

A Country's Economic Growth and Rankings of Higher Education Institutions: Is There a Relationship?

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Abstract – The components of the chain of influence of the HEI ranking on the economic growth of the country are studied in the article. The relation between the keywords university, rankings and economic was found based on the bibliometric analysis. Based on correlation and regression analysis, there has been proved the relation between the components of interaction in the chain: Total overall ranking score of universities in the country – number of FTE students enrolled in country's rated HEIs – number of country's rated Universities – GDP of the country. The confirmation of the obtained calculations is a questionnaire survey carried out among the students of the HEIs. The results of the questionnaire survey indicate the existence of the influence of the HEI ranking on the number of students enrolled in educational institutions of the studied country. Thus, based on correlation and regression analysis and sociological research, the article proves the hypothesis about the existence of the influence of the HEI ranking on the economic growth of the country.

Keywords – university, HEI ranking, GDP, Sustainable Development Goals, economic growth.

1. Introduction

In the era of globalization, it is not only the joint economic integration of countries observed but also a tendency for the globalization of education.

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International university rankings play a facilitating role in this process. This is important for entrants, as the ratings help in choosing the HEI. The prospect of the particular HEI existence will depend on how many students choose it. Therefore, we can talk about the existence of dependence between the number of students and the number of HEIs in the respective country. In return, the tendency for the formation of a high-quality learning environment in the country will depend on the number of such HEIs. This in its turn complies with the Sustainable Development Goals, namely Goal 4 – Quality Education. The aim of Goal Quality Education is to improve the quality of higher education and to ensure its strong linkages with science, to contribute to the formation of cities of education and science in a country. In addition, it is known due to the analysis of a significant number of literature sources and studies [11], [18], [33], that the GDP indicator is the main indicator while assessing sustainable development and economic growth.

Thus, analyzing the above sequence of influences, it was observed the presence of growth poles in the studied chain of interactions: Total overall ranking score of universities in the country – number of FTE students enrolled in country's rated HEIs – number of country's rated Universities – GDP of the country. At the same time, the ranking of HEI becomes such a growth pole in our research.

2. Literature Review

According to the bibliometric analysis carried out in Scopus Database based on the use of the VOSviewer program (version 1.6.17) (Figure 1), it was determined that a significant number of scientists were engaged in studying the influence of ranking on economic growth. In particular such authors as Benito, M., Gil, P., Romera, R. [8], Artiukhov, A. Y., Vasylieva, T. A., Lieonov, S. V. [3].

Such authors Frederick, D. T., & Kasztelnik, K. [16], [17], Luque-Martínez T., Faraoni N. [23], Perović L. M., Kosor M. M. [35], Nacheva R., Sulova S. [29], Osipov G., Karepova S., Ponkratov V., Karaev A., Masterov A., Vasiljeva M. [32], Perchinunno P., Cazzolle M. [34], Prisyanti A., Nurhayati O. D.,

Widodo A. P. [36], Lyeonov, S., & Liuta, O. [25], Novikov, V. [31], Xu C. [44] in their works identified and analyzed the factors influencing the ranking of universities.

The relationship between the ratings of higher education institutions and the quality of education was considered by the following authors: Aleu F. G., Gutierrez E. M. A. G., Garza-Reyes J. A., Villegas J. B. G., & Hernandez J. V. [1], Artyukhov A. [6], Vasylieva T., Lyeonov S. [3], [4], [5], Bruni R. at all [9], Buhaisi I., Damagh Al Z. [10], Liuta O. [24], [27], Degtjarjova I., Lapina I., & Freidenfelds D. [13], Dźwigoł H. [14]. The relationship between University prestige, cultural distance of the place of education and wage was considered by Argue, A. J., & Velema, T. A. [2]. Fast R. [15] studied the effects of education on a decrease the rate of violent crime as case as the US state of Alabama.

Vorontsova A., Vasylieva T., Lyeonov S., Artyukhov A., Mayboroda T. [42], Samusevych Y. V., Novikov V. V., Artyukhov A. Y., & Vasylieva T. A. [37], Novikov V.V. [30], Cosmulese C.G., Grosu V, Hlaciuc E., Zhavoronok A. [12], Shkarlet S., Kholiavko N., Dubyna M. [38] found a significant impact of digitalization on the development of universities and the quality of services in higher education. Scientists Sarsenbayeva A., Makarikhina I. [39] described the impact of globalization on higher education. Kuzmin Y. and all developed an economic and mathematical model of the processes of managing and financing the training of students in higher education [21].

