

# Descriptive report

The goal of this report is to present general descriptive information derived from the GII data. The figure below shows the minimum, the maximum and the mean scores of the GII scores along with the output and input sub-indices of the 129 countries. The standard deviation, skewness and kurtosis of the variables (and respective standard errors) are also presented. Skewness has to do with the symmetry of the distribution of data, a skewed variable is a variable whose mean is not in the center of the distribution. Kurtosis has to do with the peakedness of a distribution; a distribution is either too peaked (with short, thick tails) or too flat (with long, thin tails) (Tabachnick and Fidell, 2014).

Descriptive Statistics									
	N	Minimum	Maximum	Mean	Std. Deviation	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
Global Innovation Index	129	14,5	67,2	36,315	12,0553	0,645	0,213	-0,493	0,423
Innovation Input Sub-index	129	22,5	72,2	45,353	12,0931	0,504	0,213	-0,642	0,423
Innovation Output Sub-index	129	6,4	63,5	27,278	12,6831	0,737	0,213	-0,247	0,423
Valid N (listwise)	129								

Values for skewness and kurtosis between the -1 and 1 interval represent no substantial deviations from the normal distribution (Hair et al., 2014). The numbers show that this is the case for the three indicators presented above. Countries are performing better in terms of innovation inputs (M = 72.2) compared to outputs (M = 63.5). The minimum GII score (14.5) comes from Yemen while the highest score (67.2) comes from Switzerland. In terms of Innovation Input, Singapore is leading with a score of 72.2 while Switzerland leads on Innovation Outputs (63.5). Yemen scores worst in both indicators.

The figure below shows the same information, but regarding sub-pillars of innovation. The highest mean score belongs to Institutions, followed by Knowledge and Technology Outputs. The lowest standard deviation is shown by Market Sophistication, which suggests that the scores on this sub-pillar are relatively homogeneous across all countries. The opposite is true for Human Capital and Research, which shows the highest standard deviation.

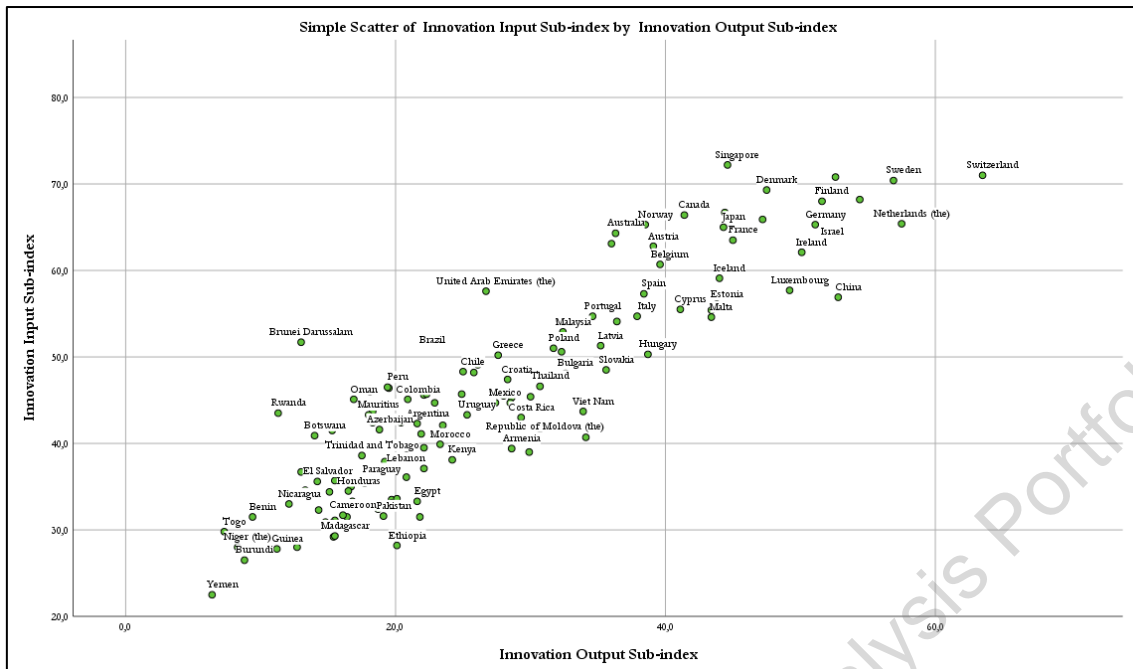
Descriptive Statistics									
	N	Minimum	Maximum	Mean	Std. Deviation	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
1 Institutions	129	27,5	94,9	65,068	14,6785	0,276	0,213	-0,645	0,423
2 Human capital and research	129	1,4	66,5	32,134	15,5260	0,344	0,213	-0,770	0,423
3 Infrastructure	129	14,0	69,9	45,979	12,4674	-0,157	0,213	-0,750	0,423
4 Market sophistication	129	26,1	87,0	49,040	11,1108	0,621	0,213	0,738	0,423
5 Business sophistication	129	16,3	68,8	34,558	12,8962	0,969	0,213	0,073	0,423
6 Knowledge and technology outputs	129	2,9	70,3	25,528	14,3616	0,977	0,213	0,467	0,423
7 Creative outputs	129	0,4	56,6	29,035	12,3452	0,388	0,213	-0,565	0,423
Valid N (listwise)	129								

