can be identified by their innovation performance in relation to their income levels.** Among the **innovation leaders** we find high-income countries such as Switzerland, Singapore, the Nordic countries, New Zealand, Malta, Israel, and Estonia. These economies have succeeded in creating innovation ecosystems where investments

in human capital thrive in fertile and stable innovation infrastructures to create impressive levels of innovation outputs. The group of **innovation learners** includes Latvia, Malaysia, China, Montenegro, Serbia, the Republic of Moldova, Jordan, Ukraine, India, Mongolia, Armenia, Georgia, Viet Nam, Swaziland, Ghana, and Kenya. These middle-income economies demonstrate rising levels of innovation achievement as a result of improvements in institutional frameworks, a skilled labour force with an expanded tertiary education, better innovation infrastructures, a deeper integration with global credit investment and trade markets, and a sophisticated business community—even if progress in these dimensions is not uniform across all segments of the country. **Countries with weaknesses in their innovation system** include a mix of high-income economies such as Qatar, the United Arab Emirates (UAE), Brunei Darussalam, Kuwait, and Greece as well as middle-income countries including Botswana, the Islamic Republic of Iran, Gabon, Venezuela, Algeria, the Syrian Arab Republic, Angola, and Sudan.

3. **Pay attention to *hysteresis* effects in innovation — investing in innovation in times of crisis is essential.** The crisis has slowed the introduction of new products or processes as a consequence of increased business uncertainty. Expenditures on total R&D in OECD countries shrunk by 1.6% in real terms in 2009 and for the first time since 1993. The decrease is mainly driven by a sharp reduction of expenditure in business (–4.5%). Large multinational firms have recently accumulated large cash stocks that are not reinvested. In other sectors, particularly higher education, R&D spending kept growing by almost 5%, also supported by government pledges to support R&D in their stimulus plans.[32] There is a risk, however, that as of 2011 R&D-related government stimuli will cease to exist. Importantly, R&D and innovation cannot be stopped and then simply picked up again when the economy recovers, and hysteresis effects in innovation lead to innovation being less dynamic even when the economy has recovered. On a positive note, in the following countries business R&D spending has increased throughout the crisis: Turkey, Slovakia, the Republic of Korea, Poland, Ireland, Hungary, and Portugal.[33] In other countries—such as the USA, Germany, France, and the Russian Federation—firms held their R&D investments steady.

4. **A focus on the systemic dimension of innovation and building strong linkages across the innovation ecosystem is crucial.** More attention needs to be put on the interplay of institutions and the interactive processes in the creation, application, and diffusion of knowledge, human capital, and technology. Policy makers should pay attention to the transfer of scientific results and inventions and their application to societal challenges in high- and lower-income countries alike. Innovation leaders (such as the Scandinavian countries) have improved their linkages across the various innovation actors, most notably with universities, public research, the government, the private sector, and increasingly also the not-for-profit sector such as philanthropies. The importance of addressing the systemic nature of innovation is evident in the case of the group of resource-rich economies (as in the Gulf Cooperation Council, or GCC), which—despite having made significant investments in human capital over the last several years—have yet to reap the innovation benefits from their actions. The GII also highlights the fact that other resource-rich countries have not started to reinvest into sound innovation infrastructure and human capital at par with their level of GDP.

5. **Policy discussions in Europe have to include a focus on innovation, not just austerity, to bridge gaps in a two-speed continent.** A two-speed Europe is emerging, with innovation leaders in northern Europe (Sweden, Finland, the United Kingdom, the Netherlands, Denmark) and countries that perform less well in innovation in southern Europe. European policy discussions need to place renewed emphasis on achieving an appropriate policy mix that fosters growth and employment while promoting sustainable public finances. Even if innovation cannot cure the most immediate financial difficulties, it is a crucial element of sustainable growth. Looking at the level of absolute business and total R&D expenditures, some countries in the East are the bright spot of Europe. Countries such as Bulgaria, Hungary, and Slovenia have seen their business and total R&D expenditures increase consistently and strongly throughout the crisis.

6. **Northern America continues to be an innovation leader but needs to address what could become chronic weaknesses.** The central role of the USA for global innovation hardly needs underlining: its universities, its research institutions, its innovation clusters, and its firms are world class and continue to be a magnet and a model for other countries. Still, the innovation rankings of the USA and also Canada point to the potential development of weaknesses. A thorough analysis of USA performance on a series of 23 key indicators, when compared with the performance of the two top leaders in the overall GII rankings (Switzerland and Sweden), shows that the USA is, in the majority of cases, either performing less well or seeing its competitive advantage decrease in the following areas: current expenditure on education as a percentage of gross national income, percentage of graduates in science and engineering, researchers headcount per million people, gross expenditure on R&D as a percentage of GDP, percentage of R&D performed by business, resident patent application at the national office (over GDP in PPP$), and scientific and technical publications (over GDP in PPP$). Although the USA continues to demonstrate great strengths in many innovation outputs, and although the country is still the leader of innovation in many respects—in particular, in creating world-class technology start-ups and hosting innovative multinationals with excellent linkages to the research system—policy leaders would be well advised to pay special heed to pressure points relating to human resources and openness to global talent. Canada—having seen its rank on all indices of the GII fall—is the only country this year to leave the top 10 in the GII. Canada's GII country profile mirrors the current debate in that country, where observers deplore the low levels of support for R&D in many areas of the Canadian private sector, the faltering scientific skills of the labour force, and a generally weakening position on innovation as demonstrated by its 22nd rank on the Knowledge and technology outputs pillar.