Bautista-Puig N., & Casado E. S. [7], Kioupi V., & Voulvoulis N. [20], Matvieieva Yu., Opanasyk Yu., Pavlenko O. and Myroshnychenko Iu. [26], Vorontsova A., Vasylieva T., Bilan Y., Ostasz G., Mayboroda T. [41] studied the quality of education in the context of the Sustainable Development Goals.

Therefore, in this research, three clusters were identified by the following keywords: university and rankings and economic.

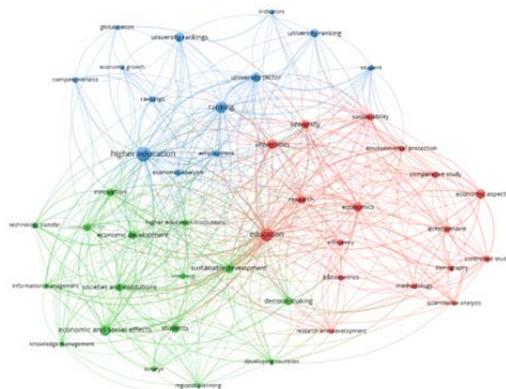


Figure 1. Three research clusters by key words university and rankings and economic in Scopus Database according to the bibliometric analysis based on using VOSviewer program (version 1.6.17)

The first cluster contains such key words as economic aspects, comparative study, economics, research, university. The second cluster includes the key words as follows: economic and social effects,

economic development, higher education institution, students, sustainable development. The third cluster in its turn covers the following key words: university rankings, university sectors, higher education, economic grows and globalization.

Figure 2 shows the relationship between University rankings and economic growth. The study of University rankings suggests that strongest relationship is observed with the concepts high education, student, economic development, university sectors, economic growth, sustainable development. It is proved by the size of the snowballs in Figure 2. The larger the snowball, the more researches by this chain of relations have been identified.

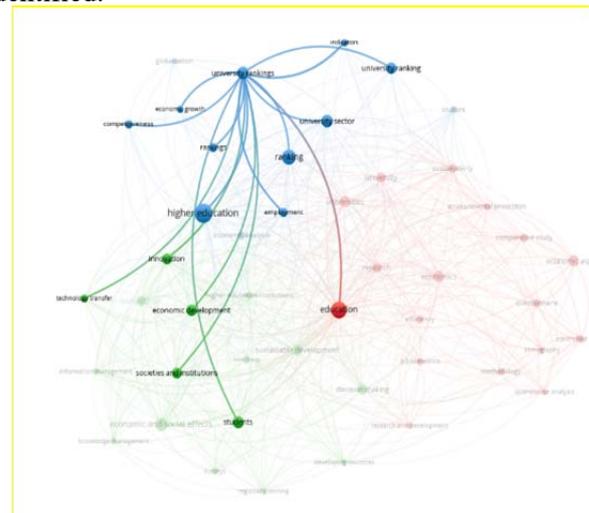


Figure 2. Identifying the bibliometric links by key word University rankings in Scopus Database according to the bibliometric analysis based on using VOSviewer program (version 1.6.17)

3. Methods

There are three stages of research determined in the article. At the first stage, the HEIs rankings are determined. For this purpose, on the basis of the HEIs ranking, given on the website of the Times Higher Education (Britain) [40], a sample of countries with the maximum total overall ranking score of the higher educational institutions was selected and the ranking of the corresponding countries was carried out.