Finally, the figure below shows the statistics for the sub-themes.

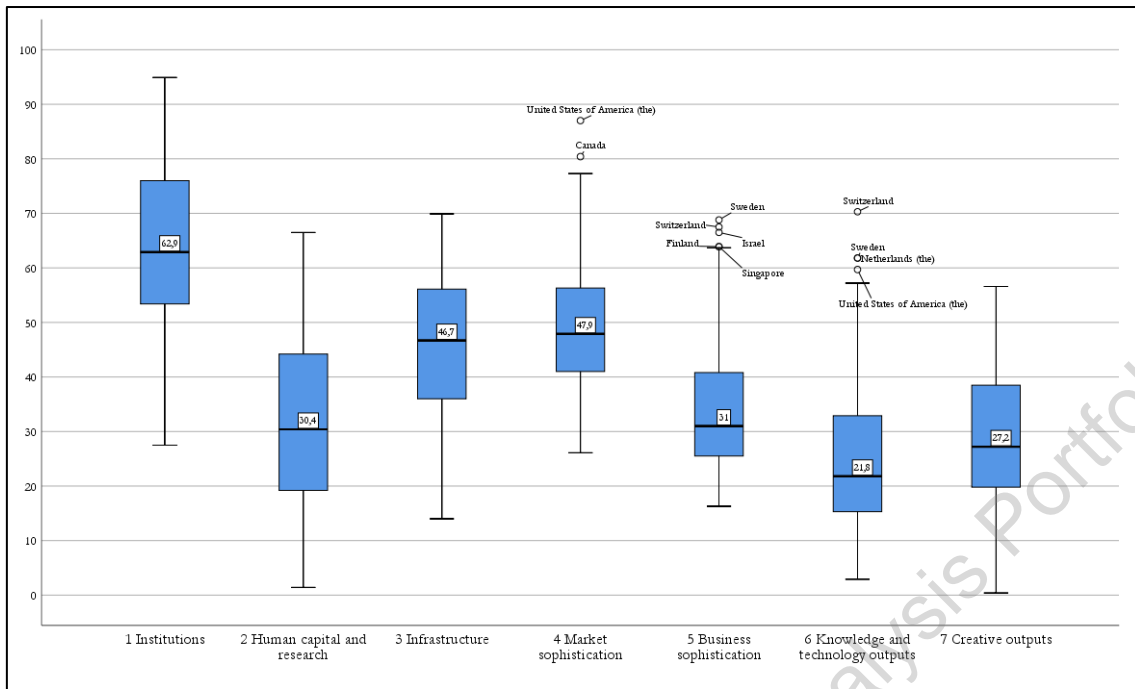
Descriptive Statistics									
	N	Minimum	Maximum	Mean	Std. Deviation	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
1.1. Political environment	129	0,0	100,0	58,357	19,1767	0,179	0,213	-0,422	0,423
1.2. Regulatory environment	129	16,1	98,8	66,525	16,9662	-0,083	0,213	-0,240	0,423
1.3. Business environment	129	40,0	92,6	70,333	11,8515	-0,048	0,213	-0,770	0,423
2.1. Education	129	0,0	92,2	46,062	15,2295	-0,251	0,213	-0,032	0,423
2.2. Tertiary education	126	1,5	77,1	30,644	15,8634	0,116	0,216	-0,439	0,428
2.3. Research and development (R&D)	129	0,0	89,3	19,946	24,1786	1,210	0,213	0,233	0,423
3.1. Information and communication technologies (ICTs)	129	10,8	94,0	62,982	20,5385	-0,473	0,213	-0,770	0,423
3.2. General infrastructure	129	0,2	68,5	35,432	12,6896	0,067	0,213	-0,107	0,423
3.3. Ecological sustainability	129	17,6	72,8	39,520	12,3300	0,449	0,213	-0,274	0,423
4.1. Credit	129	0,4	94,6	40,146	18,4236	0,674	0,213	0,363	0,423
4.2. Investment	128	25,2	81,7	45,706	13,3896	0,874	0,214	0,112	0,425
4.3. Trade, competition, & market scale	129	20,7	92,7	61,311	12,7994	-0,244	0,213	0,259	0,423
5.1. Knowledge workers	129	0,0	84,9	39,042	19,2611	0,310	0,213	-0,638	0,423
5.2. Innovation linkages	129	0,0	82,5	29,155	14,0824	1,049	0,213	0,977	0,423
5.3. Knowledge absorption	129	14,4	71,3	35,474	11,8847	0,708	0,213	-0,041	0,423
6.1. Knowledge creation	129	0,9	84,7	19,256	19,1706	1,434	0,213	1,354	0,423
6.2. Knowledge impact	129	0,6	66,6	34,760	14,2302	-0,666	0,213	0,236	0,423
6.3. Knowledge diffusion	129	2,1	83,4	22,564	16,4655	1,550	0,213	2,057	0,423
7.1. Intangible assets	129	0,0	77,6	41,688	12,7439	-0,245	0,213	0,760	0,423
7.2. Creative goods and services	129	0,0	70,5	18,340	13,7566	0,718	0,213	0,415	0,423
7.3. Online creativity	129	0,0	67,6	14,401	18,3822	1,386	0,213	0,753	0,423
Valid N (listwise)	125								

