The Global Innovation Index 2017

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Beyond Patents:
Assessing the value and Impact of Research Investment
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The Global Innovation Index 2017

1. Introduction and Rationale
2. Architecture and Metrics
3. Rankings and other Parameters
4. Conclusions and Future Perspectives

1.1 Introduction

- Measures innovation across 127 economies
- Leading reference on innovation
- A 'tool for action' for decision makers with the goal of improving countries' innovation performances
- Focuses on a particular theme where innovation is key

- Recognizes innovation as key driver of economic growth
- Offers a holistic analysis of innovation, applicable to both developed and emerging economies alike
- Helps monitor innovation progress on a yearly basis

1.2 Rationale

- Measuring innovation is complex and a moving target

No simple formula

1. Difficulty of right data selection
2. Difficulty of right scaling
3. Difficulty of right aggregation
4. Keeping model constant versus dynamic

Possible criticism: Nature of selection of variables & aggregation

When?

Launched in 2007

Why?

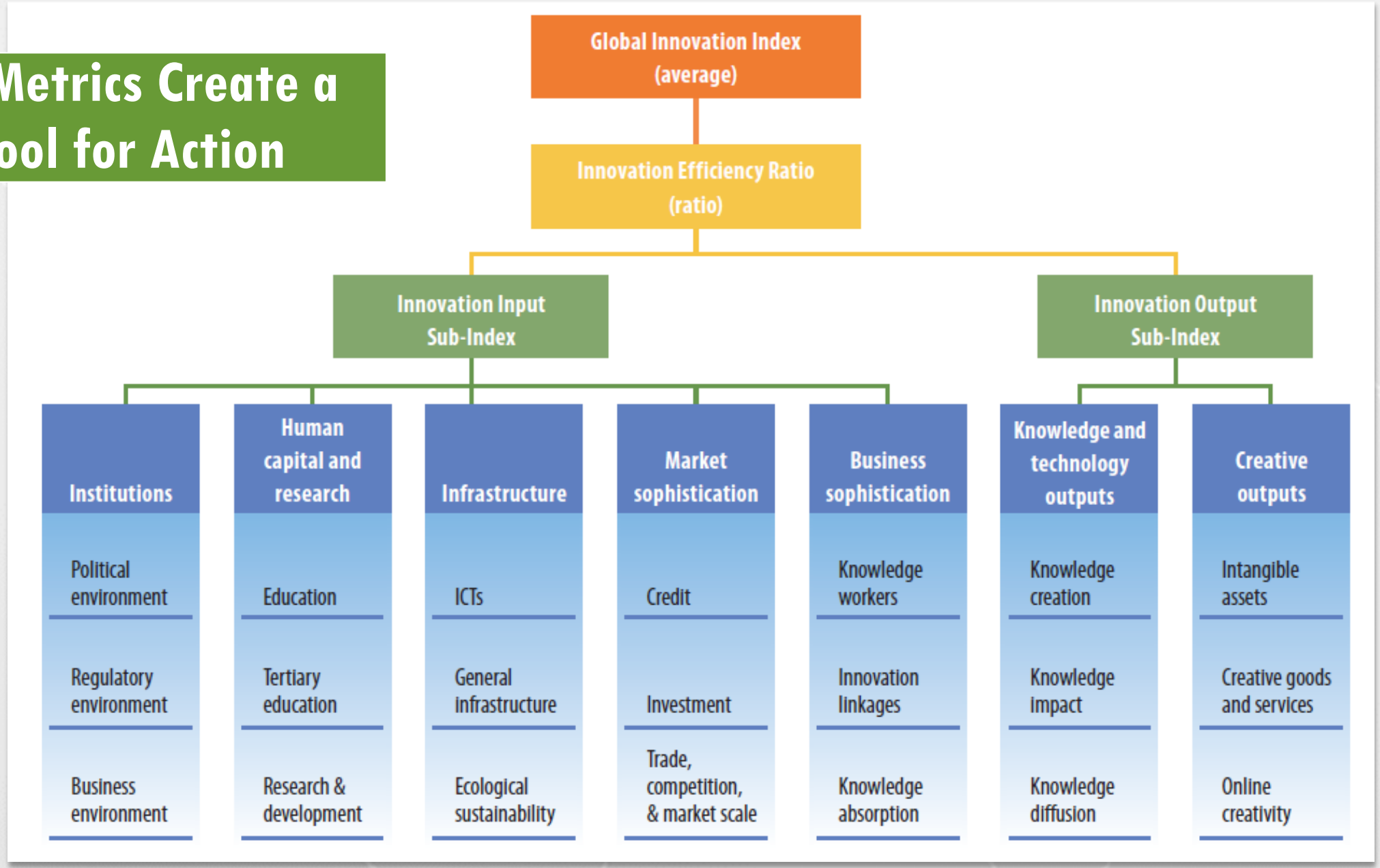
To find metrics and approaches that closely mirror innovation environments in society and go beyond traditional measures

How?

Using a collection of metrics to monitor performance over time and to benchmark developments against countries, region and income peers

2.1 Architecture

81 Metrics Create a Tool for Action



2.2 Metrics

The model includes 81 indicators, which fall within the following three categories:

1. Quantitative/objective/**hard data**
   —57 indicators
2. Composite indicators/**index data**
   —19 indicators
3. Survey/qualitative/subjective/**soft data**
   —5 indicators