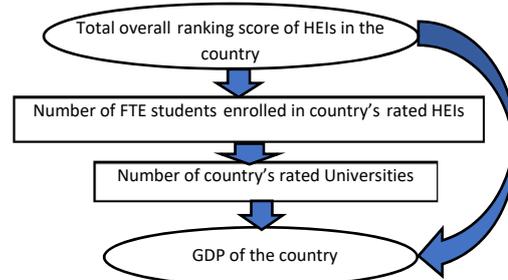
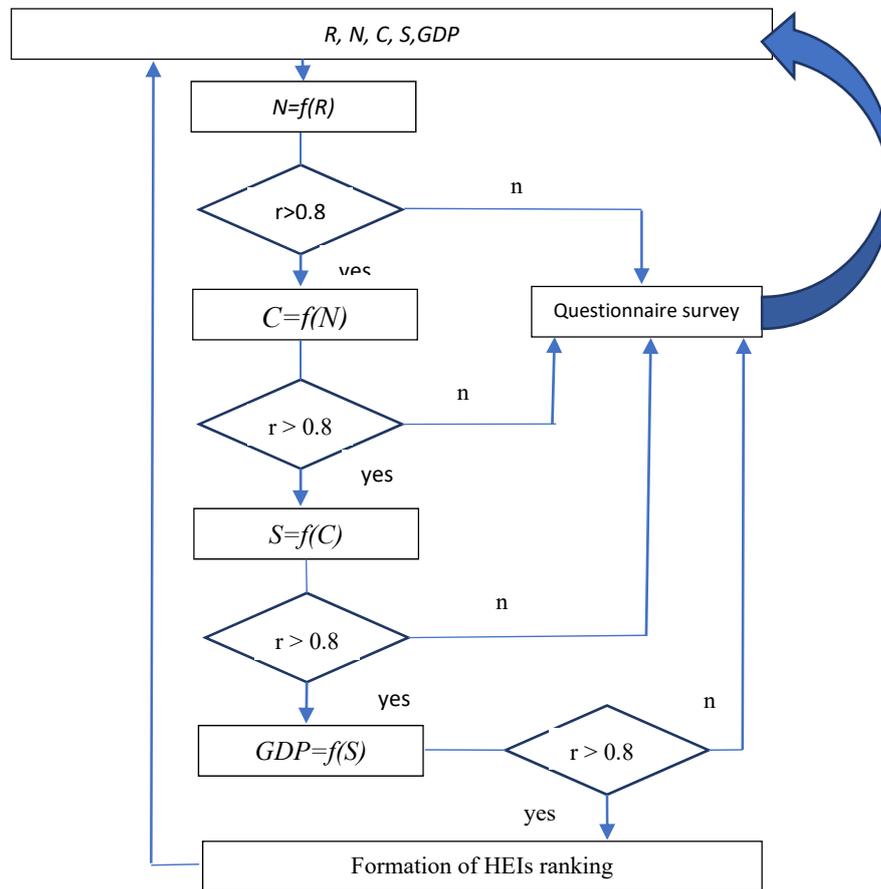


Figure 3. The chain of interactions within the system: Total overall ranking score of universities in the country – number of FTE students enrolled in country's rated HEIs – number of country's rated Universities – GDP of the country

At the second stage of the research, the correlation and regression analysis was carried out to determine stage-by-stage the strength of relationship in the chain of interactions: Total overall ranking score of universities in the country – number of FTE students enrolled in country’s rated HEIs – number of country’s rated Universities – GDP of the country (Figure 3).

To determine the influence of the HEIs ranking on economic growth, an algorithm for conducting this research is suggested (Figure 4).

At the third stage, a questionnaire survey was carried out to analyze the influence of the HEI ranking when students choose this or that HEI.



Notes: *) assessment scale of the strength of Chaddock's stochastic dependence is used for the assessment of the closeness of the interdependence between the values. According to this scale: if $r \geq 0.8$ - the dependence is close

Figure 4. The algorithm for conducting research on estimating the influence of the ranking on the country's economic growth

where, GDP – GDP, as key indicator of economic growth, R – Total overall ranking score, N – number of FTE students, C – number of universities in the country, S – Government expenditure on education, total (% of GDP)

Thus, the dependence between the studied components in the chain of interactions: Total overall ranking score of universities in the country – number of FTE students enrolled in country’s rated HEIs – number of country’s rated Universities – GDP of the country can be presented as following formula (formula 1)

$$\begin{cases} GDP_i = f(R_i, N_i, C_i, S_i) \\ N_i = f(R_i) \\ C_i = f(N_i) \\ S_i = f(C_i) \\ i = 1 \dots n \end{cases} \quad (1)$$

where GDP – indicator of economic growth of the country i, expressed in terms of gross domestic product indicator, million dollars; R – Total overall ranking score, calculated for country i, points; N – number of FTE students enrolled in HEIs of country

i, thousand people; C – number of universities in the country i, units; S – government expenditure on education, calculated for the country i, million dollars; i – country that is analyzed in the research; n – number of countries that are involved in the research.

4. Results

Within the first stage of the research, we analyzed THE World University Rankings on the website of Times Higher Education (Britain). According to the Times Higher Education methodology, all higher education institutions (HEIs) are ranked in THE World University Rankings according to total overall ranking score (R), which depends on certain constituent elements – 13 performance indicators, which are divided into 5 key areas (categories): 1) Teaching (the learning environment), 2) Research, 3) Citations (research influence), 4) International outlook, and 5) Industry income (knowledge transfer).

