

THE IMPACT OF THE QUALITY OF NATIONAL EDUCATION SYSTEM TO THE INNOVATION AND BUSINESS ENVIRONMENT

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Abstract

The quality of education is one of the important factors affecting the competitiveness of the national economy. This paper describes relations between the level of the innovation environment of national economies and the rankings of national education systems and the university rankings too. The dependency between quality of national higher education systems and business environment is sought. The data of these rankings are used: (1) The Global Innovation Index reflecting innovation environment of every country; (2) The Global Entrepreneurship Index reflecting business environment of every country; (3) U21 Ranking of National Higher Education Systems; and (4) QS World University Rankings. The positive correlation is between the level of national higher education systems and the evaluation of national business environment represented by both indexes (Global Innovation Index and Global Entrepreneurship Index). Unconvincing results are between QS World University Rankings and both indexes describing business environment. In the end, the discussion of the reasons for these conclusions is described.

Key words: national education systems, the evaluation of the quality of universities, innovation environment

JEL Code: I23, I25, O10

Introduction

Evaluation of the quality of education undoubtedly provides a very interesting insight into the monitored objects evaluation. The quality of education can be evaluated in different ways. For long-term comparability, the quality of education is done globally on two levels: such as evaluating the best universities and evaluation of the national education systems. Evaluation of the quality of national education systems offers a view of the rated countries and the level of educational policy that should be reflected in the status of specific universities, in a global perspective. On the other hand, the success of every country is given by ability to develop

innovation potential of subject in specific country, especially from entrepreneurs. The key prerequisite for the success of the national economy should be high-quality education systems.

1 Rankings of the universities, the national education systems and business environment

1.1 The rankings of universities

The world's best-known standard global rankings of universities are:

- QS World University Rankings,
- Times Higher Education World University Rankings,
- Center for World University Rankings,
- The Ranking Web of Webometrics,
- The Academic Ranking of World Universities (ARWU).

Four Czech universities regularly appear in good places in these rankings: Charles University (in Prague), Czech Technical University in Prague, Masaryk University (in Brno), and Brno University of Technology. The ranking of other universities (Palacky University Olomouc or the University of Chemistry and Technology Prague) depends on the particular ranking and its scale in the given evaluation year.

For the purpose of this article, QS World University Rankings (QS) are selected as a representative, for several reasons: (1) the reputation of this ranking, (2) global ranking prestige of them, (3) and the multi-criteria assessment of universities based on hard data (publication and scientific activity) and own stakeholders research too. The Ranking Web of Webometrics is also interesting, but it takes hard data only (citation in different databases, number of publication outputs, etc.).

The QS World University Rankings is based on four areas of evaluation:

- An academic reputation with a weight of 40%; it is obtained from a large annual survey among academics from around the world (about 75,000 academics in 2017).
- An employee reputation with a weight of 40%; it is obtained from annual survey among university staff from around the world.
- The number of students per teacher as a quality standard with a weight of 20%.
- Citation based on quotes in the Scopus database with a weight of 20%.
- The share of foreign employees with a weight of 5%.
- The share of international students with a weight of 5%.

The first 400 universities have their specific order, the next 500 universities in the rankings are grouped (the last named group “701+” is the largest). In total, 3800 universities from around the world are rated (University Rankings | Top Universities, 2017). Interestingly, Table 1 shows selected results for QS between 2014 and 2017.

Tab. 1: The university rankings by QS World University Rankings

University	2014/15	2015/16	2016/17	2017/18
MIT (USA)	1	1	1	1
Stanford University (USA)	7	3	2	2
Harvard University (USA)	4	2	3	3
Caltech (USA)	8	5	5	4
University of Cambridge (UK)	2	3	4	5
University of Oxford (UK)	5	6	6	6
University College London (UK)	5	7	7	7
ETH Zurich (Switzerland)	12	9	8	8
Imperial College London (UK)	2	8	9	9
University of Chicago (USA)	11	10	10	10

Source: University Rankings | Top Universities (2017)

For the comparison, the first nine places of The Ranking Web of Webometrics are occupied by universities from the US; University of Oxford is ranked in the 10th position (Webometrics, 2017).

1.2 The rankings of national education systems

Globally, there are several global rankings which ranking the countries according to the level of their education systems. There are two international evaluation of the whole education system (primary, secondary and tertiary spheres):

- The United Nations' Educational, Scientific and Cultural Organization's (UNESCO) Educational for All Development Index (EDI),
- U. S. News Best Countries Rankings.

U21 Ranking of National Higher Education Systems is primary focused on the higher education sector. EDI is primary focused on literacy and primary sphere. Unfortunately, many interesting countries is not included to EDI (e.g. countries from Central Europe). The absence of including

some countries into U.S. News Best Countries Rankings (e.g. Finland, Norway or Switzerland) is reason to disqualify this ranking too. You can read more about these rankings in Švecová (2016).