Patent-related

- Patents filed in 2+ offices
- Patents by origin
- PCT patent applications

All scaled by bn PPP$ GDP

Statistical strategies to ensure robustness of results

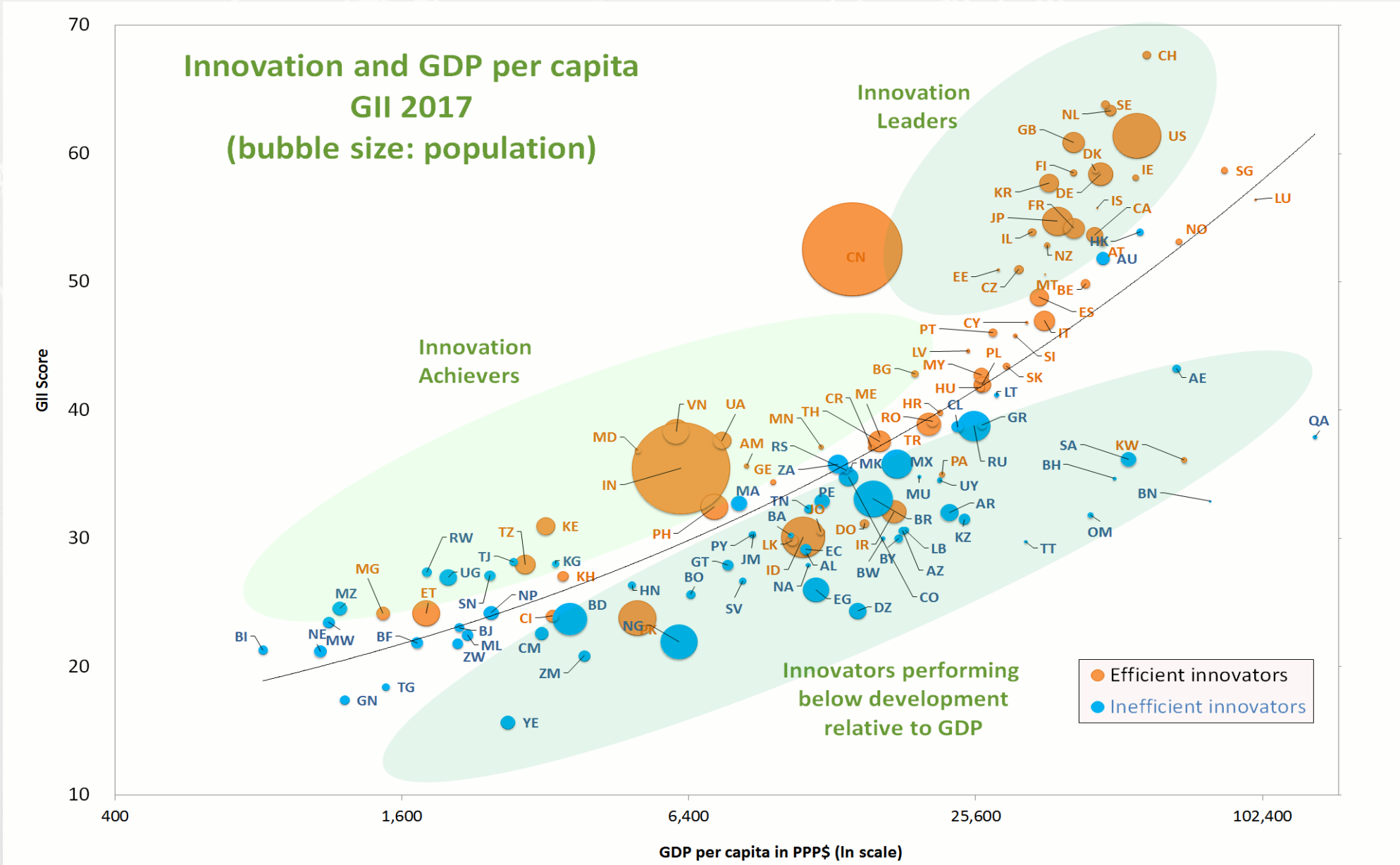
- The statistical soundness of the GII and of modelling assumptions on scores and ranks is tested every year.
- Problematic indicators = identified and treated.
- The redundancy of indicators is assessed.
- Sensitivity and uncertainty analysis conducted
- Recognition that **measuring innovation is a journey**. The GII team continually tests the model for relevance to better reflect an improved understanding of innovation

3 Rankings and other Parameters

Global rankings of GII 2017 (top 10)

Input Sub-Index	Output Sub-Index	GII
1. Singapore	1. Switzerland	1. Switzerland
2. Sweden	2. Netherlands	2. Sweden
3. Switzerland	3. Sweden	3. Netherlands
4. Finland	4. Luxembourg	4. USA
5. USA	5. USA	5. United Kingdom
6. Denmark	6. United Kingdom	6. Denmark
7. United Kingdom	7. Germany	7. Singapore
8. Hong Kong (China)	8. Ireland	8. Finland
9. Netherlands	9. Korea, Rep.	9. Germany
10. Canada	10. Iceland	10. Ireland

Efficient and Inefficient Innovators



Strength

- Scores with percent ranks greater than the 10th largest percent rank among the 81 indicators in that economy.

Weakness

- Scores with percent ranks lower than the 10th smallest percent rank among the 81 indicators in that economy.

Innovation Achievers

- Countries which GII scores are higher than expected, based on their level of economic development as measured by GDP per capita.

Pillar Outperformers

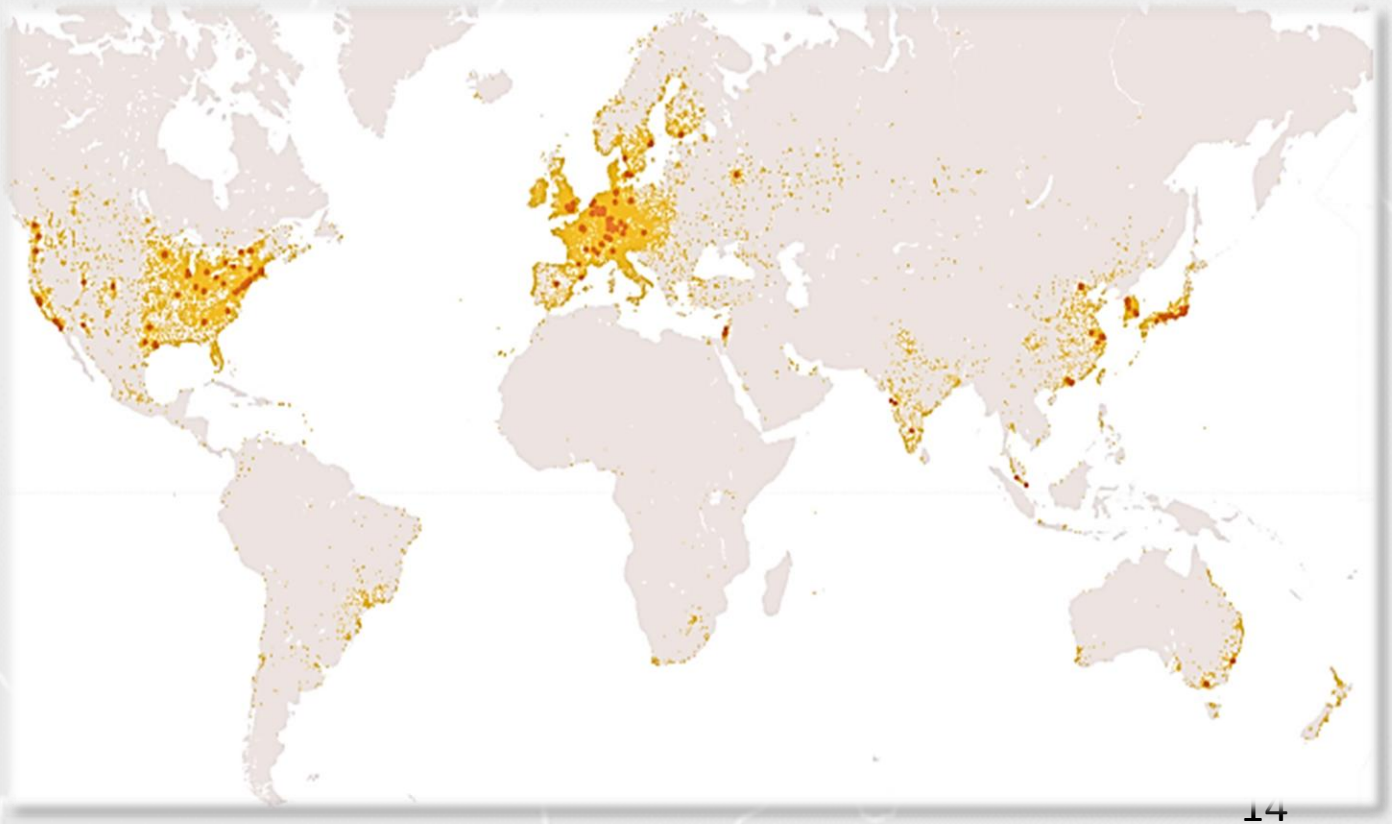
- Countries that outperform their income group peers in four or more GII pillars.