The first three categories of performance indicators of this ranking have the greatest weight – the each makes 30%. The last two categories share 10% of the total overall ranking score, namely 7.5% – International outlook and 2.5% – Industry income.

The first category (teaching) consists of 5 indicators, the second category (research) consists of 4 indicators and the most significant ones among them are Reputation Survey (15% and 18%, respectively).

The third category (citations) consists of one performance indicator, namely citations of published articles in journals indexed in Elsevier's Scopus Databases, and makes 30% of the total overall ranking scores [19], [40].

We have selected the HEIs ranked in the TOP 400 and for the correct comparison of the information, the pre-covid period was chosen – the ranking for 2019. The ranking of countries was carried out according to the total overall ranking score (R). The impact of the Covid-19 pandemic on higher education was studied by Moskovicz, A. in the article [28].

The total overall ranking score of all the country's HEIs that entered the TOP 400 was determined as follows:

- for the HEIs that entered the THE World University Rankings from 1 to 200 positions by their individual total ranking score given in table [1];
- for the HEIs, which were ranked from 201 to 250, it is accepted as 51.3 – the average value within the range 49.5-53.0 that is the same for all HEIs from this range;
- for the HEIs that are next in ranking list from 251 to 300 position – 47.9 that is the average value within the range of 46.4-49.4;

- for HEIs that ranked from 301 to 350 – the average ranking score makes 45.2 for all HEIs within the range 44.0-46.3;
- for HEIs ranked 351 to 400 the average value makes 42.8 within the range 41.7-43.9.

The TOP 400 was entered by HEIs from 41 countries of the world. While calculating the total overall ranking score of all HEIs of the country that were ranked as the most rated HEIs in the world, we were able to list the TOP 20 countries of the world by this indicator. At the same time, this ranking (TOP 20 countries of the world) includes 356 HEIs, that is, 89% of the 400 HEIs that we studied. The results of the research are given in Table 1.

While analyzing Table 1, it can be mentioned that the TOP 20 ranking of countries with the highest total overall ranking score of the HEIs was entered by countries of North America, Europe, Asia and Australia. The country with a highest total overall ranking score of 6462.7 is United States. It holds leading position and the number of high-rated HEIs that entered the TOP 400 according to the Times Higher Education ranking in this country is the highest and makes 107. However, there are countries that have the highest estimated arithmetic mean ranking of the country's HEIs, for example, in Hong Kong, only 5 universities entered this ranking, but the arithmetic mean rating score is 67.5 compared to the same indicator in the United States – 60.4. In addition, such countries as Switzerland and the Netherlands are ahead of the United States by this indicator – 64.4 and 61.7, respectively.

The number of FTE students and the number of foreign students studying at the rated HEI is the largest in the United States and makes 2609.3 thousand and 404.6 thousand people, respectively. It should be noted that number of FTE students per one full-time lecturer is the smallest in Finland (6 people), Denmark (9 people), USA (12 people), Sweden (12 people), and the largest number is in Germany (40 people) and Belgium (34 people).

Due to the lack of data on the Government expenditure on education indicator in 2019, the values of this indicator were calculated in the research. For this purpose, based on the exponential smoothing method, a forecast for the Government expenditure on education indicator was made based on actual data for 2013-2017 (based on source [43]).

The statistical information was analyzed at the second stage of the research.

Thus, table 2 is based on the data of table 1 and formula 1. It provides calculated data for visual comparison and plotting graphical trends of interdependencies between studied indicators. Since the total number of countries for which the correlation and regression analysis was carried out (Table 3) in this research is quite large and amounts

to 41 countries, it is suggested, for clarity, to carry out a graphical analysis using the case study of ten countries. These 10 countries are ranked first according to Total overall ranking score.

Table 1. Summary table of the TOP 20 countries (ranked in the TOP 400 according to THE World University Rankings) according to the total overall ranking scores of the HEI and economic indicators for 2019