The U21 is a group of 21 universities around the world. This group performs an evaluation of national higher education systems as part of its activities since 2012 under the name U21 Ranking of National Higher Education Systems (U21). The specificity of this ranking is the focus only on 50 selected (developed) countries. The evaluation is carried out in four different areas, with 25 different criteria. Every country is separately evaluated in these areas (U21 Ranking of National Higher Education Systems, 2017):

- Resources: this area includes criteria such as public spending on institutions in this area and their share of GDP, public spending on the student, etc.
- Environment: this area integrates three surveys: gender aspects (share of female students, share of female employees in institutions), the degree of diversity and quality of data about higher education.
- Connectivity: this area is oriented to technical changes and economic growth, measured by, for example, the share of international students, the number of full open-access texts, the share of articles in international co-authorship etc.
- Output: this area is declared as research outcomes and impacts, study throughput, quality of national universities, etc.

The first three areas have a weight of 20%, the last area has 40%. The resulting state score is expressed in relation to the best result. Source data is from the OECD database, from the Webometrics (already mentioned above), from the Google Scholar or from its own research (William, 2016, p. 6-7), (Williams & De Rassenfosse, 2016, p. 51-62). Ranking U21 between 2014 and 2016 shows table 2.

Tab. 2: U21 Ranking of National Higher Education Systems

Country	2014	2015	2016	2017
United States	1	1	1	1
Switzerland	6	2	2	2
Denmark	3	3	3	4
United Kingdom	8	8	4	3
Sweden	2	5	5	5

Finland	5	4	6	9
Netherlands	7	7	7	8
Singapore	10	9	8	6
Canada	3	6	9	7
Australia	9	10	10	10

Source: U21 Ranking of National Higher Education Systems (2017)

1.3 The rankings of business environment

The rankings for evaluation competitiveness of countries are numerous, for the purposes of this article will be used ranking of the Global Innovation Index (GII) and ranking the Global Entrepreneurship Index (GEI). Table 3 shows the ranking of top 10 countries.

The Global Innovation Index (2017) “*is the simple average of the Input and Output Sub-Index scores*”. Innovation Input Sub-Index involves five pillars: (1) Institutions, (2) Human capital and research, (3) Infrastructure, (4) Market sophistication, and (5) Business sophistication. Innovation Output Sub-Index is divided into two pillars: (6) Knowledge and technology outputs, and (7) Creative outputs. Each pillar is composed from several indicators. Data are collected from more than 30 various sources (including five surveys), for example OECD, Webometrics, Google Scholar, surveys or own estimation.

The Global Entrepreneurship Index (2017) is “*an annual index that measures the health of the entrepreneurship ecosystems in each of 137 countries.*” GEI ranks the performance of every country and it describes these performances in both the domestic and international context. GEI uses 14 pillars to measure the health of the nation entrepreneurship environment. GEI is based on data on the entrepreneurial attitudes, abilities and aspirations of the local population. The factors such as broadband connectivity and the transport links to external markets are included too.

Tab. 3: Rank of countries: Global Innovation Index and Global Entrepreneurship Index

Rank	GII	GEI
1	Switzerland	United States
2	Taiwan	Switzerland
3	Sweden	Canada
4	Netherlands	Sweden
5	United States	Denmark
6	United Kingdom	Iceland
7	Denmark	Australia
8	Singapore	United Kingdom
9	Finland	Ireland
10	Germany	Netherlands

Source: Global Innovation Index (2017); Global Entrepreneurship Index (2017)

2 Research questions and results

2.1 Research hypothesis

The aim of this article is to find out whether there is a correlation between the evaluation of national higher education systems and the evaluation of business environment. These hypotheses are formulated to fulfil this objective:

- H1: The better ranking of the national education system of a given country (in U21) has a positive impact on the evaluation of innovation environment (in GII).
- H2: The better ranking of the national education system of a given country (in U21) has a positive impact on the evaluation of entrepreneurship environment (in GEI).
- H3: The better ranking of the universities in a given country (in QS) has a positive impact on the evaluation of innovation environment (in GII).
- H4: The better ranking of the universities in a given country (in QS) has a positive impact on the evaluation of entrepreneurship environment (in GEI).