Higher mean scores are observed for Business Environment (70.33) followed by Regulatory Environment (66.52), while the worst mean score is shown by Online Creativity (14.40). Business Environment also shows the lowest standard deviation, while R&D shows the highest.

In order to provide an overview about the performance of each country in terms of innovation inputs and outputs, the following scatterplot was produced. It shows the position of each country relative to their output and input scores. Countries positioned on the top right corner have better performance in both indicators. The opposite is valid for the low left corner of the graph. Countries positioned in the lowest portion of the 'group' of dots have relatively higher output performances (e.g. China, Moldova, Ethiopia). Contrastively, countries such as Singapore, United Arab Emirates and Brunei are more inclined to innovation inputs instead.

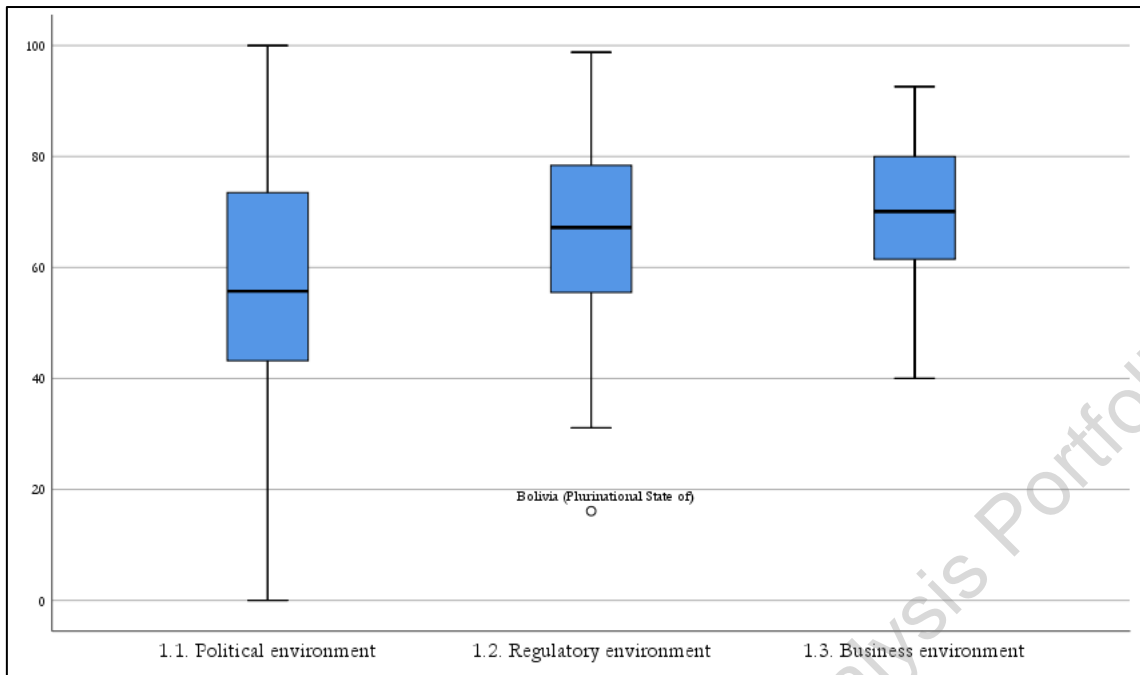


The following figures present box plots of the pillars and sub-pillars of the Global Innovation Index. Box plots are graphical representations of the distribution of values in a particular variable. The graph literally box in