“Rankings in the higher education competitiveness management system”

AUTHORS	Larysa Antoniuk https://orcid.org/0000-0001-6921-2800 http://www.researcherid.com/rid/J-7149-2015 Iryna Kalenyuk https://orcid.org/0000-0003-1807-2849 http://www.researcherid.com/rid/G-1149-2017 Olena Tsyrkun https://orcid.org/0000-0002-8071-485X http://www.researcherid.com/rid/I-8067-2018 Mariia Sandul https://orcid.org/0000-0001-6985-5179 http://www.researcherid.com/rid/Q-3872-2018

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Larysa Antoniuk (Ukraine), **Iryna Kalenyuk** (Ukraine), **Olena Tsyrkun** (Ukraine), **Mariia Sandul** (Ukraine)

RANKINGS IN THE HIGHER EDUCATION COMPETITIVENESS MANAGEMENT SYSTEM

Abstract

The modern approaches towards higher education systems management often tend to focus on separate universities' performance, lacking the systemic view of the overall higher education systems' competitiveness. Thus, the policymakers often fail in tailoring the higher education strategies to the mission of higher education in contemporary society.

The article focuses on providing a systemic insight into the global competitive positioning of the national higher education systems. Based on the suggested ranking methodology, the authors perform the evaluation and ranking of 94 higher education systems, highlighting the limitations of this method, and the cluster analysis, identifying 3 types of their competitive positioning: leaders, followers, and underperformers. Based on Pearson coefficients of skewness and kurtosis calculation, the article shows that globally the inequalities in terms of higher education enrolment rate are decreasing, while those of R&D institutions quality and university-industry collaboration in research remain unchanged. Therefore, upgrading higher education quality assurance systems becomes the main strategic priority for the developing countries in terms of ensuring their higher education systems' competitiveness. Given the levelling of higher education attainment and its quality worldwide, the authors anticipate further specialization of the universities and broadening of their role within the national innovation system. The article shows that the more comprehensive the approach for evaluating the higher education systems performance – the better the policymakers may benefit in terms of higher education strategic management.

Keywords higher education system, competition, clustering, development, asymmetry, competitive advantage, higher education strategy

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Larysa Antoniuk, Doctor of Economics, Professor, Vice-Rector, Kyiv National Economic University named after Vadym Hetman, Ukraine.

Iryna Kalenyuk, Doctor of Economics, Professor, Director of the Institute of Economic Development Studies, Kyiv National Economic University named after Vadym Hetman, Ukraine.

Olena Tsyrkun, Senior Lecturer, Director of the Institute of English-Taught Programs, Kyiv National Economic University named after Vadym Hetman, Ukraine.

Mariia Sandul, Ph.D. (Economics), Associate Professor, Kyiv National Economic University named after Vadym Hetman, Ukraine.

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INTRODUCTION

One of the determining factors for achieving the goals of sustainable economic growth and increasing the global competitiveness of countries is the creation of favorable conditions for the development of human capital, conditioned by establishment of a higher education system, which through a set of legal, organizational, economic and information mechanisms ensures the continuous generation of knowledge, its dissemination, and formation of the competencies for the future in the society.

The national higher education systems of the highly developed countries, providing the formation of global competencies and values in the learning society, act as generators of innovation, drivers for collaboration within the global research network, and leaders of intercultural understanding in the diversified environment of international economic relations. Contemporary challenges affecting higher education institutions worldwide are sharpened by increased global competition in higher education for funding and talent. In such conditions, the universities face the need to rethink their core missions and identity

in order to find their competitive advantages. And nationwide, finding the best-tailored solutions and creating the conditions for the national research universities' transformation into drivers of innovation becomes one of the main focus areas of the developing countries. In this context, the problem of theoretical understanding of the influence of the national higher education systems and of the research universities in particular on the competitive development of a state, as well as the identification of effective mechanisms and roadmaps for increasing their global competitiveness, poses a challenge to scholars and governments of different countries, which determines the relevance of the topic under study.

Over the last decade, much attention has been paid to the universities' rankings. They have become a useful tool and information source for both the educators and the society, although there has also been much discussion on the implications of such popularization of global universities' rankings for the national higher education systems. Given the fact that on the backdrop of the increasing popularity of universities' rankings and their overwhelming impact on HEIs worldwide, quite a little attention was given to complex studies of higher education systems. The article aims to bridge this gap and provide more insight on this topic.

The purpose of the article is to sum up the theoretical approaches and concepts of the higher education systems and their competitiveness, and further to systematize the higher education systems' competitiveness evaluation methodologies. Moreover, the article aims to provide the comprehensive insight into the global competitive positioning of the national higher education systems through performing the ranking of the national higher education systems and their cluster analysis. Finally, it aims to assess the main inequalities worldwide in terms of higher education quality, enrolment rate, R&D institutions' quality, and university-industry collaboration in research. The results of the authors' ranking methodology are presented with the aim of summarizing and highlighting the strategic directions of national higher education systems' development of the most innovative countries.

1. LITERATURE REVIEW

A systemic approach to the analysis of higher education is a relatively new phenomenon in economic theory. The term "higher education system" is quite common in economic literature but there is no comprehensive definition of this concept. The components of national higher education systems are usually grouped into three units: 1) higher education institutions of any form of ownership, including their academic and administrative staff, students, resources, missions, and strategies; 2) state and private organizations, which influence the higher education institutions' activities, management, and finances; 3) legislation, standards, and academic traditions, which guide the behaviours and interrelation among various institutions and individuals involved in higher education activities (Teichler, 2006). Further, all components of higher education systems interact within the framework of 5 sub-systems: financial resources management, academic personnel development and management, quality assurance systems, learning outcomes evaluation systems, and monitoring and informational support systems (World Bank, 2010).

A comprehensive synthesis of various theoretical approaches and concepts of higher education with a primary focus on determining the essence of national higher education systems and their global competitiveness identifies 3 stages of their evolution according to the criteria of the dominant organizational model, the potential impact on socio-economic development, and the mission of universities. At the first stage (1970–1990), the national higher education systems are considered as hierarchical structures with centralized management, limited influence on the economy, with autonomous subjects, and the main mission of universities is to create, accumulate, and disseminate the knowledge. Such views are reflected in the works by Trow (1974), Clark (1986), etc.