4.1 Conclusions

- Innovation activities confronted with **low investment** and resource constraints
- Evolving innovation landscape: **emerging economies play** increasingly a role in innovation
- Good **quality of innovation** remains a distinct characteristic of innovation leaders
- The **innovation divide** remains
- **Sub-Saharan Africa** region sees the most significant improvements in the GII rankings, but still needs support
- **Key role of governments**, and of public and coordinated private investments in creating sound innovation systems

Importance of clusters of inventive activity and innovation hubs at sub-national level

- Geocoded patent data enables the identification of clusters
- Largest clusters of inventive activity:
  1. Tokyo-Yokohama
  2. Shenzhen-Hong Kong (China)
  3. San Jose– San Francisco, CA
- Measurement remains challenging



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Annexes

Annex I: Main quantitative results of GII 2017

Country Profile

United States of America

Key indicators

Population (millions)	324.1
GDP (US $ billion)	18,561.9
GDP per capita, PPP$	55,805.2
Income group	High income
Region	Northern America

		Score 0–100 or value (hard data)	Rank	
Global Innovation Index (out of 127)		**61.4**	**4**	
Innovation Output Sub-Index		53.9	5	
Innovation Input Sub-Index		68.9	5	
Innovation Efficiency Ratio		0.8	21	
Global Innovation Index 2016 (out of 128)		61.4	4	
1	**Institutions**	**86.2**	**17**	
1.1	Political environment	80.3	21	
1.1.1	Political stability & safety*	80.8	31	
1.1.2	Government effectiveness*	79.7	20	
1.2	Regulatory environment	90.4	13	
1.2.1	Regulatory quality*	75.3	19	
1.2.2	Rule of law*	86.3	18	
1.2.3	Cost of redundancy dismissal, salary weeks	8.0	1	●
1.3	Business environment	88.1	10	
1.3.1	Ease of starting a business*	91.2	44	
1.3.2	Ease of resolving insolvency*	89.2	5	
1.3.3	Ease of paying taxes*	83.9	32	
2	**Human capital & research**	**57.2**	**13**	
2.1	Education	54.7	41	
2.1.1	Expenditure on education, % GDP	4.9	54	
2.1.2	Gov't expenditure/pupil, secondary, % GDP/cap	22.7	41	
2.1.3	School life expectancy, years	16.5	20	
2.1.4	PISA scales in reading, maths, & science	487.6	29	
2.1.5	Pupil-teacher ratio, secondary[d]	14.8	63	○
2.2	Tertiary education	38.1	54	
2.2.1	Tertiary enrolment, % gross	85.8	9	
2.2.2	Graduates in science & engineering, %	14.9	85	○
2.2.3	Tertiary inbound mobility, %	4.6	40	
2.3	Research & development (R&D)	78.8	4	
2.3.1	Researchers, FTE/mn pop[d]	4,232.0	20	
2.3.2	Gross expenditure on R&D, % GDP	2.8	10	
2.3.3	Global R&D companies, avg. expend. top 3, mn $US	100.0	1	●
2.3.4	QS university ranking, average score top 3*	99.0	1	●
3	**Infrastructure**	**61.0**	**21**	
3.1	Information & communication technologies (ICTs)	85.2	11	
3.1.1	ICT access*	82.7	19	
3.1.2	ICT use*	75.7	17	
3.1.3	Government's online service*	92.8	9	
3.1.4	E-participation*	89.8	12	
3.2	General infrastructure	52.8	16	
3.2.1	Electricity output, kWh/cap	13,342.4	8	
3.2.2	Logistics performance*	89.2	10	
3.2.3	Gross capital formation, % GDP	19.8	82	○
3.3	Ecological sustainability	45.0	61	
3.3.1	GDP/unit of energy use	7.6	76	○
3.3.2	Environmental performance*	84.7	26	
3.3.3	ISO 14001 environmental certificates/bn PPP$ GDP	0.3	91	○
4	**Market sophistication**	**83.4**	**1**	●
4.1	Credit	85.5	1	●
4.1.1	Ease of getting credit*	95.0	2	●
4.1.2	Domestic credit to private sector, % GDP	188.8	3	●
4.1.3	Microfinance gross loans, % GDP	n/a	n/a	
4.2	Investment	72.2	3	●
4.2.1	Ease of protecting minority investors*	64.7	40	
4.2.2	Market capitalization, % GDP	139.0	5	
4.2.3	Venture capital deals/bn PPP$ GDP	0.4	1	●
4.3	Trade, competition, & market scale	92.7	1	●
4.3.1	Applied tariff rate, weighted mean, %	1.6	50	
4.3.2	Intensity of local competition†	83.0	5	
4.3.3	Domestic market scale, bn PPP$	18,561.9	2	●
5	**Business sophistication**	**56.4**	**8**	
5.1	Knowledge workers	67.4	11	
5.1.1	Knowledge-intensive employment, %[d]	38.0	28	
5.1.2	Firms offering formal training, % firms	n/a	n/a	
5.1.3	GERD performed by business, % of GDP	2.0	7	
5.1.4	GERD financed by business, %	64.2	8	
5.1.5	Females employed w/advanced degrees, % total	n/a	n/a	
5.2	Innovation linkages	46.6	15	
5.2.1	University/industry research collaboration†	76.2	4	
5.2.2	State of cluster development†	76.0	1	●
5.2.3	GERD financed by abroad, %	4.7	66	○
5.2.4	JV–strategic alliance deals/bn PPP$ GDP	0.1	17	
5.2.5	Patent families 2+ offices/bn PPP$ GDP	5.0	13	
5.3	Knowledge absorption	55.2	6	
5.3.1	Intellectual property payments, % total trade	1.6	19	
5.3.2	High-tech imports less re-imports, % total trade	17.7	11	
5.3.3	ICT services imports, % total trade	1.3	52	
5.3.4	FDI net inflows, % GDP	1.7	90	○
5.3.5	Research talent, % in business enterprise[d]	71.0	4	
6	**Knowledge & technology outputs**	**54.4**	**7**	
6.1	Knowledge creation	63.4	7	
6.1.1	Patents by origin/bn PPP$ GDP	16.0	6	
6.1.2	PCT patent applications/bn PPP$ GDP	3.0	14	
6.1.3	Utility models by origin/bn PPP$ GDP	n/a	n/a	
6.1.4	Scientific & technical articles/bn PPP$ GDP	19.8	38	
6.1.5	Citable documents H index	100.0	1	●
6.2	Knowledge impact	52.5	7	
6.2.1	Growth rate of PPP$ GDP/worker, %	0.7	67	○
6.2.2	New businesses/th pop. 15–64	n/a	n/a	
6.2.3	Computer software spending, % GDP	1.1	1	●
6.2.4	ISO 9001 quality certificates/bn PPP$ GDP	1.8	94	○
6.2.5	High- & medium-high-tech manufactures, %[d]	0.4	13	
6.3	Knowledge diffusion	47.3	12	
6.3.1	Intellectual property receipts, % total trade	5.1	1	●
6.3.2	High-tech exports less re-exports, % total trade	7.1	26	
6.3.3	ICT services exports, % total trade	1.5	68	
6.3.4	FDI net outflows, % GDP	2.1	29	
7	**Creative outputs**	**53.5**	**10**	
7.1	Intangible assets	50.1	38	
7.1.1	Trademarks by origin/bn PPP$ GDP	21.5	81	○
7.1.2	Industrial designs by origin/bn PPP$ GDP	1.3	54	
7.1.3	ICTs & business model creation†	79.2	12	
7.1.4	ICTs & organizational model creation†	82.3	1	●
7.2	Creative goods & services	48.2	5	
7.2.1	Cultural & creative services exports, % of total trade[d]	2.0	1	●
7.2.2	National feature films/mn pop. 15–69	3.5	53	
7.2.3	Global ent. & media market/th pop. 15–69	97.1	3	●
7.2.4	Printing & publishing manufactures, %[d]	1.9	24	
7.2.5	Creative goods exports, % total trade	1.7	31	
7.3	Online creativity	65.4	7	
7.3.1	Generic top-level domains (TLDs)/th pop. 15–69	100.0	1	●
7.3.2	Country-code TLDs/th pop. 15–69	2.9	58	
7.3.3	Wikipedia edits/mn pop. 15–69	6.1	41	
7.3.4	Video uploads on YouTube/pop. 15–69	100.0	1	●