observations that are around the median (horizontal line in the middle of the box). The box edges represent the interquartile range of values. That is, the 25<sup>th</sup> percentile (lowest edge) and the 75<sup>th</sup> percentile (highest edge). 50% of values lie inside the box. The whiskers (lines protruding from the box), represent the minimum and maximum values observed among the cases. Outliers (countries of which values surpass 1.5 times the interquartile range) are presented as dots outside the whiskers, extreme cases (more than 3 times this range) are represented as stars. The following graph shows the results for the pillars.

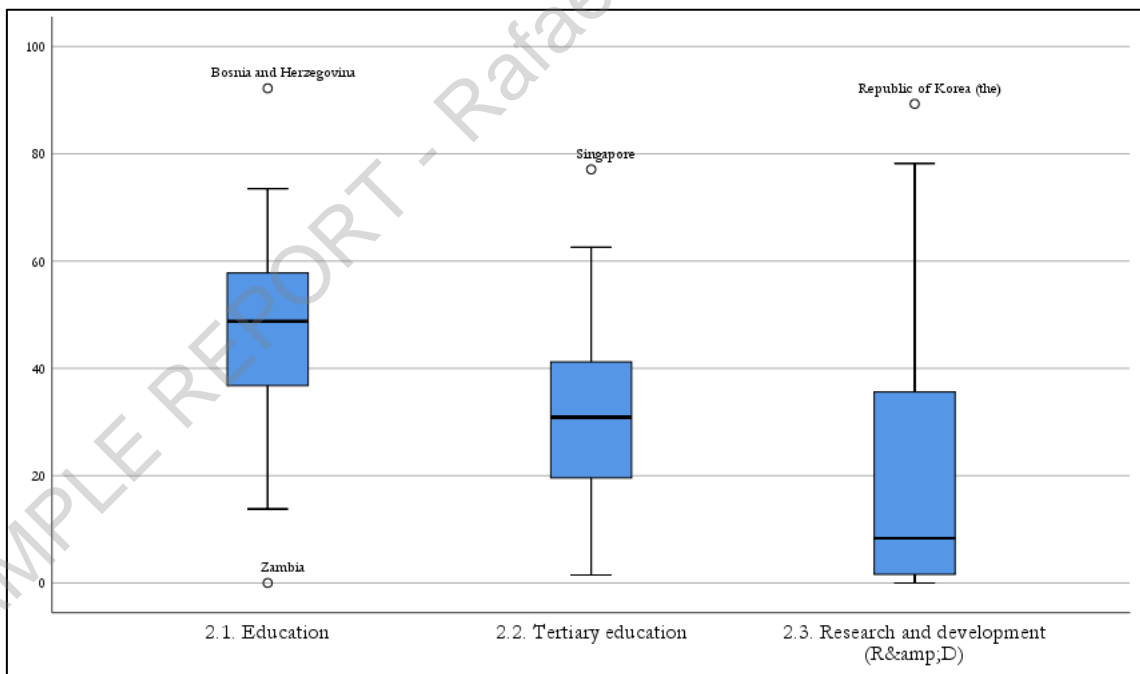


Canada and the United States are outliers in terms of Market Sophistication. Sweden and Switzerland are outliers in terms of Business Sophistication and Knowledge and Technology Outputs. An additional interpretation that can be drawn from boxplots is that the smaller the box, the more concentrated countries are around the median values for that particular pillar. This is the case for Market Sophistication, of which 50% of countries have values ranging from around 40 to around 55 (graph above).