At the second stage (1990–2010) the national higher education systems are referred to and studied as the integrated elements of the national innovation system, as 'generators' of the global competitive-

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ness of countries in the transition to a knowledge economy. The mission of universities on this stage is transformed towards increasing their leadership, entrepreneurship, with a high focus on commercialization of knowledge (Marginson, 2006; Etzkowitz, 2008; Ederer, Schuller, & Willms, 2008; Altbach, Reisberg, & Rumbley, 2010).

The third stage (2010 – to the present) is characterized by the interpretation of national higher education systems as evolving network structures (from Education 1.0 to 4.0), which are deeply integrated into both national and global scientific and innovation infrastructure, and capable of adapting to changes at a faster pace and achieving the goals of sustainable development. The mission of universities in the contemporary society, as based on this forward-thinking approach, is to train the innovators who can think critically and act in conditions of uncertainty, i.e., the formation of the continuous learning society (Moravec, 2008; Zhilyaev, Kovtunets, & Syomkin, 2015; Pavlenko et al.; 2014; Ilnytsky, 2016; Stonkienė, Matkevičienė, & Vaiginienė, 2016; Williams & Leahy, 2018; Maret & Salmi, 2018). There is convincing evidence that the higher the level of education of the population is, the better quality of life can be expected in terms of such aspects as personal achievements, material status, social relationships, interpersonal relationships, health, welfare of children, sense of happiness, security (Edgerton, 2012). Therefore, at this stage, it is suggested to interpret the global competitiveness of national higher education systems as the ability of their subjects to provide high-quality educational services and to ensure that the graduates of higher education institutions master global competencies due to universities' leadership in innovative development, entrepreneurship, and in creative society, and due to their leading role in enhancement of intellectual capital and achievement of the sustainable development goals.

Given the global challenges and the growing influence of higher education on the economic and societal development, there is a need to systematize the mechanisms for enhancing the dynamic competitive advantages of the higher education systems by identifying the effective methods and models, as well as to rethink and improve the methodological approaches to conducting the comparative research in this area. The first attempt to comprehensively evaluate higher education systems of 17 OECD countries was made by Ederer et al. (2008). The authors highlighted the importance of taking into account a wide range of tasks which a higher education system is designed to perform in the society, namely ensuring that the maximum number of people have access to a comprehensive range of tools for their transformation into well-developed participants of the high-grade economic life, concentration of the relevant research in the higher education institutions, and attraction of the most talented individuals from around the world due to the established effective mechanisms of developing and enhancing their talents and skills.

A comprehensive comparative study of the potential and competitiveness of higher education systems has been made by Williams and Leahy (2018) from the University of Melbourne, in which these systems are studied from the point of view of educational and research efficiency and the ability to form productive relationships with a wider economic environment. The U21 National Higher Education Systems Ranking has been presented annually since 2012 and covers 50 countries. The study is based upon 25 indicators grouped into 4 sub-indexes, which reflect the resource base of a higher education system, its output, environment, and connectivity. The other tool for international comparisons of the higher education systems' effectiveness across countries is the QS Higher Education System Strength Ranking, first presented in 2016. Its methodology relies on the data describing the countries' best universities, and the national higher education systems are then compared according to system's strength, access, flagship institution, and economic context (QS, 2018).

There are several other detailed international comparative tools, which partly reflect the competitive positions of the national higher education systems, such as the Global Talent Competitiveness Index (INSEAD, 2018), the Efficiency Index (Dolton, Marcenaro-Gutiérrez, & Stil, 2014). Various indicators and sub-indexes characterizing higher education systems are part of bigger global rankings, such as the Global

Competitiveness Index (WEF, 2017b), the Global Innovation Index (Cornell University, INSEAD, & WIPO, 2018), the Global Creativity Index (Florida, Mellander, & King, 2015), to name a few. However, the theoretical backgrounds of the national higher education systems development and competitiveness in conditions of knowledge economy are not sufficiently disclosed in contemporary scientific sources, and the existing methodologies are usually limited in terms of either the number of countries included or the number of criteria in focus.

2. METHODS

In order to cover a wider range of national higher education systems of the world, which would allow a more comprehensive analysis of the global competitiveness of national higher education systems, and based on the studied approaches to understanding this concept and its components, a group of indicators (24) were identified that characterize various aspects of the higher education systems' development (Appendix B), and data, which are reliable and available for almost 100 countries around the world (the main sources of data are the WEF publications (namely, the Executive Opinion Survey) and UNESCO). These indicators served as the basis of the expert survey conducted to identify the most significant factors of the competitiveness of national higher education systems, which determined the key criteria for its evaluation. By systematizing the available qualitative and quantitative monitoring parameters of the national higher education systems' development, expert assessments of importance, and taking into account the determinants of their high competitive status, an alternative methodology is suggested to evaluate the global competitiveness of the national higher education systems based on the following indicators: (I1) tertiary education enrolment rate; (I2) higher education quality index; (I3) impact of scientific publications (H-index); (I4) university-industry collaboration in R&D; (I5) attractiveness for international students; (I6) share of the national universities in the Top 900 world universities ranking; (I7) quality of the national research institutions. Based on these indicators, an alternative higher education system assessment methodology is suggested. Data limitations were also taken into consideration while choosing the abovementioned 7 indicators; the methodology allowed to assess 94 countries' higher education systems based on the data of 2017.

The statistical data from the WEF Global Competitiveness Report 2016–2017 was used for the indicators of quality of the education system, tertiary education enrolment rate, quality of research institutions, and university-industry collaboration in R&D (WEF, 2017b). The data of the UNESCO Institute of Statistics were used for indicator of the number of international students; the SCImago data on H-index of citations were used to characterize the impact of scientific publications (SCImago Lab, 2017). The QS (2017) ranking of world's best universities was used to evaluate the share of the national universities in the list of Top 900 (data for 2017, without adjusting to the position in the ranking). In the ranking process, the actual data for these indicators were standardized (as a percentage of the maximum).

Based on the data for the abovementioned indicators, the National Higher Education Systems' Ranking of 94 countries is performed. Raw data were standardized for the calculations. The overall index was calculated as a simple arithmetic mean with the provision of the same weight for each of the indicators:

$$I_{HESC} = \sum \frac{I_n}{n}.$$

Based on 7 chosen indicators, which characterize the national higher education systems' competitiveness, the cluster analysis is performed to distinguish the global competitive positions of the national higher education systems (using software STATISTICA 10.0, hierarchical clustering method, complete linkage, Euclidean distance), which allows studying the national higher education systems' competitive positioning in more detail.