2.2 Indicator construction

Correlation analysis (Pearson's correlation coefficient) is used to measure statistical dependence. To confirm the hypothesis, the following indicators are constructed:

- GIIs: the score of the country in the Global Innovation Index for 2017;
- GEIs: the score of the country in the Global Entrepreneurship Index for 2017;

- U21_S: the score of the country in the U21 ranking for 2017;
- QS_{SCORE}: the score for each country calculated as a sum of the differences between the total number of universities in the world and the rank in QS ranking for 2017/2018;
- QS_I: the number of inhabitants of a given country attributable to one of its universities in the QS ranking for 2017/2018.
- QS_{I400}: the number of inhabitants of a given country attributable to one of its universities with a ranking up to 400th ranking in the QS ranking for 2017/2018.

Specifically, the relationships (correlation) are determined:

- to verify hypothesis H1: (1) between U21_S and GIIs;
- to verify hypothesis H2: (3) between U21_S and GEIs;
- to verify hypothesis H3: (4) between QS_{SCORE} and GIIs; (5) between QS_I and GIIs; (6) between QS_{I400} and GIIs;
- to verify hypothesis H4: (7) between QS_{SCORE} and GEIs; (8) between QS_I and GEIs; (9) between QS_{I400} and GEIs.

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2.3 Results

The table 4 shows the values of Pearson’s correlation coefficients between given indicators.

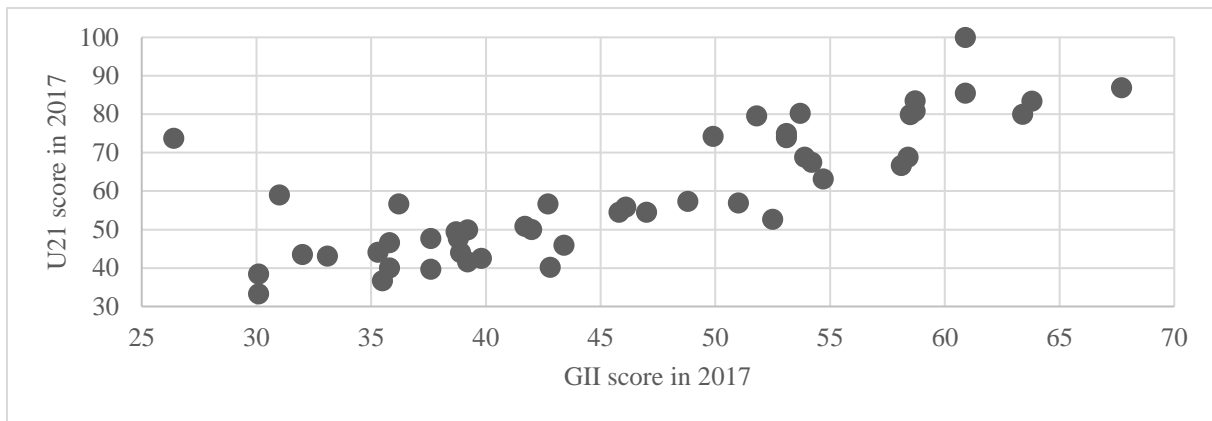
Tab. 4: Values of Pearson’s correlation coefficients between indicators

	GIIs	GEIs
U21 _S	0.81	0.91
QS _{SCORE}	0.38	0.39
QS _I	-0.26	-0.30
QS _{I400}	-0.26	-0.30

Source: author

Hypothesis **H1** “The better ranking of the national education system of a given country (in U21) has a positive impact on the evaluation of innovation environment (in GII).” **is not rejected**. Correlation coefficient value symbolizes the positive strong dependence of both indicators (the value is 0.81). Fig. 1 symbolizes the dependencies between both indicators.

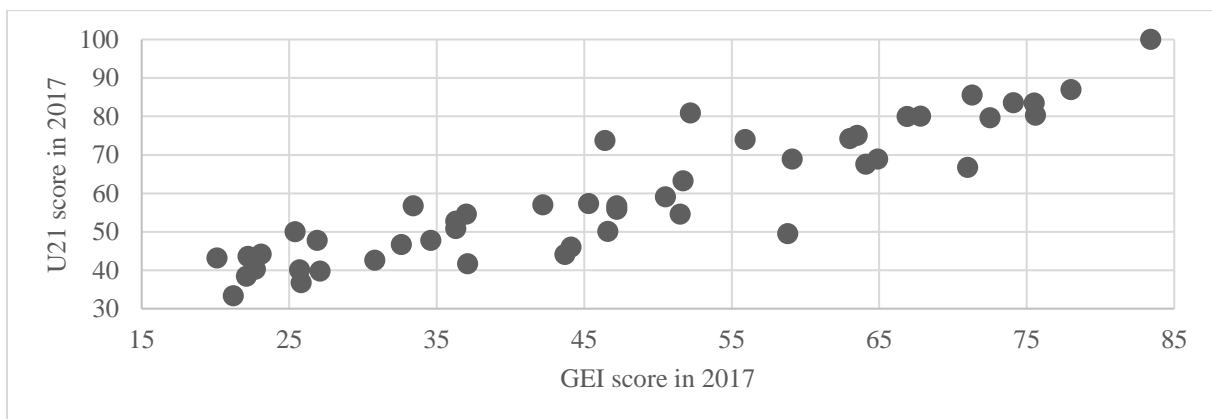
Fig. 1: Dependencies between indicators U21_S and GIIs



Source: author

Hypothesis **H2** “The better ranking of the national education system of a given country (in U21) has a positive impact on the evaluation of entrepreneurship environment (in GEI)” is **not rejected**. Correlation coefficient value symbolizes the positive strong dependence of both indicators (the value is 0.91); see Fig. 2 too.