NOTES: ● Indicates a strength; ○ a weakness; * an index; † a survey question.
[d] Indicates that the country's data are older than the base year; see Appendix II for details, including the year of the data, at http://globalinnovationindex.org.
Square brackets indicate that the data minimum coverage (DMC) requirements were not met at the sub-pillar or pillar level; see page 181 of this appendix for details.

Data Table

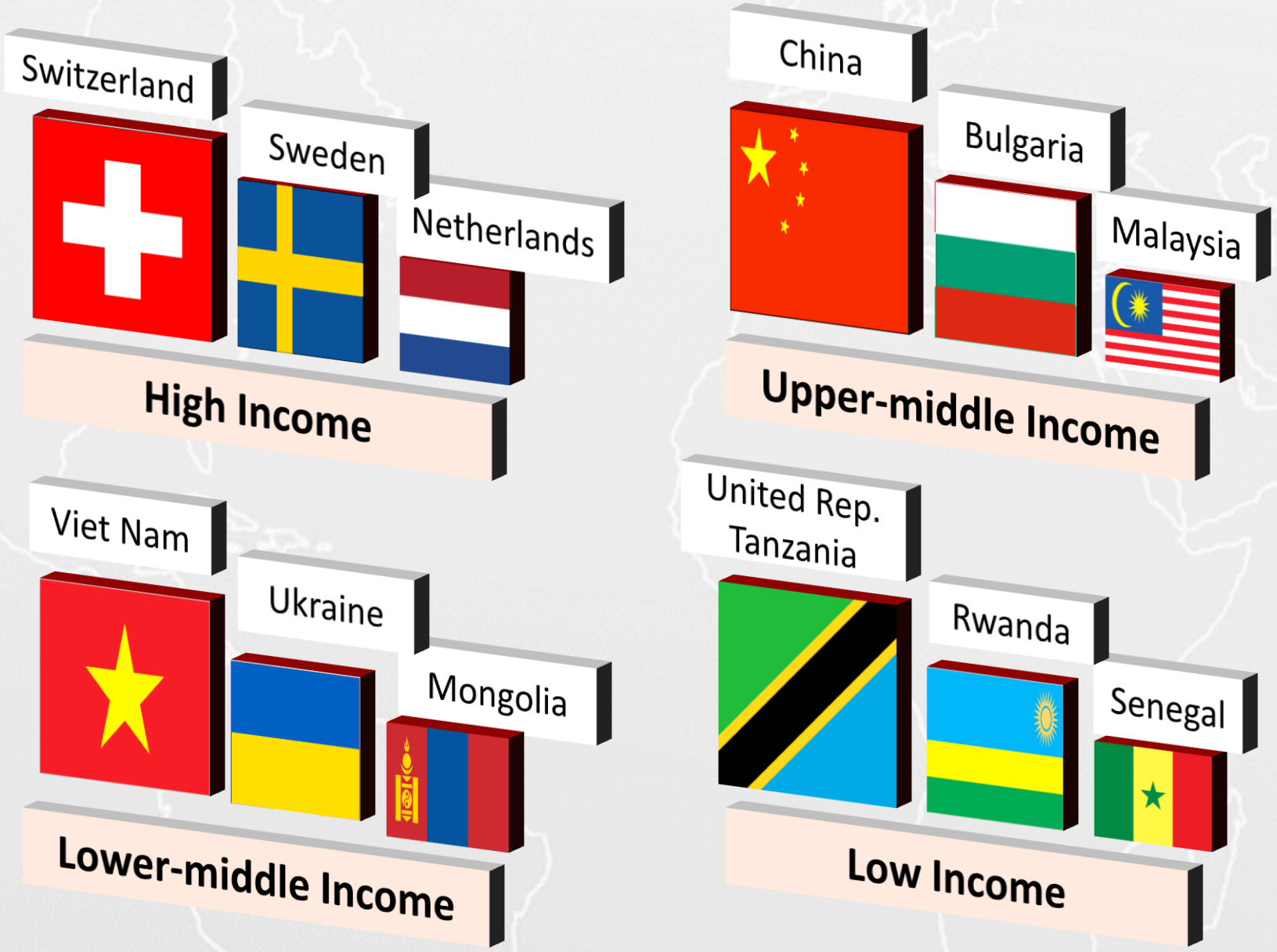
2.3.2 Gross expenditure on R&D (GERD)