	Countries	Total overall ranking score of the HEI, points, R	Number of universities of a country ranked in TOP 400 according to Times ranking, C	Estimated arithmetic mean ranking of the country's HEIs	Number of FTE students enrolled in the HEI ranked in TOP 400, N		Average academic staff-to-student ratio for country	GDP of the country, billion dollars	Government expenditure on education, (% of GDP), S
					Total	Including foreign students, people			
1	United States	6462.7	107	60.4	2609.3	404.6	12	21433.2	4.93
2	United Kingdom	2738.3	47	58.3	796.6	283.2	15	2830.8	5.51
3	Germany	2176.9	39	55.8	1039.5	150.8	40	3861.1	4.9
4	Australia	1291.2	24	53.8	639	183.3	28	1396.6	5.22
5	Canada	912.5	16	57	534.6	114.5	21	1741.6	5.5
6	Netherlands	801.7	13	61.7	244.3	45.2	17	907.1	5.4
7	Italy	760.5	16	47.5	436.8	28.4	22	2004.9	4.03
8	France	719.7	14	51.4	433.9	74.5	18	2715.5	5.45
9	China	682.4	12	56.9	429.1	42.1	13	14279.9	4.98
10	Sweden	550	10	55	172.3	22.5	12	531.3	7.56
11	Switzerland	515.5	8	64.4	118	34.5	15	731.5	5.09
12	South Korea	492.1	9	54.7	149.1	25.3	15	1646.7	4.33
13	Belgium	384.8	7	55	180.4	34.4	34	533.3	6.51
14	Hong Kong	337.7	5	67.5	78.3	26.5	19	363	3.81
15	Japan	330.3	6	55.1	114.4	11.8	25	5064.9	2.72
16	Denmark	327.7	6	54.6	127.1	21	9	350.1	4.79
17	Finland	301.7	6	50.3	78.3	6.9	6	268.9	6.90
18	Ireland	295	6	49.2	79.8	18.6	24	398.6	4.24
19	Spain	257.8	5	51.6	130	17.5	13	1393.5	4.28
20	Austria	250.9	5	50.2	76	22.6	17	445.1	5.46

Calculated on the basis of [40, 43]

Table 2. Data to identify the interdependencies between the studied indicators R, N, C, S and GDP

Country	Total overall ranking score, points, R	Number of FTE students, thousand people, N	Number of Universities, units C	Government expenditure on education*, million dollars, S	GDP (current US\$), million dollars
United States	6462.7	2609.3	107	1071.660	21433.2
United Kingdom	2738.3	796.6	47	141.541	2830.8
Germany	2176.9	1039.5	39	193.056	3861.1
Australia	1291	639.0	24	69.829	1396.6
Canada	912.5	534.6	16	87.079	1741.6
Netherlands	801.7	244.3	13	45.353	907.1
Italy	760.5	436.8	16	80.196	2004.9
France	719.7	433.9	14	135.776	2715.5
China	682.4	429.1	12	713.995	14279.9
Sweden	550	172.3	10	39.846	531.3

* Calculated by the authors based on the actual values of GDP and the forecast of the indicator "Government expenditure on education" given in Table 1.

Based on data of table 2, the figure 5 shows the interdependencies between the studied indicators R, N, C, S and GDP.

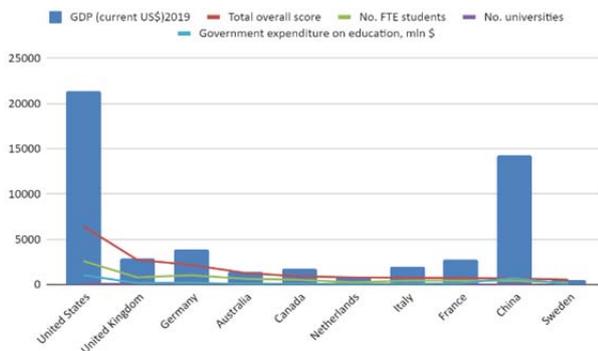


Figure 5. Interdependence between the studied components in the chain of interactions: Total overall ranking score of universities in the country – number of FTE students enrolled in country’s rated HEIs – number of country’s rated Universities – GDP of the country

For clarity, let us consider the trends of change in the studied indicators for ten countries that are selected for detailed analysis in this research (Figure 6).

Based on formula (1) and correlation and regression analysis, an assessment of the influence on the economic growth of the factors under research was carried out: Total overall ranking score, Number of FTE students, Number of Universities and

government expenditure on education. This assessment was carried out by gradually replacing the basic value of each factor indicator with a performance indicator. This method will make it possible to forecast trends in the development of the market educational services in the future and be the basis of marketing research in this area. [22]. The authors calculated a single and multiple regression of the dependence of the GDP indicator on the mentioned factors. The research results are presented in the matrix (Table 3).