Fig. 2: Dependencies between indicators U21s and GEIs



Source: author

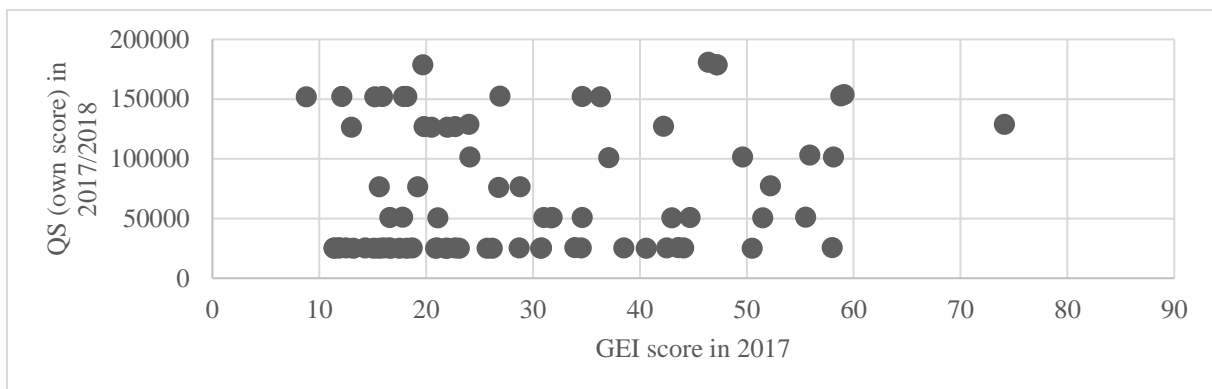
Hypothesis **H3** “The better ranking of the universities in a given country (in QS) has a positive impact on the evaluation of innovation environment (in GII)” is **rejected**. Correlation coefficient values symbolize only:

- the weak positive dependence between the score for each country calculated from QS (QS_{SCORE}) and the ranking in GII (the value is 0.38);
- the weak negative dependence between the number of inhabitants of a given country attributable to one of its universities in the QS ranking (QS_1 ; QS_{1400}) and the ranking in GII (the values are -0.26).

Hypothesis **H4** “The better ranking of the universities in a given country (in QS) has a positive impact on the evaluation of entrepreneurship environment (in GEI)” **is rejected** too. Correlation coefficient values symbolize only:

- the weak positive dependence between the score for each country calculated from QS (QS_{SCORE}) and the ranking in GEI (the value is 0.39); freer spreading values is also obvious from Figure 3.

Fig. 3: Dependencies between indicators Q_{SCORE} and GEIs



Source: author

- the weak negative dependence between the number of inhabitants of a given country attributable to one of its universities in the QS ranking (QS_I; QS_{I400}) and the ranking in GEI (the values are -0.30).

Conclusion

Based on the results of the analysis, there is clear (positive) link between the evaluation of the national education systems and the ranking of countries due to innovation and entrepreneurship environment. These conclusions correspond with the opinions, that high quality education system is crucial for healthy business environment.

On the other hand, it is difficult to find the dependence between QS ranking and business environment. The causes of these findings may be, for example:

- There are incompatible evaluation criteria in the ranks of universities and national education systems, more (Millot, 2015, p. 7-8).
- There are inappropriately chosen assessment criteria for national education systems (e.g. if one of the U21 criteria is the level of public expenditure in the higher education

system, and most countries have the most significant share of private funding, so the inclusion of this criterion may be debatable).

- There are inappropriately chosen criteria for the evaluation of universities (e.g. the dependence of the evaluation on surveys among employees and students is recording the universities in countries with strong loyalty and patriotism, which is not the Czech Republic), more about problems with the evaluation of universities (Bowman & Bastedo, 2011, p. 431-444), (De Witte & Hudrlikova, 2013, p. 337-364), (Aitbach, 2015).
- There is the fact that the world's best universities are not a regional market player, but they are strongly internationalized, both from the point of view of academic staff and students (the impact of national policies is so greatly reduced).

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