GERD: Gross expenditure on R&D (% of GDP) | 2015

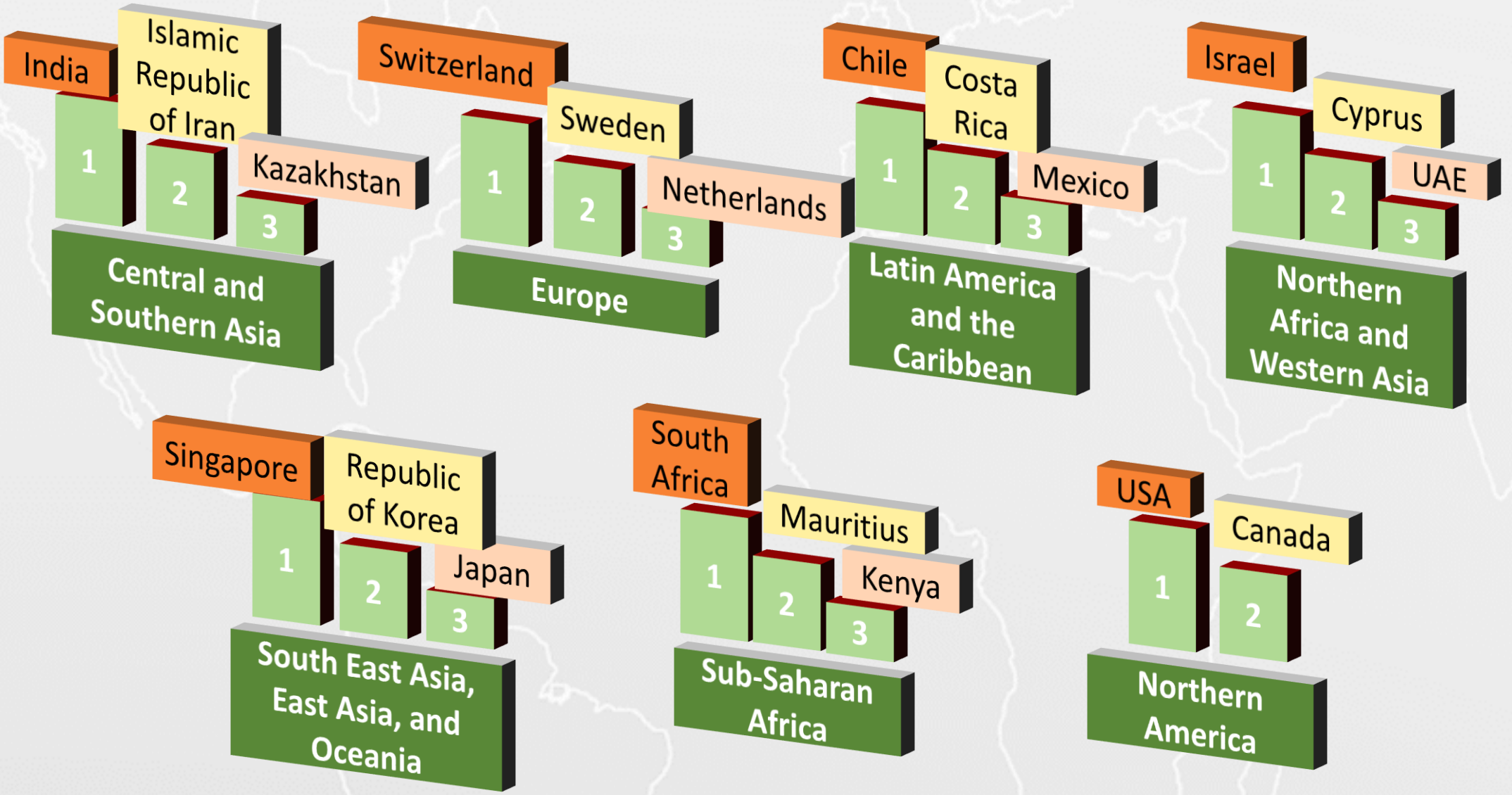
Rank	Country/Economy	Value	Score (0–100)	Percent rank		Rank	Country/Economy	Value	Score (0–100)	Percent rank	
1	Israel	4.30	100.00	1.00	●	65	Uganda (2010)	0.48	10.75	0.41	
2	Korea, Rep.	4.23	98.40	0.99	●	66	Qatar (2012)	0.47	10.61	0.40	
3	Japan	3.49	81.17	0.98	●	67	Cyprus	0.46	10.42	0.39	
4	Sweden	3.28	76.24	0.97	●	68	Ecuador (2014)	0.45	10.06	0.39	
5	Austria	3.10	71.91	0.96	●	69	TFYR of Macedonia	0.44	9.99	0.38	
6	Denmark	3.02	70.12	0.95		70	Jordan (2008)	0.43	9.79	0.37	
7	Switzerland (2012)	2.97	68.87	0.94		71	Chile	0.39	8.67	0.36	
8	Finland	2.93	68.01	0.94		72	Montenegro	0.38	8.51	0.35	
9	Germany	2.88	66.89	0.93		73	Viet Nam (2013)	0.37	8.37	0.34	
10	United States of America	2.80	65.04	0.92		74	Moldova, Rep.	0.37	8.29	0.33	
11	Belgium	2.46	57.06	0.91	●	75	Mozambique	0.34	7.58	0.32	
12	France	2.23	51.63	0.90		76	Namibia (2014)	0.34	7.55	0.31	
13	Iceland	2.22	51.34	0.89		77	Uruguay (2014)	0.34	7.48	0.30	
14	Slovenia	2.21	51.30	0.88		78	Iran, Islamic Rep. (2012)	0.33	7.23	0.29	
15	Singapore (2014)	2.20	50.91	0.87		79	Nepal (2010)	0.30	6.70	0.28	
16	Australia (2013)	2.20	50.89	0.86		80	Kuwait (2013)	0.30	6.69	0.28	
17	China	2.09	48.51	0.85		81	Zambia (2008)	0.28	6.14	0.27	
18	Netherlands	2.01	46.52	0.84		82	Togo (2014)	0.27	5.99	0.26	
19	Czech Republic	1.98	45.91	0.83		83	Armenia	0.25	5.48	0.25	
20	Norway	1.93	44.59	0.83		84	Pakistan	0.25	5.40	0.24	
21	United Kingdom	1.71	39.50	0.82		85	Oman	0.24	5.37	0.23	
22	Canada (2014)	1.61	37.29	0.81		86	Colombia	0.24	5.29	0.22	○
23	Ireland (2014)	1.55	35.71	0.80		87	Azerbaijan	0.22	4.84	0.21	
24	Estonia	1.48	34.18	0.79		88	Bosnia and Hezegovina	0.22	4.82	0.20	
25	Hungary	1.39	32.07	0.78		89	Nigeria (2007)	0.22	4.76	0.19	
26	Italy	1.34	30.87	0.77		90	Burkina Faso (2009)	0.20	4.32	0.18	
27	Luxembourg	1.29	29.70	0.76		91	Mauritius (2012)	0.18	3.88	0.17	○
28	Portugal	1.28	29.43	0.75		92	Kazakhstan (2013)	0.17	3.53	0.17	
29	Malaysia (2014)	1.26	29.11	0.74		93	Bolivia, Plurinational St. (2009)	0.16	3.31	0.16	
30	Spain	1.22	28.08	0.73		94	Mongolia	0.15	3.26	0.15	