The dynamics of higher education quality, tertiary education enrolment rate, quality of national research institutions, and intensity of collaboration between universities and industry in R&D over the last decade was investigated based on the data from WEF (2017a). The assessment of the national higher education systems' development disproportionateness based on Pearson coefficients of skewness and kurtosis was performed (using MS Office software (Excel)).

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3. RESULTS

Table 1 shows the results of the National Higher Education Systems Ranking. The performed ranking of 94 national higher education systems shows that the most competitive are the national higher education systems of the highly developed countries (USA, UK, Australia, Germany, the Netherlands, France, Switzerland, Canada, Japan, etc.), as well as of the new industrialized countries, which managed to achieve the significant results in terms of building their own intellectual capital over the past two decades (Singapore, Hong Kong, Korea (Rep.), China).

Given the limitations of the ranking methodology, mainly caused by the lack of comparable data on a wider range of higher education systems' performance indicators, it is necessary to further supplement it with some additional studies. Therefore, based on the cluster analysis, competitive positioning of the national higher education systems, as well as means for each indicator and each cluster, were analyzed (Table 2, Figure 1).

The United States of America forms the first cluster in the competitive positioning of the national higher education systems. The country remains the trendsetter and innovation leader in the international academic and scientific community. Together with the UK, these 2 top performers attract 33 percent of all international students, and account for 33.9 percent of the total number of scientific publications (SCImago Lab, 2017).

The second cluster integrates the effective and influential national higher education systems of the

Table 1. The national higher education systems' competitiveness index

Source: Authors' calculation.

Rank	Country	Value	Rank	Country	Value	Rank	Country	Value
1	USA	96.75	33	UAE	46.13	64	Tunisia	33.78
2	United Kingdom	74.00	34	Hungary	45.99	65	Cape Verde	33.47
3	Australia	65.34	35	Chile	45.40	66	Oman	33.46
4	Germany	65.34	36	Poland	44.84	67	Vietnam	33.10
5	Netherlands	62.18	37	Ukraine	44.48	68	Honduras	32.82
6	France	61.79	38	Saudi Arabia	44.38	69	Albania	32.82
7	Switzerland	61.70	39	Costa Rika	44.36	70	Ghana	32.34
8	Canada	61.01	40	Greece	42.81	71	Moldova	32.23
9	Japan	60.63	41	Latvia	42.47	72	Georgia	32.13
10	Finland	60.12	42	Thailand	42.17	73	Bolivia	31.75
11	Belgium	59.42	43	Indonesia	42.02	74	Dominican Republic	31.29
12	Singapore	58.30	44	South Africa	41.30	75	Morocco	30.64
13	Sweden	57.08	45	Malta	40.59	76	Côte d'Ivoire	30.55
14	Israel	55.57	46	India	40.37	77	Algeria	30.44
15	Denmark	55.42	47	Romania	40.34	78	Guatemala	30.14
16	New Zealand	55.08	48	Mexico	40.02	79	Ruanda	29.62
17	Norway	54.33	49	Columbia	39.68	80	Cameroon	29.30
18	Ireland	54.08	50	Brazil	39.37	81	Egypt	28.50
19	Austria	52.71	51	Slovak Rep.	39.20	82	Ethiopia	27.89
20	Italy	51.78	52	Bulgaria	38.96	83	Uganda	27.75
21	Hong Kong	51.69	53	Iran	38.66	84	Mali	27.28
22	Spain	51.03	54	Serbia	38.43	85	Benin	26.88
23	Korea (Rep.)	50.70	55	Ecuador	37.94	86	Nepal	26.67
24	Russia	49.76	56	Bahrain	37.62	87	Madagascar	26.03
25	Estonia	49.43	57	Sri Lanka	37.40	88	Mozambique	23.75
26	Malaysia	48.98	58	Lebanon	37.24	89	Malawi	23.23
27	China	48.68	59	Peru	36.99	90	Niger	22.85
28	Qatar	48.25	60	Mauritius	36.35	91	Burundi	20.44
29	Lithuania	47.80	61	Armenia	35.82	92	Sierra Leone	20.26
30	Slovenia	47.77	62	Guyana	35.12	93	Guinea	19.24
31	Czech Rep.	46.60	63	Tajikistan	34.76	94	Mauritania	18.77
32	Argentina	46.35						

Table 2. Competitive positioning of the national higher education systems

Source: Authors' calculation.

Group	Clusters		
	Cluster 1	**Cluster 2**	
Leaders	United States of America	Australia, Belgium, Canada, Denmark, Finland, France, Germany, Ireland, Israel, Japan, Netherlands, New Zealand, Norway, Singapore, Sweden, Switzerland, United Kingdom	
	Cluster 3	**Cluster 4**	**Cluster 5**
Followers	Argentina, Greece, Italy, Korea (Rep.), Poland, Russia, Spain	Austria, Chile, Costa Rica, Czech Rep., Estonia, Hong Kong, Hungary, Latvia, Lithuania, Saudi Arabia, Slovenia, Ukraine	China, India, Indonesia, Malaysia, Qatar, South Africa, UAE
	Cluster 6	**Cluster 7**	**Cluster 8**
Underperformers	Albania, Armenia, Bahrain, Bulgaria, Cape Verde, Iran, Columbia, Ecuador, Georgia, Lebanon, Malta, Mauritius, Moldova, Peru, Romania, Serbia, Slovak Rep., Sri Lanka, Tajikistan, Thailand, Tunisia	Algeria, Bolivia, Brazil, Dominican Republic, Egypt, Ghana, Guatemala, Guyana, Honduras, Mexico, Morocco, Nepal, Oman, Vietnam	Benin, Burundi, Cameroon Côte d'Ivoire, Ethiopia, Guinea, Madagascar, Malawi, Mali, Mauritania, Mozambique, Niger, Ruanda, Sierra Leone, Uganda

most innovative countries. Overall, 18 countries of these two clusters represent the leading higher education systems that perform over 70 percent of all research work in the world and account for about 80 percent of international students, 75 percent of scientific publications, and 95 percent of the Top 100 world class universities.