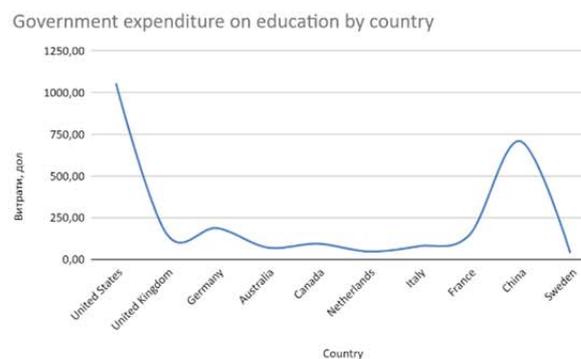
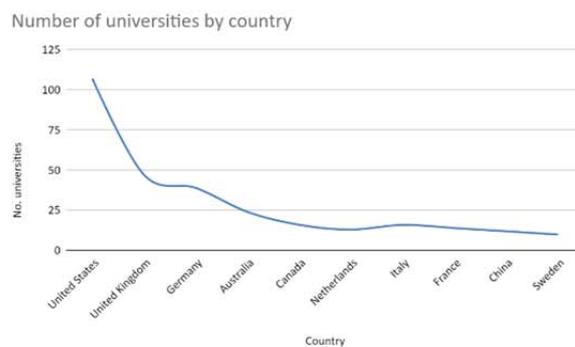
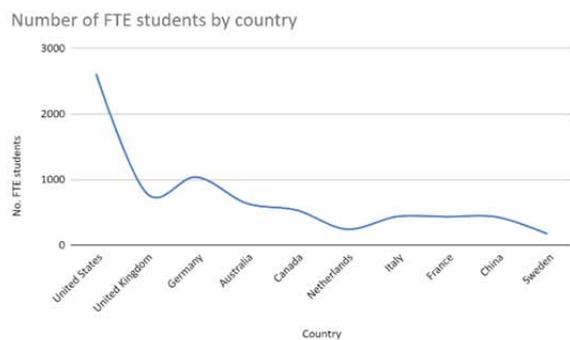
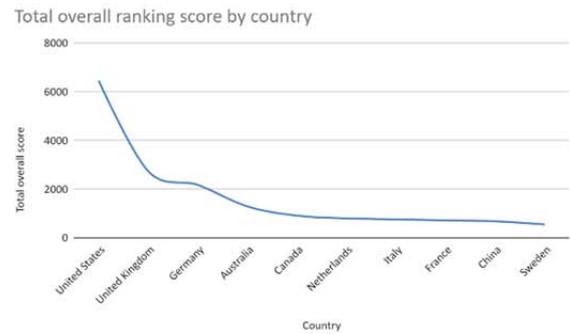


Figure 6. The trends of change in the studied indicators for ten countries that are selected for detailed analysis

Table 3. The matrix of interdependencies of the studied indicators R, N, C, S, GDP based on correlation and regression analysis

Y=f(X)		X				
		Total overall ranking score, points, R	Number of FTE students, thousand people, N	Number of Universities, units, C	Government expenditure on education, million dollars, S	GDP (current US\$) million dollars
Y	Total overall ranking score, points, R		$N=2506,11+401,13*R$ $r=0,98$ $r^2=0,96$	-	-	-
	Number of FTE students, N	$N=2506,11+401,13*R$ $r=0,98$ $r^2=0,96$		$C=0,77+0,00004*N$ $r=0,98$ $r^2=0,97$	-	-
	Number of Universities, units, C	$C=0,59+0,014*K+0,432*10^{-6}*N$, $r=0,99$ $r^2=0,99$			$S=4,02+8,41*C$ $r=0,79$ $r^2=0,63$	-
	Government expenditure on education, million dollars, S	$S=44,88+0,86*K+0,8*10^{-3}*N-63,88*C$, $r=0,87$ $r^2=0,76$				$GDP=72,77+20,24*S$ $r=0,99$ $r^2=0,98$
	GDP (current US\$) million dollars	$GDP=55,19-0,68*K-0,9*10^{-3}*N+55,02*C+21,07*S$, $r=0,99$ $r^2=0,98$				

Analyzing the value of the correlation coefficient (r), we can conclude that the values range from 0.79 to 0.99. This means that a tight relationship was found between the studied factors and the performance indicator. The value of the coefficient of determination r² ranges from 0.63 to 0.99. This indicates that the calculated parameters of the model explain the dependence between the studied parameters by 63% -99%. While analyzing the equations given in the matrix, it is necessary to pay attention to the dependence $N = f(R)$, which corresponds to the regression equation $N = 2506.11 + 401.13*R$. It can be assumed that R will increase by 2506 conventional units with an increase of N by 1 conventional unit. Therefore, the number of FTE students increases in arithmetic progression from the Total overall ranking score.