7. **BRICs need to renew their innovation drivers to live up to their expected potential.** The BRIC countries (Brazil, the Russian Federation, India, and China) have been seen as drivers of the global economic engine since 2008 and the slowdown in high-income economies. But these countries too are slowing down, and despite their unrealized potential, they need to continue to invest in building their innovation infrastructures. China and India come in at 1st and 2nd place, respectively, in the Innovation Efficiency Index rankings, demonstrating a great ability to translate pockets of excellence in their innovation infrastructures into valuable innovation outputs. China's performance on the key Knowledge and technology outputs pillar is impressive—the country is outpaced only by Switzerland, Sweden, Singapore, and Finland. However, both of these countries have weaknesses in their innovation infrastructures—for example, ICT is poor in China and Human capital and research needs improvement in India—that must be addressed if these countries wish to resume higher levels of growth and innovation. Brazil has suffered the largest drop among the BRICs. This drop demonstrates the importance of addressing structural weaknesses in innovation ecosystems in the face of a global slowdown in growth. The country profiles reveal important differences across the four BRIC countries, but they all have in common governance and institutional challenges that need to be addressed if they wish to live up to their expected innovation potentials.

8. **Measuring innovation is a moving target.** Based on discussions with innovation experts and inputs from the Advisory Board and Knowledge Partners, the GII model is revised every year in a transparent exercise to improve the way innovation is measured. This year, for example, the Infrastructure pillar was reorganized to single out ecological sustainability in a new sub-pillar. In addition, a new sub-pillar on online creativity was added to the Creative outputs pillar. Such evolution will continue over the years as new metrics that provide better and more accurate measures of innovation, capabilities, and impact become available. The GII is not meant to be the definitive ranking of economies with respect to innovation. The GII is more concerned with improving the 'journey' to better measuring and understanding innovation; and with identifying targeted policies, good practices, and other levers to foster innovation.

The GII model does not capture all dimensions of innovation across continents. In GII 2011, we stated:

More formal analysis, beyond the scope of this Report, is required to explore in depth the linkages and dynamics between development stages and innovation phenomena in depth. . . . Innovation is a multi-stakeholder effort, with many different roles for the different actors. Governments have a role in setting the right environment and policies. Firms have to improve their innovation readiness and innovation results—they must protect and leverage their intellectual property, increase their investment in R&D, and make better use—through international trade, linkages, and the adoption of ICT—of innovations developed elsewhere. Societies and individual citizens also have to look at different aspects that help them create a broader capacity for innovation. All of these stakeholders must collaborate in order to foster and sustain innovation.

The following analytical chapters included in this year's report illustrate the richness of innovation, which is difficult to define, much less to encapsulate in a particular metric.

Notes

1 IMF, 2012; OECD, 2012.

2 See on this topic and first assessment about the effect of the crisis: OECD, 2009, 2010; WIPO, 2010, 2011a; Archibugi and Filippetti, 2011; and Filippetti and Archibugi, 2011. See also the upcoming OECD *Science, Technology and Industry Outlook 2012* (OECD, 2012 forthcoming).

3 OECD, 2012 forthcoming.

4 OECD Main Science and Technology Indicators.

5 EC, 2011.

6 OECD, 2009.

7 WIPO, 2011b.

8 See Chapter 9, contributed by ITU and INSEAD; Chapter 10, contributed by ISOC; and Chapter 11, contributed by Google.

9 Athreye and Yang, 2011; WIPO, 2011b.

10 Freeman and Soete, 2007.

11 See Chapter 4 of the GII 2012.

12 Ray and Ray, 2010; WIPO, 2011b.

13 For a fuller introduction to the Global Innovation Index, see INSEAD, 2011. Examples of other composite innovation indices were reviewed in the GII 2011. More recently, the Global Innovation Policy Index of the Information Technology and Innovation Foundation (2012), which is quite complementary to the GII, has been formulated.

14 Eurostat and OECD, 2005.

15 OECD, 2010; INSEAD, 2011; WIPO, 2011b.

16 GII 2011; OECD Scoreboard, 2011; WIPO, 2011b.

17 INSEAD 2011; OECD Scoreboard, 2011; WIPO, 2011b.

18 This was 4.1% from 2008. Only 5.23% of data points date from earlier years in the period 2001–07. In addition, the GII is calculated on the basis of 10,274 data points (compared with 11,844 in case of complete series), implying that 13.3% of data points are missing. Data Tables (Appendix II) include the reference year for each data point; in addition, missing data are marked as not available (n/a). Appendix II provides tables for each of the 84 indicators that make up the Global Innovation Index 2012. The Data Tables are included in the digital copy only and are available online at http://globalinnovationindex.org.