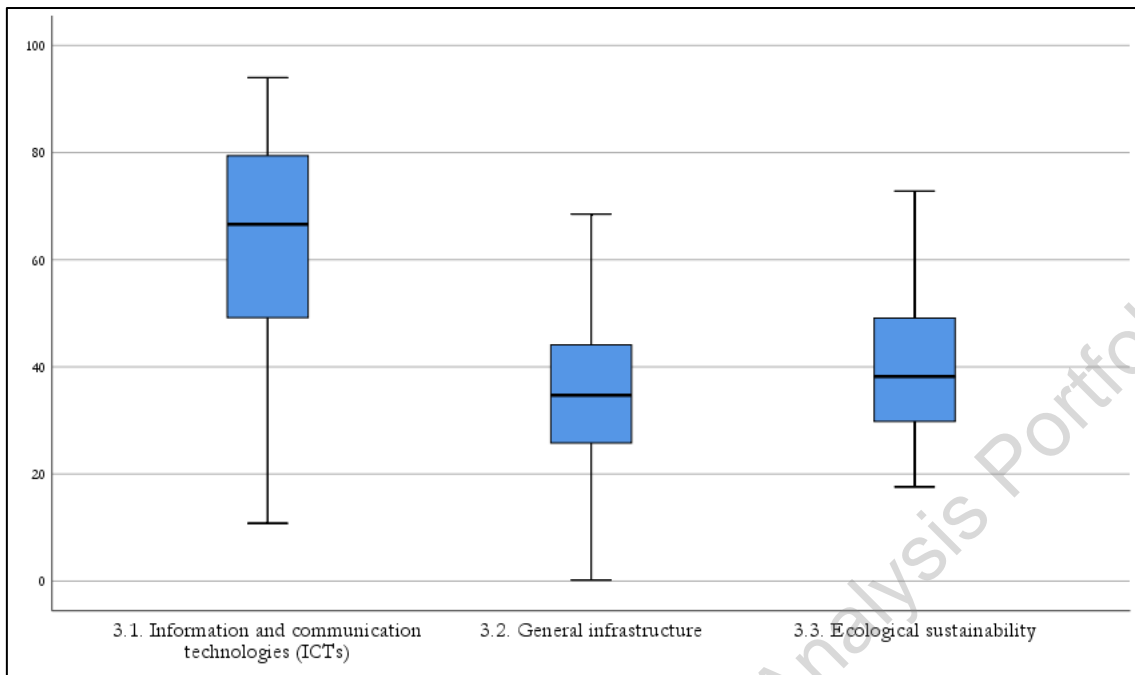
The following seven graphs present box plots for each pillar of innovation. The first figure (below) shows the results for 'Institutions'. The graph demonstrated that 'Political Environment' has a more widespread distribution of scores across all countries, differently from 'Business Environment'. Bolivia was considered an outlier in terms of 'Regulatory Environment', with a relatively extreme low value, in comparison with all other countries.