Since r and r² in some equations are less than 0.8, in accordance with the research algorithm (Figure 4), we additionally carried out a survey among students of the HEIs. The research was carried out in the form of a questionnaire. The purpose of the questionnaire survey is to identify the criteria by which students choose an HEI. The questionnaire survey was carried out using online technologies, namely Google forms.

The questions of the questionnaire correspond to the topic and objectives of the research. They have a logical sequence and are short, specific, simple and understandable. There were open-ended and closed-ended questions in the questionnaire.

Thereby the respondents could not only choose the suggested answer option, but also express their point of view. Ukrainian and foreign students from leading universities of Ukraine took part in the questionnaire survey. The total number of respondents makes 69 people – 77% of women and 23% of men. According to the results of the questionnaire survey, among the key factors that influenced the choice of the HEI, the students indicated: the HEI ranking – 75%, the prestige of the specialty – 61%, the experience of friends who are studying – 45% (Figure 7).

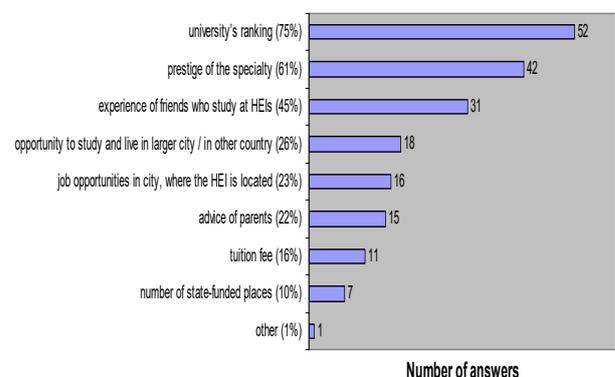


Figure 7. Factors that influenced the students' choice of HEIs

The majority of respondents (78%) gave the answer “yes” on the question “Did the ranking of the HEI influence your choice?” Interestingly in students' opinion, the components of the ranking that

determine the highly ranked HEI were distributed as follows (Figure 8): a high professional level of teachers and teaching (49%), a high probability of employment by the specialty after graduation (23%), a high-quality material basis (17%), prestige (6%), an opportunity to prove oneself in science (4%), and all the above-mentioned (1%).

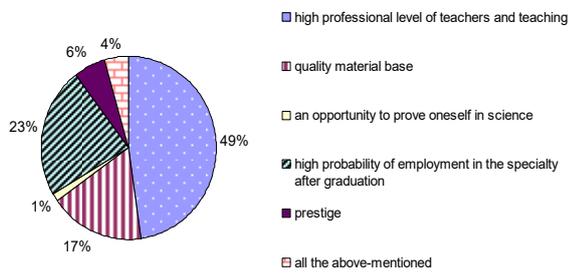


Figure 8. Components of the HEIs ranking according to the respondents

The results of the questionnaire survey showed that when choosing a HEI the students consider the HEI ranking as one of the important criteria. The overwhelming number of students who took part in the questionnaire survey consider that the HEIs ranking is primarily determined by the high professional level of teachers and teaching. This component coincides with the first category “Teaching (the learning environment)” of the methodology for assessing the HEIs according to THE World University Rankings and is essential while determining the HEIs ranking.

5. Conclusion

The research proved the existence of the influence of the HEI ranking on the economic growth of the country. The correlation and regression analysis used in the research showed a tight relationship between the factors under study (Total overall ranking score of universities in the country – number of FTE students enrolled in country’s rated HEIs – number of country’s rated Universities) and economic growth (GDP). This is shown by the values of the correlation coefficient r (0.79-0.99) and the value of the determination coefficient r^2 (0.63 to 0.99). In addition, one more confirmation of the proven hypothesis is the results of the questionnaire survey. In particular, 78% of the respondents chose the HEI by the HEI ranking. Based on the carried research, it is possible to determine the vectors of the country’s development through improving the education quality at state, regional and local levels.