The third cluster integrates the higher education systems of Argentina, Greece, Italy, Korea (Rep.), Poland, Russia, and Spain. Compared to the rest of the clusters, tertiary education enrolment rate is the highest in these countries; however, mean results of the other 7 indicators are mediocre (Figure 1). The next two clusters include somewhat less powerful national higher education systems than those of the first 2 clusters, which, however, are rapidly expanding and building the capacity: a separate cluster is formed by Austria, Chile, Costa Rica, Czech Rep., Estonia, Hong Kong, Hungary, Latvia, Lithuania, Saudi Arabia, Slovenia, and Ukraine, indicating a greater similarity between these countries compared to members of a neighboring cluster, which includes China, India,

Source: Authors' calculation.

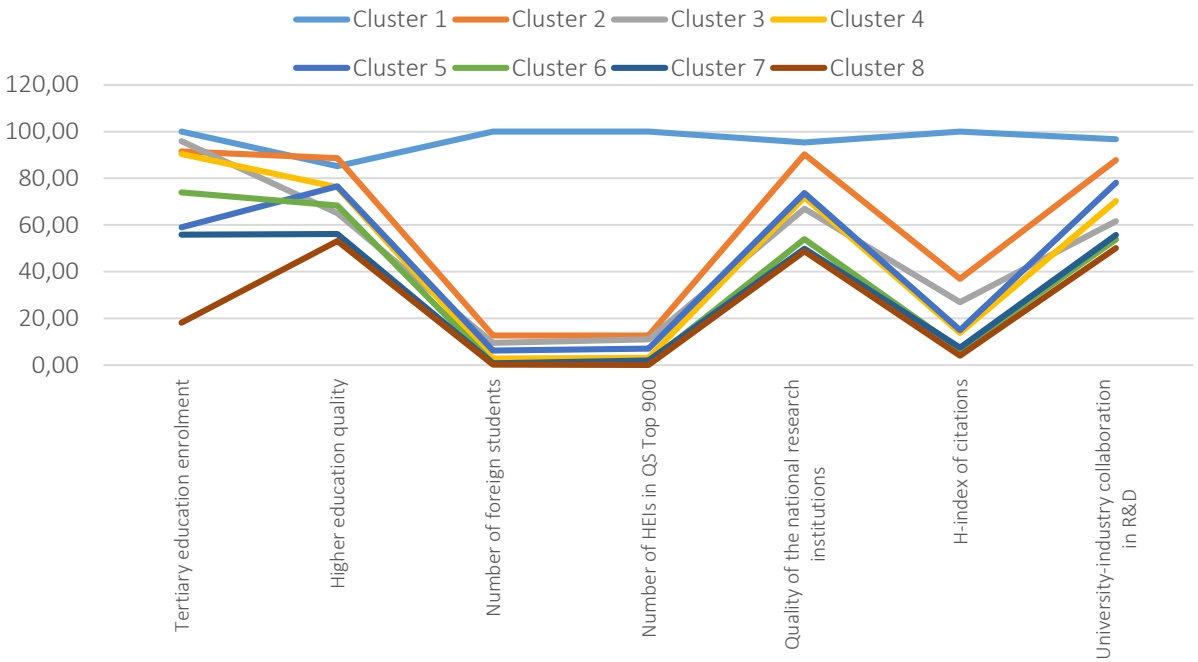

Figure 1. Graphs of means for clusters 1-8

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Indonesia, Malaysia, Qatar, South Africa, UAE. The differences between these two clusters are rather insignificant, and mainly refer to higher education enrolment rate, higher education quality, and quality of research institutions.

The last three clusters represent the higher education systems of the remaining 50 countries, which overall can be characterized as 'underperforming.' The results of 21 higher education systems' performance (cluster 6) are comparatively better. In comparison with the rest of the clusters, tertiary education enrolment rate is the lowest in 15 countries of the eighth cluster, where the higher education is still at the early stage of development with less than 15 percent of the corresponding age groups enrolled in tertiary education. However, in the majority of these countries, in recent years, this indicator grew faster than in the rest of the world.

In addition to the presented ranking and clustering with the aim of revealing the competitive positioning of the countries in terms of their higher education systems' competitiveness, it is quite relevant to supplement this study with the analysis of some global tendencies. Based on WEF (2017a), the dynamics of 4 indicators, which characterize various aspects of the national higher education systems development in the world in 2007–2017 was investigated. Comparing data on 152 countries from 2007 (as baseline) to 2017, it was estimated that the higher education systems of the vast majority of analyzed countries over the last decade have improved (with the exception of Liberia, Niger, and Hungary). The biggest increase refers to the higher education enrolment rate. This figure improved most significantly over the last decade in Serbia (more than 5 times from 10.6 to 58.3 percent), Mozambique (from 1.2 to 6.4 percent of the population), Benin, Cambodia, Oman, Cameroon, Ethiopia, Pakistan, Vietnam, Ghana, Morocco, Mali, Mauritius, China, Costa Rica, Colombia, Brazil, Burundi, Albania; and somewhat declined over the last decade in Bolivia, Qatar, Latvia, Lithuania, Liberia, Lebanon, Malaysia, Niger, New Zealand, the UAE, Sweden, and the UK.

Higher education quality increased mostly in Albania, Bahrain, Vietnam, Ecuador, Ethiopia, China, Côte d'Ivoire, Nepal, UAE, Pakistan, Peru, Saudi Arabia, Tajikistan, and Jamaica. In some countries, the higher education quality has slightly worsened over the past decade: in particular, in Austria, Belgium, Benin, Hong Kong, Denmark, Colombia, Liberia, Mauritania, Morocco, Nigeria, South Africa, Korea (Rep.), Poland, Russia, Romania, Serbia, Slovakia, Tunisia, Hungary, Czech Republic, and Japan.

The quality of the national research institutions has improved in Albania, Argentina, Bahrain, Italy, Cameroon, Cape Verde, Qatar, Côte d'Ivoire, Lebanon, Mauritania, UAE, and declined a little in Brazil, Georgia, Egypt, Oman, Malawi, and Tunisia. University-industry collaboration in R&D, according to WEF (2017a) data, has increased in Albania, Bahrain, Guyana, Guinea, Ethiopia, Indonesia, Cameroon, Qatar, Côte d'Ivoire, Lithuania, Mauritania, Madagascar, Mali, Malta, UAE, and Tajikistan. However, in some countries, this indicator has deteriorated, particularly in Greece, Denmark, Canada, Latvia, Oman, South Africa, Korea (Rep.), Slovakia, Thailand, and Czech Republic.