31	Slovakia	1.19	27.36	0.72		95	Albania (2008)	0.15	3.25	0.14	
32	Brazil (2014)	1.17	26.91	0.72	●	96	Philippines (2013)	0.14	2.87	0.13	
33	New Zealand (2013)	1.15	26.59	0.71		97	Peru	0.13	2.75	0.12	○
34	Russian Federation	1.13	26.06	0.70		98	Paraguay	0.13	2.61	0.11	
35	Lithuania	1.04	23.98	0.69		99	Burundi (2011)	0.12	2.48	0.10	
36	Poland	1.01	23.20	0.68		100	Kyrgyzstan	0.12	2.47	0.09	
37	Turkey (2014)	1.01	23.14	0.67		101	Tajikistan (2013)	0.12	2.40	0.08	
38	Bulgaria	0.98	22.54	0.66		102	Sri Lanka (2013)	0.10	2.00	0.07	○
39	Greece	0.96	21.97	0.65		103	Bahrain (2014)	0.10	1.98	0.06	○
40	Serbia	0.88	20.20	0.64		104	Georgia (2014)	0.10	1.95	0.06	○
41	United Arab Emirates	0.87	19.85	0.63		105	Indonesia (2013)	0.08	1.63	0.05	○
42	Croatia	0.85	19.57	0.62		106	El Salvador (2014)	0.08	1.62	0.04	○
43	India (2011)	0.83	19.05	0.61		107	Trinidad and Tobago (2014)	0.08	1.47	0.03	○
44	Saudi Arabia (2013)	0.82	18.75	0.61		108	Panama (2013)	0.06	1.12	0.02	○
45	Kenya (2010)	0.79	17.99	0.60		109	Guatemala (2012)	0.04	0.69	0.01	○
46	Malta (2014)	0.76	17.44	0.59		110	Madagascar (2014)	0.02	0.00	0.00	○
47	Hong Kong (China) (2014)	0.74	16.93	0.58		n/a	Algeria	n/a	n/a	n/a	
48	South Africa (2013)	0.73	16.59	0.57		n/a	Bangladesh	n/a	n/a	n/a	
49	Egypt	0.72	16.51	0.56		n/a	Benin	n/a	n/a	n/a	
50	Morocco (2010)	0.71	16.32	0.55		n/a	Brunei Darussalam	n/a	n/a	n/a	
51	Tunisia (2014)	0.65	14.92	0.54		n/a	Cambodia	n/a	n/a	n/a	
52	Thailand	0.63	14.24	0.53		n/a	Cameroon	n/a	n/a	n/a	
53	Latvia	0.62	14.23	0.52		n/a	Côte d'Ivoire	n/a	n/a	n/a	
54	Ukraine	0.62	14.06	0.51		n/a	Dominican Republic	n/a	n/a	n/a	
55	Argentina (2014)	0.61	13.95	0.50		n/a	Guinea	n/a	n/a	n/a	
56	Ethiopia (2013)	0.60	13.76	0.50		n/a	Honduras	n/a	n/a	n/a	
57	Costa Rica (2014)	0.58	13.28	0.49		n/a	Jamaica	n/a	n/a	n/a	
58	Mali (2010)	0.58	13.27	0.48		n/a	Lebanon	n/a	n/a	n/a	
59	Mexico	0.55	12.51	0.47		n/a	Malawi	n/a	n/a	n/a	
60	Botswana (2013)	0.54	12.27	0.46		n/a	Niger	n/a	n/a	n/a	
61	Senegal (2010)	0.54	12.27	0.45		n/a	Rwanda	n/a	n/a	n/a	
62	Tanzania, United Rep. (2013)	0.53	12.00	0.44		n/a	Yemen	n/a	n/a	n/a	
63	Belarus	0.52	11.71	0.43		n/a	Zimbabwe	n/a	n/a	n/a	
64	Romania	0.49	11.03	0.42							