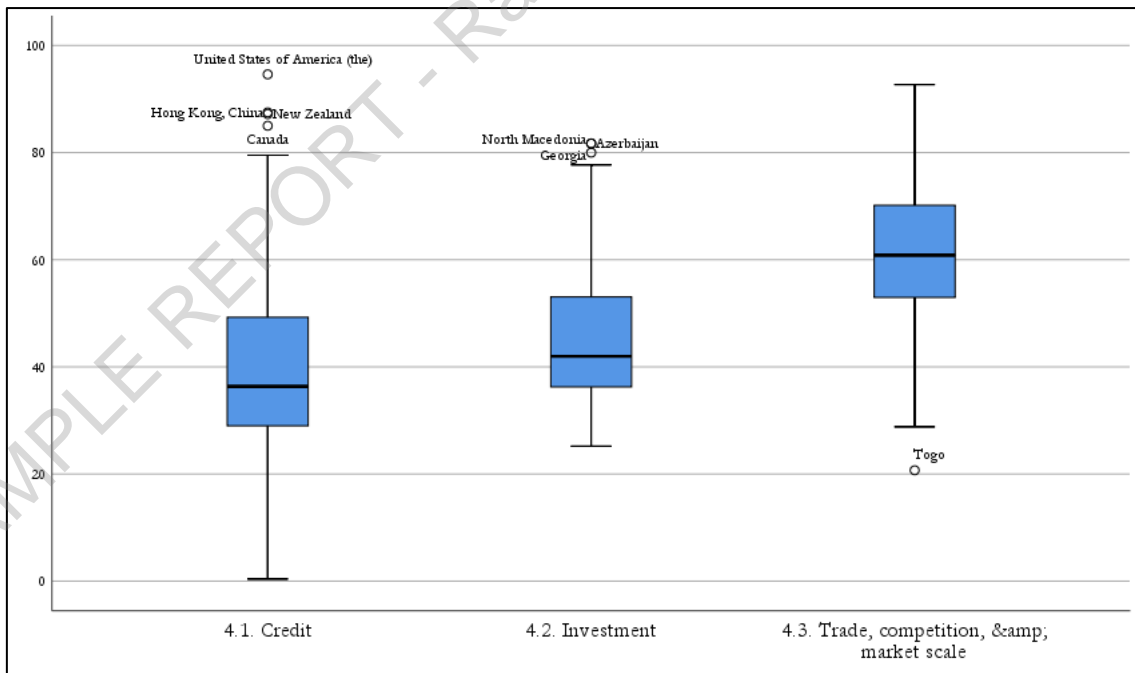
Bosnia and Zambia are outliers (on the higher and lower sides, respectively), when it comes to Education (graph below). The performance of Singapore and South Korea are highlighted in terms of tertiary education and research and development (respectively).



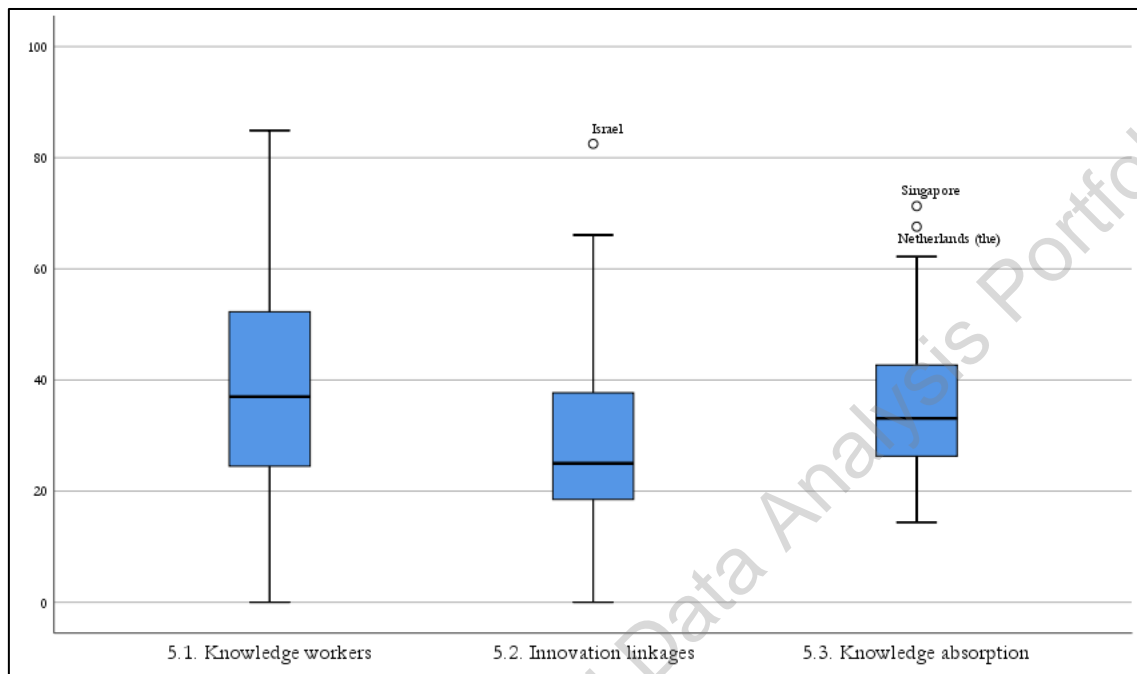
With regards to 'Infrastructure', countries perform better at ICTs. The score of General Infrastructure and Ecological Sustainability are less heterogeneous across countries (smaller boxes).