For the final stage of the study, the assessment of the disproportionateness of the national higher education systems' development based on calculating the Pearson's coefficients of skewness and kurtosis was performed (Table 3).

The abovementioned Pearson coefficients of skewness and kurtosis were calculated using MS Office tools (Excel), and data for 152 countries from WEF (2007–2017). Skewness makes it possible to determine the presence and size of the asymmetry in the sample; the value of the coefficient of skewness greater than |0.5| is considered significant, and less |0.25| – insignificant. The kurtosis coefficient shows how sharp the oscillation is in the studied phenomenon. If the value of this indicator is above zero, the fluctuations in database are considered significant. The negative value of the kurtosis coefficient indicates that the distribution is "flat," and the fluctuation of the phenomenon in the sample is negligible.

Trend function calculation based on the obtained results anticipates further decrease of disproportions in terms of tertiary education enrolment together with a certain leveling of higher education

Table 3. Higher education systems' Pearson coefficients of skewness and kurtosis (values) (152 countries, 4 indicators characterizing the national higher education systems), 2007–2017

Source: Authors' calculations based on WEF (2017a) data.

Year	Tertiary education enrolment		Higher education quality		Quality of the national research institutions		University-industry collaboration in R&D	
	Skewness	Kurtosis	Skewness	Kurtosis	Skewness	Kurtosis	Skewness	Kurtosis
2007	0.552886	–0.7843	0.442152	–0.67007	0.474212	–0.37002	0.769626	–0.25189
2008	0.505255	–0.81013	0.546399	–0.43826	0.443053	–0.35876	0.784388	–0.15939
2009	0.427812	–0.92057	0.554949	–0.40996	0.515208	–0.43429	0.708552	–0.13947
2010	0.390153	–0.94165	0.385642	–0.47832	0.454591	–0.49012	0.609258	–0.40673
2011	0.389056	–1.00597	0.255148	–0.45108	0.410551	–0.4469	0.372921	–0.31306
2012	0.365523	–1.01108	0.327159	–0.47194	0.488292	–0.47927	0.41288	–0.36144
2013	0.396712	–1.00844	0.367332	–0.41632	0.512056	–0.48493	0.481335	–0.40917
2014	0.32458	–1.03872	0.34633	–0.36627	0.443693	–0.41704	0.462435	–0.2628
2015	0.334829	–0.96319	0.413321	–0.39898	0.555158	–0.44889	0.551338	–0.30127
2016	0.205325	–1.11145	0.291752	–0.49169	0.425779	–0.40501	0.808899	–0.00441
2017	0.196751	–1.09833	0.371539	–0.4737	0.4587	–0.51063	0.716617	–0.2048

quality, which, combined with the decreasing kurtosis, verifies the global trend towards better average higher education quality (Figure 2).

The conducted analysis proves the leading position of the USA among the rest of the national higher education systems at present. Research universities in the United States remain the key drivers of the global competitive leadership of the higher education system (Romanovskiy, 2012). In terms of numbers, 157 out of top thousand world's best universities (and 5 out of the Top 10), according to QS (2018), are the American ones. According to Polsky Innovation Indicator, "71 percent of Americans believe research universities are a "major force" in driving U.S. innovation", which is more than the number who said that of large corporations (60 percent), start-up businesses (53 percent), or government (47 percent) (NORC at the University of Chicago, 2018). Furthermore, the study shows a significant correlation ($R = 0.92$) between the Global Innovation Index (Cornell University, INSEAD, & WIPO, 2017) and the results of the suggested national higher education systems' competitiveness index (Figure 2).

The study of contemporary higher education strategies of the highly developed countries, namely "The National Strategy for Higher Education" (France), "National Strategy for Access and Student Success in Higher Education" (UK), "National Strategy for International Education 2025" (Australia), "Strategy for American Innovation" and the U.S. Government's higher education support programs, EU higher education strategic framework "Education & Training 2020," EU Youth Strategy, national programs for higher education system's development of the Republic of Korea ("Brain Korea 21" and "World-class universities"), as well as other strategic documents in the field of higher education of the World Bank, UNESCO, international analyt-

Source: Authors' calculations based on WEF (2017a) data.

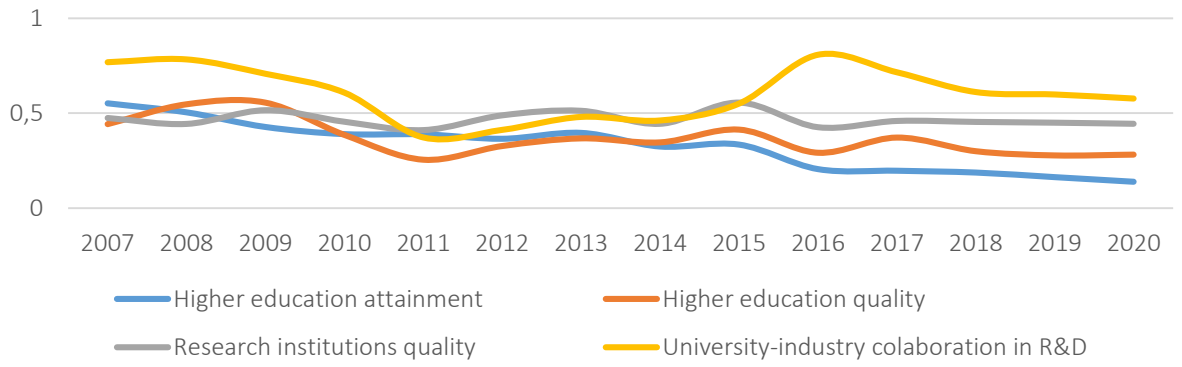

Figure 2. Higher education systems' skewness (152 countries, 4 indicators characterizing the national higher education systems) over the last decade, 2018–2021 – linear trend line estimation

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Source: Authors' calculations.