SOURCE: UNESCO Institute for Statistics, *UIS online database*
NOTE: ● Indicates a strength; ○ a weakness

Income Group Rankings (top 3)



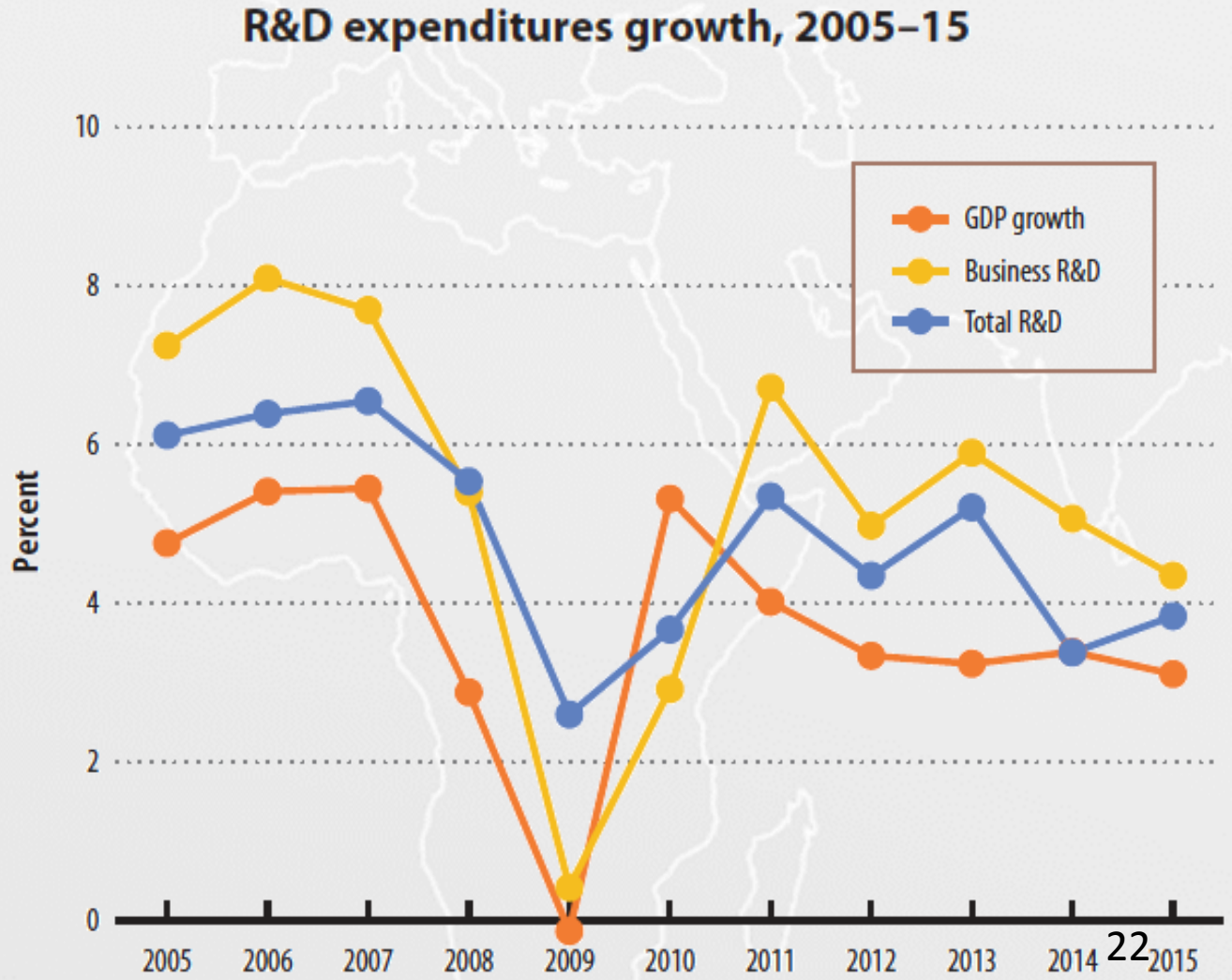
Regional Rankings – Top 3



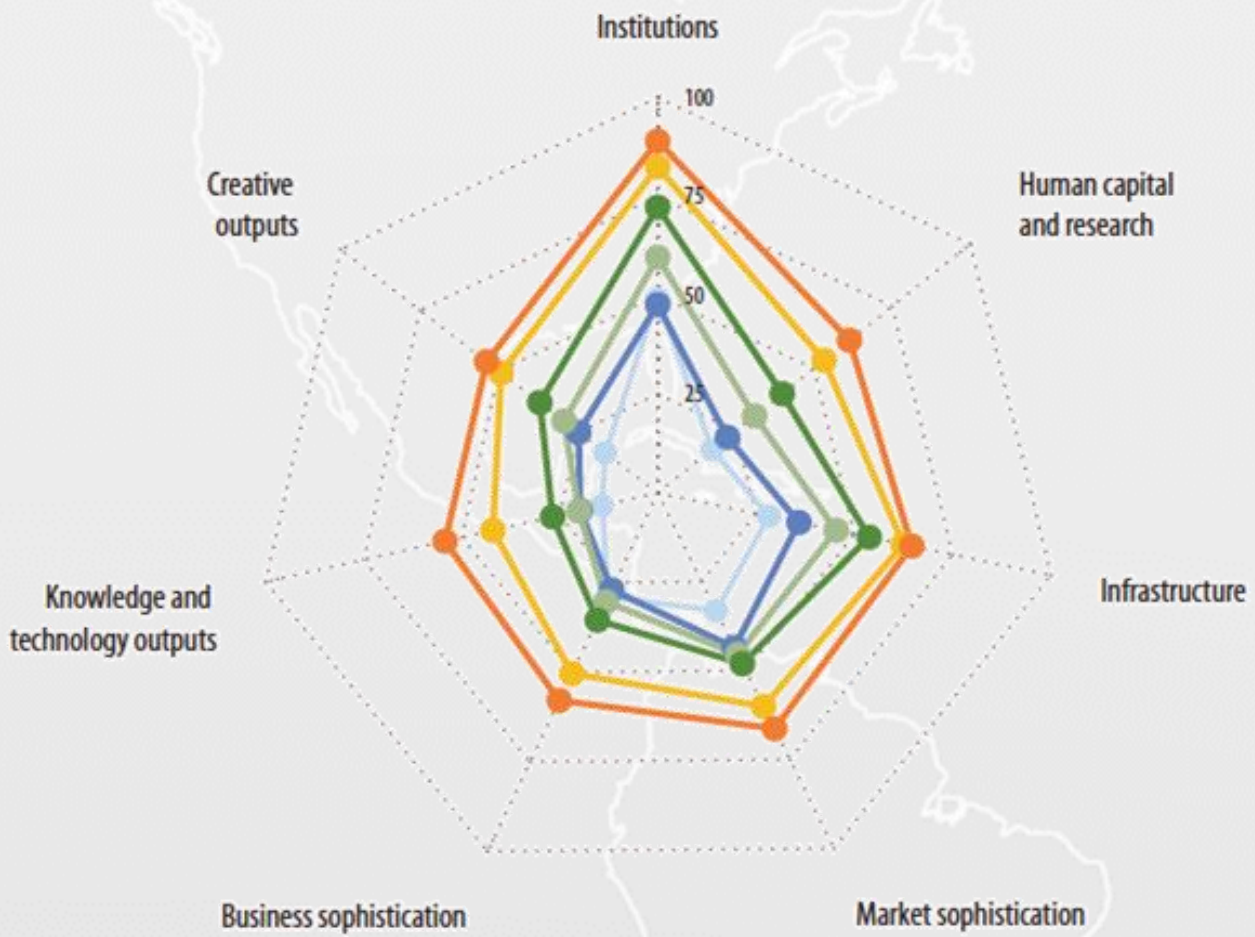
Annex II: Conclusions and key messages 2017

Leveraging innovation-driven growth

- New growth momentum, but investment and productivity growth at historic lows
- Lackluster growth rates for R&D activities, both at the government and corporate levels.