19 This pillar was entitled 'Scientific outputs' in the 2011 GII.

20 Beyond the use of WIPO data, we collaborate both with public international bodies (such as the International Labour Organization, the OECD, UNESCO, and the World Bank) and private organizations (such as the ISO, the Graduate Management Admission Council, Thomson Reuters, ZookNIC, and Google) to obtain the best data on innovation measurement globally.

21 Countries are classified according to the World Bank classification. Economies are divided according to 2010 gross national income (GNI) per capita, calculated using the World Bank Atlas method. The groups are: low-income, US$1,005 or less; lower-middle-income, US$1,006 to US$3,975; upper-middle-income, US$3,976 to US$12,275; and high-income, US$12,276 or more.

22 This year the regional groups 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 and Oceania; NAWA = Northern Africa and Western Asia; and SSF = Sub-Saharan Africa.

23 Caution should be exercised in directly comparing ranks across years with previous editions of the GII report because the model has evolved, as have the variables that are included and particular countries covered (Annex 2).

24 The series was winsorized because of economies with high values distorting the distribution, explaining the tie in ranking with Hong Kong (China), Singapore, and Luxembourg, which achieve higher percentages of exports of goods of services over GDP than Ireland.

25 IMF, 2012.

26 IMF, 2012.

27 IMF, 2012.

28 In fact, the JRC Audit, which assesses the reliability of rankings, by, among others, imputing missing data, revealed that there is not much room for complacency with Qatar's ranking, as it is in the upper range of the 90% confidence interval [32, 42] because of missing data.

29 As it should be, 2012 rankings were recalculated among the 125 countries included in GII 2011 only. In that case, the rankings in the seven pillars of Brunei Darussalam are, respectively, 26 and 48 (pillar 1), 60 and 77 (pillar 2), 50 and 115 (pillar 3), 46 and 46 (pillar 4), 79 and 96 (pillar 5), 77 and 88 (pillar 6), and 49 and 87 (pillar 7).

30 The EU15 group includes Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal, Spain, Sweden, and the United Kingdom. The EU15 includes three Nordic countries: Denmark, Finland, and Sweden.

31 The EU12 group includes Bulgaria, the Czech Republic, Cyprus, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Romania, Slovakia, and Slovenia.

32 OECD Main Science and Technology Indicators database, February 2012.

33 OECD Main Science and Technology Indicators database, February 2012.

References

Archibugi, D., and A. Filippetti. 2011. 'Is the Economic Crisis Impairing Convergence in Innovation Performance across Europe?' *Journal of Common Market Studies* 49 (6): 1153–82.

Athreye S., and Y. Yang. 2011. 'Disembodied Knowledge Flows in the World Economy'. *WIPO Economics Research Working Papers* No. 4. Geneva: World Intellectual Property Organization.

EC (European Commission). 2011. *The 2011 EU Industrial R&D Scoreboard.* Brussels: European Commission.

Eurostat and OECD. 2005. *Oslo Manual: Guidelines for Collecting and Interpreting Innovation Data.* 3rd edition. Paris: OECD.

Filippetti, A., and D. Archibugi. 2011. 'Innovation in Times of Crisis: National Systems of Innovation, Structure, and Demand'. *Research Policy* 40 (2): 179–92.

Freeman, C., and L. Soete. 2007. 'Science, Technology and Innovation Indicators: The Twenty-First Century Challenges'. In *Science, Technology and Innovation Indicators in a Changing World: Responding to Policy Needs,* Chapter 15. Paris: OECD.

IMF (International Monetary Fund). 2012. *World Economic Outlook (WEO): Growth Resuming, Dangers Remain.* April 2012. Washington, DC: IMF.

INSEAD. 2011. *The Global Innovation Index 2011: Accelerating Growth and Development.* Fountainebleau: INSEAD.

OECD (Organisation for Economic Co-operation and Development). 2009. *Policy Responses to the Economic Crisis: Investing in Innovation for Long-Term Growth.* Paris: OECD. Available at http://www.oecd.org/dataoecd/59/45/42983414.pdf.

———. 2010. *The OECD Innovation Strategy: Getting a Head Start on Tomorrow.* Paris: OECD.

———. 2011. *OECD Science, Technology and Industry Scoreboard 2011.* Paris: OECD.

———. 2012. *OECD Economic Outlook,* No. 91, May 2012. Paris: OECD.

———. 2012, forthcoming. *Science, Technology and Industry Outlook.* Paris: OECD.

Ray, P. K., and S. Ray. 2010. 'Resource Constrained Innovation for Emerging Economies: The Case of the Indian Telecommunications Industry'. *IEEE Transactions on Engineering Management* 57 (1): 144–56.

WIPO (World Intellectual Property Organization). 2010. *World Intellectual Property Indicators 2011.* Economics and Statistics Division, December 2011. Geneva: WIPO.

———. 2011a. Survey on Patenting Strategies in 2009 and 2010 to Better Understand How Users of the PCT System Responded to the Economic Crisis. Economics and Statistics Division, January 2011, Geneva: WIPO.

———. 2011b. '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.wio.int/econ_stat/en/economics/publications.html.