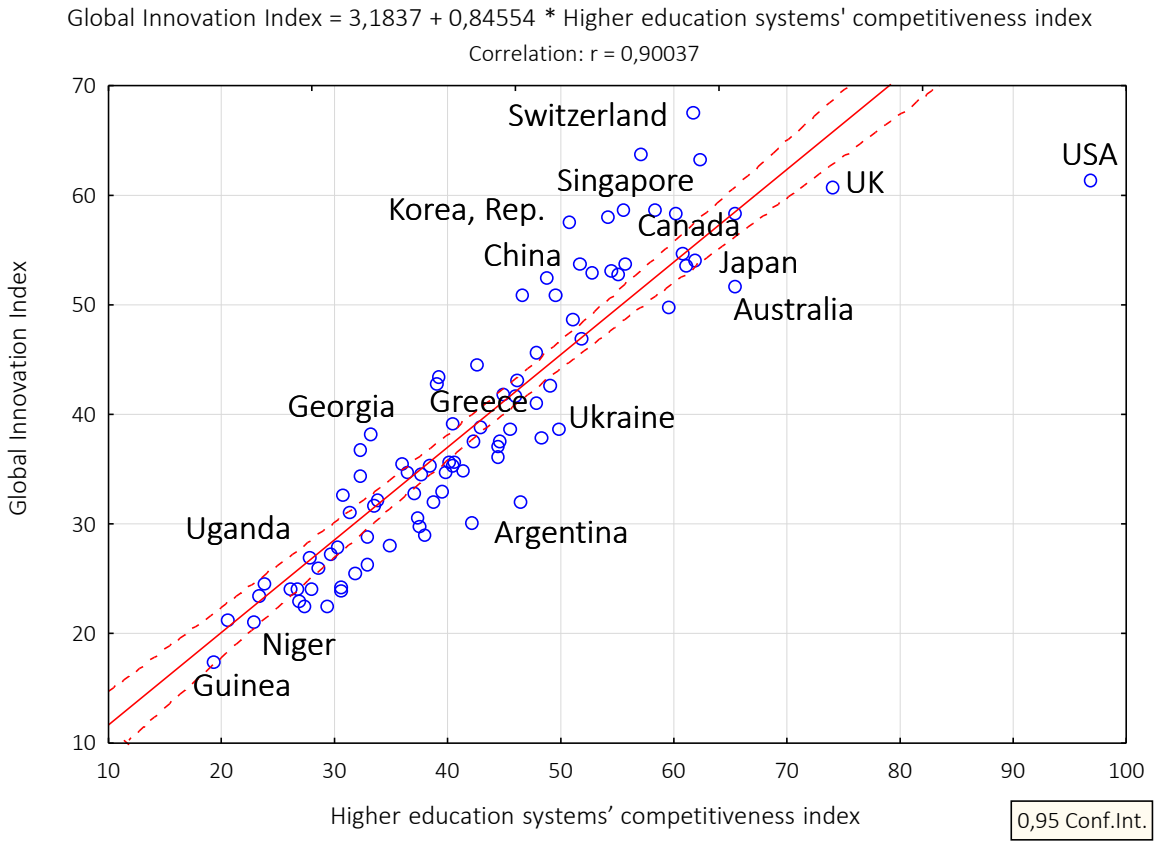

Figure 3. Scatterplot: higher education systems' competitiveness index vs. Global Innovation Index (2017)

ical agencies, etc. identified the main priorities of enhancing the competitiveness of the higher education systems. It is determined that such priorities are strengthening the research and entrepreneurial components in the universities' activities, deepening the cooperation with the industry, finding the alternative funding sources, improving the higher education quality assurance systems, increasing the academic mobility, disseminating the new teaching methods and technologies with the emphasis on student-centric approach, competencies for the future, digitalization, and providing wider access to higher education. Thus, competitive higher education systems provide the grounds for mastering the competencies, skills, and values highly demanded by the tech-driven economy.

4. DISCUSSION

Practical application of the results and conclusions of the article refers primarily to their relevance in the process of preparing the strategy, programs, and plans of the national higher education system development of Ukraine. It may also be used in further research dedicated to higher education systems' development and competitiveness, especially given the high relevance of the issues under study.

The conducted research allows to sum up that the most competitive are the national higher education systems of the highly developed countries: USA, UK, Switzerland, Germany, Australia, Japan, as well as of the new industrialized countries, which managed to achieve the significant results in terms of building their intellectual capital over the past two decades, such as Singapore, Korea (Rep.), and China. The results of the ranking are overall consistent with the U21 National Higher Education Systems' Ranking (Williams, Leahy, & Jensen, 2017).

The countries of the world are significantly diversified in terms of higher education quality and enrolment rates. Competitive higher education systems are primarily characterized by high quality of

both educational and research components. At the same time, the dynamics of higher education systems' performance in recent years (based on the indicators of higher education quality, attainment, quality of the national R&D institutions, and university-industry collaboration in R&D) is the best in some least developed countries, i.e., Albania, Bahrain, Bulgaria, Burundi, Vietnam, Guyana, Guatemala, Ecuador, Ethiopia, Cambodia, Cameroon, China, Mali, Malta, Pakistan, Chile; also, all four indicators improved (albeit less) in Argentina, Bhutan, Armenia, Honduras, Italy, Côte d'Ivoire, Madagascar, Mexico, Netherlands, Germany, Peru, Saudi Arabia, Sierra Leone, Ukraine, and Switzerland.

In terms of the disproportionateness of the national higher education systems' development worldwide, the conducted analysis reveals the reduction of gaps among countries in terms of tertiary education enrolment, and to some extent – of higher education quality, as well as their instability or preservation in terms of university-industry collaboration in R&D and quality of research institutions. Thus, we argue that while for the developing higher education systems, the enhancement of higher education quality is the key priority nowadays, the drivers of their competitiveness lay within enhancing the research universities and broadening their innovative role in the society.

There are various ways the research universities can support the innovation. Acting as economic accelerators, they foster a culture of entrepreneurship and encourage the collaboration with the private sector. According to the Association of University Technology Managers data, academic technology transfer contributed up to USD 591 billion to U.S. gross domestic product in 1996–2015, supported 4.3 million jobs. In the past 25 years, more than 80,000 U.S. patents were issued to research institutions, and more than 11,000 start-ups were formed (Jahanian, 2018). Overall, the influence of the best research universities is not limited to a national higher education system, as due to intellectual leadership, they naturally become the global players. Apart from that, the research universities are designed to combine public and private missions, expanding the opportunity for diversity and inclusion, and "exploring the nexus of technology and society" (Jahanian, 2018). Moreover, they should work together as a "network for the public good" (Maret & Salmi, 2018), showing the best example of international collaboration, ethics, objectivity, and relevance while addressing the global challenges.