More innovation convergence is needed



- GII remains stable at the top
- China keeps rising
- Continued gap between developed and developing nations
- Low-income economies closing the gap

Sub-Saharan Africa and Latin America: Preserve the momentum and leverage the innovation potential

Sub-Saharan Africa

- High innovation performance relative to development
- More innovation achievers than any other region
- Noted improvements in: Institutions, Market sophistication, Infrastructure and Human Capital
- Drivers of growth in the region have seen a slowdown

Latin America and the Caribbean

- Opportunity to improve innovation capacity
- No identified innovation achiever
- Sustained efforts in improved innovation investments and more coordinated innovation systems are required
- Broader regional R&D and innovation cooperation also needed

Smart digital agricultural innovation to overcome food challenges

- Innovation is required to confront slow growth in agricultural productivity:
- Adequate information to farmers, skills, adoption of new products and processes
- Farmers empowerment by providing access to digital technologies and new service platforms
- Boost entrepreneurship and venture capital approaches
- Adopt excellence and innovation attitudes into the agricultural sector
- Improve national legal and regulatory frameworks in agriculture

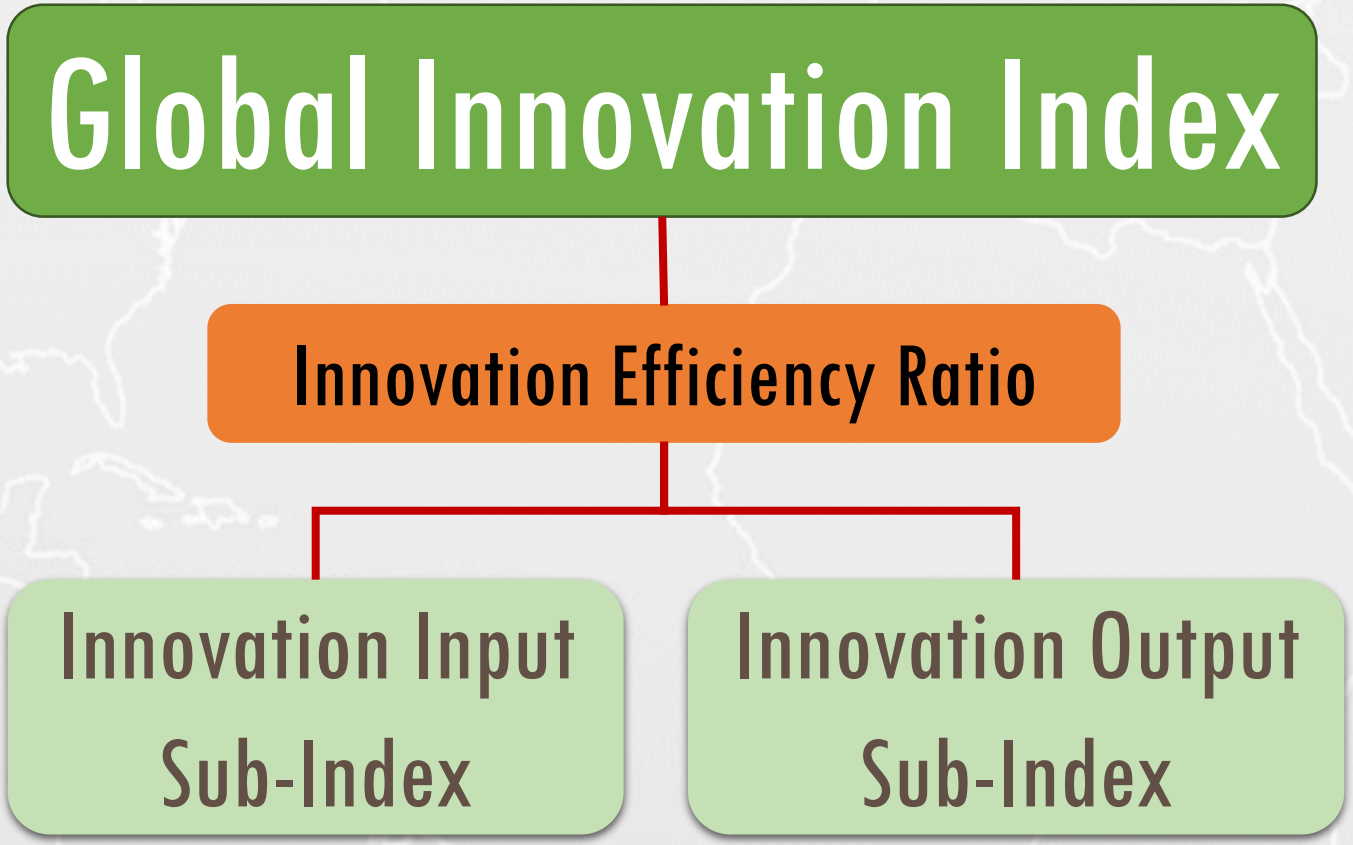
Innovation Feeding the World : from Digital to Smart Agriculture

- **Solving the food equation** (feeding 10 billion people while reducing pressure on natural resources (land, energy eg) requires innovation.
- A wave of new agricultural innovations is taking place (**digital agriculture**), but rolling out rather slowly in many parts of the world

- **Smart agriculture** (distribution, value chains) is now required on a global scale
- Policy makers have a responsibility to provide **funding mechanisms** to stimulate innovation in agriculture and food production, especially in developing countries, which have yet to benefit from earlier waves of agricultural innovations

Annex III: Structure and Computation

Structure (1/2)



Structure (2/2)

Innovation Input Sub-Index

1. Institutions
2. Human capital and research
3. Infrastructure
4. Market sophistication
5. Business sophistication

Innovation Output Sub-Index

6. Knowledge and technology outputs
7. Creative outputs

The two sub-indices have the same weight

Computation (1/2)

Country/economy coverage

- Inputs: 54 indicators
- Outputs: 27 indicators
- Minimum coverage: 66%-66% per sub-index
- Must have scores for at least two sub-pillars per pillar.

Data range

- 10 year range cut-off (except when new or revised data).

Missing data

- Not considered in Sub-pillar score
- For the sake of transparency and replicability of results, no effort made to fill missing values.

Computation (2/2)

Outliers

- Selection:
  - Absoluter skewness > 2.25 or
  - Kurtosis greater than 3.5
- Treatment:
  - Winsorization
  - Multiplication by f factor plus Log transformation

Normalization

- Min-Max Method
- All scores are normalized between 0 and 100
- Except Innovation Efficiency Ratio

Annex IV: Collaborators

Collaboration among GII Partners

Co-published by Cornell University, INSEAD and WIPO

Three Knowledge Partners:

Confederation of Indian Industry, PricewaterhouseCoopers and Strategy&,

National Confederation of Industry and Serviço Brasileiro de Apoio às Micro e Pequenas Empresas

Independent statistical audit by the Joint Research Centre of the European Commission

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Cornell SC Johnson College of Business

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WIPO WORLD INTELLECTUAL PROPERTY ORGANIZATION

CII Confederation of Indian Industry

strategy&

pwc

SEBRAE

CNI Confederação Nacional da Indústria

European Commission Joint Research Centre