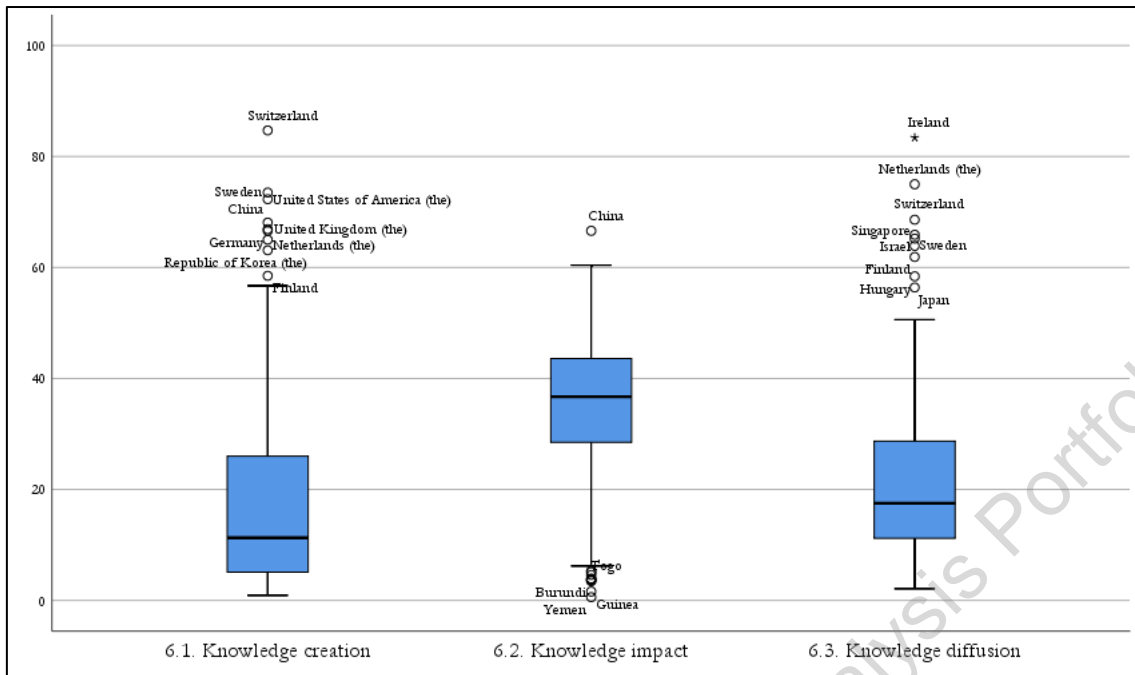
The results for Market Sophistication are shown below. United States, Hong Kong, New Zealand and Canada perform well above average when it comes to Credit, while North Macedonia, Georgia and Azerbaijan perform similarly in the case of Investment. No substantially above-average outliers are observed for Trade, Competition and Market Scale, but Togo is shown as a lower than average outlier (figure below).



No outliers are observed for the category 'Knowledge Workers', which means that all countries are equally dispersed across the range of scores. Israel is the only country defined as an outlier for Innovation Linkages, while Singapore and Netherlands stand out in terms of Knowledge Absorption.



Knowledge and Technology Outputs stands out as the pillar with the most heterogeneity regarding the performance on its three indicators. While half of countries have scores around a relatively low median for Knowledge Creation, eight countries are shown as outliers (with values around 60 to 90). Similarly, nine countries stand out in terms of Knowledge Diffusion, with Ireland considered as an extremely high case (higher than 3 times the interquartile range). Only China is a high outlier in the case of Knowledge Impact, while six countries are on the lower side of the performance in this indicator (figure below).



Finally, next figure shows results for Creative Outputs. While the median of values for Online Creativity lies around 5, twelve countries have much higher scores and are considered outliers. Hong Kong is the only positive outlier for Creative Goods and Services and China for Intangible Assets. With regards to this last indicator, Belarus, Togo and Niger stand out negatively.