Nationwide, higher education strategies of some of the most innovative countries and the key priorities outlined in them show that the main target directions of higher education systems development at present include developing the effective instruments for sharing best practices; creating the attractive environment for international students; adding the value for the economy through strengthening the collaboration within national innovation systems in R&D; enhancing the quality management systems, as well as innovative educational methods and technologies through taking advantage of student-cantered approach, dual learning, online learning, project-based learning, gamification, digitalization etc. aiming at development of global competencies, and providing the access to qualitative higher education to wider society in order to bridge the skills gaps; diversifying the funding sources; optimizing the universities' management and organizational structures in order to enhance the efficiency. With regard to that, quality assurance in the European Higher Education Area (EHEA), as well as various tools and approaches such as the European Foundation for Quality Management (EFQM) Excellence Model (Mulé, 2016), can be a reference point on the roadmap to enhancing higher education quality and competitiveness.

CONCLUSION

A more integrated and comprehensive approach towards higher education functions and university's role in the contemporary society wins ground worldwide. Thus, due to many limitations that any ranking methodology has, it may not become the prevailing tool and starting point for setting the performance indicators for higher education systems' management, although the global rankings may supplement it as a valuable source of information.

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The performed study allows concluding that the higher education systems' development across countries is characterized by significant imbalances, which shows the dominance of the most innovative countries. The conducted analysis of the dynamics and disproportions in higher education across countries verifies the overall improvement of the higher education systems' development indicators, especially with regard to an increasing tertiary education enrolment rate. This indicates further stability in terms of global demand for higher education services. Furthermore, with the signs of rather slow, but steady levelling of higher education quality across countries and increase of international student mobility, the universities of the top innovator countries become more specialized and focused on qualitative participation within the communities, entrepreneurship, clusters, and wider society.

Therefore, the global competitiveness of the national higher education systems nowadays is conditioned by the establishment of effective collaboration mechanisms within their institutional structure and determined by the ability of universities to provide high-quality educational, scientific, expert services and to guarantee that the graduates master the global competencies. Competitive leadership of the national higher education systems of the most innovative countries is based on consistent state support for educational and research activities, continuous improvement of the resource base of the scientific and research institutions, significant financial investments and diversification of their sources, high quality standards, university management efficiency, ability to provide wider access to higher education, deep integration into the national innovation system and the global research networks, university autonomy, and ability to perform continuous innovation. These directions may further become the strategic priorities for the development of higher education systems. Given such a wide range of goals, it is of high importance for the universities to make their organizational management systems highly efficient, identify clearly and strengthen their competitive advantages, finding a niche in a highly competitive but increasingly mobile and diversified higher education environment. On the other hand, moving with the times, the best universities' practices show that it is necessary not to lose focus on primary functions and core mission of the higher education within the society, and not to discontinue but step up the mechanisms to provide them. And with regard to those primary goals, which any developing higher education system should pursue in order to boost its performance, it is suggested that the emphasis should be given to upgrading the higher education management (and quality assurance) systems, and broadening the universities' role within the national innovation system.

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APPENDIX A

Table A1. Data used for calculations of Higher Education Systems' Ranking and cluster analysis (standardized)

Country	Tertiary education enrolment	Higher education quality	Number of foreign students	Number of HEIs in QS Top 900	Quality of the national research institutions	H-index of citations	University-industry collaboration in R&D
Albania	77.14	75.41	0.20	0	35.94	2.69	38.33
Algeria	68.57	52.46	0.87	0	46.88	5.95	38.33
Argentina	97.14	62.3	9.02	10.39	68.75	16.83	60
Armenia	77.14	63.93	0.46	0	50	7.57	51.67
Australia	100	86.89	38.70	21.43	90.63	39.76	80
Austria	92.86	78.69	7.51	4.55	79.69	27.31	78.33
Bahrain	70	78.69	0.57	1.3	54.69	3.08	55
Belgium	91.43	95.08	4.57	4.55	93.75	33.26	93.33
Benin	30	50.82	0.90	0	57.81	3.65	45
Bolivia	64.29	50.82	0.12	0	43.75	4.94	58.33
Brazil	65.71	50.82	2.10	14.29	56.25	23.11	63.33
Bulgaria	87.14	65.57	1.24	0.65	57.81	10.32	50
Burundi	14.29	42.62	0.18	0	37.5	1.79	46.67
Cameroon	25.71	63.93	0.40	0	53.13	5.27	56.67
Canada	84.29	90.16	21.32	16.88	84.38	48.35	81.67
Cape Verde	62.86	65.57	0.01	0	51.56	0.95	53.33
Chile	92.86	68.85	0.48	7.14	64.06	14.41	70
China	64.29	70.49	15.95	19.48	65.63	31.58	73.33
Columbia	78.57	59.02	0.46	6.49	57.81	10.43	65
Costa Rika	78.57	77.05	0.05	1.95	71.88	7.68	73.33
Côte d'Ivoire	17.14	73.77	0.48	0	62.5	4.99	55
Czech Rep.	87.14	73.77	4.49	2.6	73.44	18.06	66.67
Denmark	97.14	85.25	3.41	3.25	85.94	31.3	81.67
Dominican Republic	65.71	49.18	0.98	0	45.31	2.86	55
Ecuador	74.29	65.57	0.07	1.3	53.13	6.23	65
Egypt	64.29	40.98	0.05	3.25	40.63	10.32	40

Table A1 (cont.). Data used for calculations of Higher Education Systems' Ranking and cluster analysis (standardized)

Country	Tertiary education enrolment	Higher education quality	Number of foreign students	Number of HEIs in QS Top 900	Quality of the national research institutions	H-index of citations	University-industry collaboration in R&D
Estonia	95.71	83.61	0.40	1.3	81.25	10.38	73.33
Ethiopia	14.29	60.66	0.05	0	56.25	5.66	58.33
Finland	100	95.08	2.45	5.84	90.63	26.86	100
France	84.29	81.97	26.23	26.62	87.5	49.24	76.67
Georgia	70	60.66	0.81	0	43.75	6.39	43.33
Germany	85.71	85.25	26.28	27.27	90.63	53.9	88.33
Ghana	40	63.93	1.32	0.65	56.25	5.89	58.33
Greece	100	62.3	2.55	3.9	59.38	19.85	51.67
Guatemala	41.43	54.1	0.05	0	51.56	3.87	60
Guinea	17.14	40.98	0.05	0	35.94	3.87	36.67
Guyana	57.14	68.85	0.05	0	54.69	1.79	63.33
Honduras	47.14	60.66	0.97	0	53.13	2.86	65
Hong Kong	90	90.16	3.49	4.55	75	21.99	76.67
Hungary	85.71	65.57	2.91	2.6	75	18.45	71.67
India	48.57	67.21	4.74	9.09	64.06	23.89	65
Indonesia	62.86	73.77	0.79	5.84	67.19	8.69	75
Iran	80	60.66	1.70	1.3	62.5	11.16	53.33
Ireland	91.43	86.89	2.03	5.19	85.94	20.42	86.67
Israel	90	75.41	1.07	3.9	96.875	30.06	91.67
Italy	87.14	70.49	9.91	16.88	73.44	42.96	61.67
Japan	85.71	78.69	16.69	24.68	90.63	44.7	83.33
Korea (Rep.)	100	52.46	7.19	16.88	75	26.7	76.67
Latvia	88.57	75.41	0.62	0.65	64.06	6.28	61.67
Lebanon	67.14	81.97	2.00	1.95	51.56	7.74	48.33
Lithuania	92.86	80.33	0.59	2.6	73.44	8.08	76.67
Madagascar	17.14	54.1	0.24	0	51.56	4.15	55
Malawi	15.71	47.54	0.00	0	46.88	5.83	46.67
Malaysia	57.14	88.52	10.23	5.19	82.81	10.66	88.33
Mali	21.43	54.1	0.07	0	57.81	4.21	53.33
Malta	71.43	81.97	0.11	0	60.94	4.66	65
Mauritania	14.29	44.26	0.21	0	37.5	1.79	33.33
Mauritius	74.29	70.49	0.21	0	53.13	3.03	53.33
Mexico	64.29	55.74	2.55	9.09	64.06	17.72	66.67
Moldova	72.86	60.66	0.40	0	42.19	4.49	45
Morocco	42.86	59.02	2.04	0	50	7.23	53.33
Mozambique	14.29	45.9	0.06	0	46.88	4.09	55
Nepal	40	59.02	0.00	0	39.06	5.27	43.33
Netherlands	95.71	93.44	9.78	10.39	93.75	42.18	90
New Zealand	97.14	90.16	5.35	5.19	84.38	21.7	81.67
Niger	21.43	49.18	0.28	0	39.06	3.31	46.67
Norway	94.29	90.16	0.91	2.6	84.38	24.62	83.33
Oman	67.14	55.74	0.31	0.65	45.31	5.1	60
Peru	74.29	77.05	0.00	1.95	45.31	8.64	51.67
Poland	92.86	68.85	6.49	3.9	60.94	22.49	58.33
Qatar	58.57	95.08	1.12	0.65	87.5	4.82	90
Romania	80	68.85	2.62	2.6	57.81	10.49	60
Ruanda	14.29	68.85	0.14	0	59.38	3.03	61.67
Russia	94.29	68.85	25.45	13.64	62.5	23.61	60
Saudi Arabia	84.29	68.85	7.95	4.55	64.06	10.94	70
Serbia	82.86	60.66	1.18	0.65	59.38	10.94	53.33

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Table A1 (cont.). Data used for calculations of Higher Education Systems' Ranking and cluster analysis (standardized)

Country	Tertiary education enrolment	Higher education quality	Number of foreign students	Number of HEIs in QS Top 900	Quality of the national research institutions	H-index of citations	University-industry collaboration in R&D
Sierra Leone	21.43	44.26	0.00	0	34.38	1.74	40
Singapore	98.57	100	5.40	1.3	87.5	21.99	93.33
Slovak Rep.	82.86	65.57	1.09	0.65	60.94	6.62	56.67
Slovenia	100	80.33	0.31	0.65	75	11.44	66.67
South Africa	61.43	50.82	4.60	5.84	73.44	17.95	75
Spain	100	70.49	6.59	11.69	68.75	36.34	63.33
Sri Lanka	60	75.41	0.13	0.65	67.19	6.73	51.67
Sweden	91.43	85.25	2.92	5.19	89.06	37.35	88.33
Switzerland	82.86	100	5.42	5.19	100	41.73	96.67
Tajikistan	61.43	67.21	0.23	0	57.81	1.63	55
Thailand	77.14	67.21	3.21	5.19	62.5	13.24	66.67
Tunisia	71.43	62.3	0.65	0	46.88	6.9	48.33
UAE	60	90.16	6.54	3.9	75	7.29	80
Uganda	14.29	55.74	0.00	0.65	54.69	7.18	61.67
Ukraine	97.14	70.49	5.36	3.9	65.63	10.54	58.33
United Kingdom	85.71	86.89	44.24	46.1	98.4375	61.64	95
USA	100	85.25	100.00	100	95.3125	100	96.67
Vietnam	52.86	63.93	0.42	0	51.56	7.96	55

APPENDIX B

Table B1. Indicators base

Indicator
"Share of population with tertiary education or higher"
"Tertiary education graduates, total number"
"Unemployment rates for those with tertiary education"
"Governmental expenditure in higher education (% of GDP)"
"Governmental expenditure in higher education per student, USD PPP"
"Expenditure in higher education as % of total government expenditure"
"Number of teachers in HEIs"
"International attractiveness of the higher education system" (% of total number of international students)
"Ability to retain talent"
"Skills disproportions in population"
"Higher education quality"
"Number of scientists and researchers (per 1 million people)"
"Number of scientific articles published"
"Citation indicators"
"Quality of national research institutions"
"Labor efficiency rate (per 1 employee)"
"Possibilities for advanced training and lifelong learning"
"Availability of high quality advanced training programs and courses"
"Number of national HEIs in global Top 1,000"
"Cluster development index"
"Total expenditure for science and research (% of GDP)"
"ICT infrastructure development index"
"University-industry collaboration in R&D"
"Higher education system compliance with economic needs"