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References

- [1]. Gonzalez Aleu, F., Granda Gutierrez, E. M. A., Garza-Reyes, J. A., Garza Villegas, J. B., & Vazquez Hernandez, J. (2021). Increasing service quality at a university: a continuous improvement project. *Quality Assurance in Education*, 29(2-3), 209-224. <https://doi.org/10.1108/QAE-02-2021-0020>
- [2]. Argue, A. J., & Velema, T. A. (2021). University prestige, cultural distance of the place of education, and wage differences between high-skilled coUS immigrants with foreign and domestic credentials. *Research in Social Stratification and Mobility*, 77, 100650. <https://doi.org/10.1016/j.rssm.2021.100650>.
- [3]. Artyukhov, A. Y., Vasylieva, T. A., & Lyeonov, S. V. (2021). An Integrated Method For Evaluating The Quality Of Education And University Performance. *Natsional'nyi Hirnychiy Universytet. Naukovyi Visnyk*, (3), 148-154.
- [4]. Artyukhov, A., Dluhopolskyi, O., Vasylieva, T., Lyeonov, S., Dluhopolska, T., & Tsikh, H. (2021, September). Local (university) rankings and quality of education: identification of publication activity indicators. In *2021 11th International Conference on Advanced Computer Information Technologies (ACIT)* (pp. 246-249). IEEE.
- [5]. Artyukhov, A., Volk, I., Vasylieva, T., & Lyeonov, S. (2021). The role of the university in achieving SDGs 4 and 7: a Ukrainian case. In *E3S Web of Conferences* (Vol. 250, p. 04006). EDP Sciences. doi:10.1051/e3sconf/202125004006
- [6]. Artyukhov, A., Volk, I., Krmelova, V., Krmela, J. (2021). Quality Of Education System As A Determinant Of Socio-Economic Development: Assessment Of Technological Level Of Readiness. *SocioEconomic Challenges*, 5(4), 172-182. [https://doi.org/10.21272/sec.5\(4\).172-182.2021](https://doi.org/10.21272/sec.5(4).172-182.2021)
- [7]. Bautista-Puig, N., & Sanz-Casado, E. (2021). Sustainability practices in Spanish higher education institutions: An overview of status and implementation. *Journal of cleaner production*, 295, 126320. <https://doi.org/10.1016/j.rssm.2021.100650>
- [8]. Benito, M., Gil, P., & Romera, R. (2020). Evaluating the influence of country characteristics on the Higher Education System Rankings’ progress. *Journal of Informetrics*, 14(3), 101051.
- [9]. Bruni, R., Catalano, G., Daraio, C., Gregori, M., & Moed, H. F. (2020). Studying the heterogeneity of European higher education institutions. *Scientometrics*, 125(2), 1117-1144.

- [10]. Buhaisi, I., Damagh Al Z. (2021). Corporate Governance and Its Effect On Professional Performance In Palestinian Private Universities, In Light Of Quality, Accreditation, And Classification Requirements. *Socio Economic Challenges*, 5(3), 51-60. [https://doi.org/10.21272/sec.5\(3\).51-60.2021](https://doi.org/10.21272/sec.5(3).51-60.2021)
- [11]. Burbyka, M., & Telizhenko, O. (2015). The problems of the present condition of state control and regulation in the field of economic activity. *Problems and Perspectives in Management*, 13(4), 254-258.
- [12]. Cosmulese, C.G., Grosu, V., Hlaciuc, E., Zhavoronok, A. (2019). The Influences of the Digital Revolution on the Educational System of the EU Countries. *Marketing and Management of Innovations*, (3), 242-254. <http://doi.org/10.21272/mmi.2019.3-18>
- [13]. Degtjarjova, I., Lapina, I., & Freidenfelds, D. (2018). Student as stakeholder: "voice of customer" in higher education quality development. *Marketing and Management of Innovations*, (2), 388-398. <http://doi.org/10.21272/mmi.2018.2-30>
- [14]. Dźwigoł, H. (2021). Leadership in the Research: Determinants of Quality, Standards and Best Practices. *Business Ethics and Leadership*, 5(1), 45-56. [https://doi.org/10.21272/bel.5\(1\).45-56.2021](https://doi.org/10.21272/bel.5(1).45-56.2021)
- [15]. Fast, R. (2021). The Effects Of Education On Alabama's Violent Crime Rate. *SocioEconomic Challenges*, 5(2), 5-14. [https://doi.org/10.21272/sec.5\(2\).5-14.2021](https://doi.org/10.21272/sec.5(2).5-14.2021)
- [16]. Frederick, D. T., & Kasztelnik, K. (2020). An Analytical Study of Impact of International Merger and Acquisitions on the Financial Performance for Higher Education Institution in the United States. *Financial Markets, Institutions and Risks*, 4(4), 5-30. [https://doi.org/10.21272/fmir.4\(4\).5-30.2020](https://doi.org/10.21272/fmir.4(4).5-30.2020)
- [17]. Frezghi, T. G., & Tsegay, S. M. (2019). Internationalisation of higher education in China: A critical analysis. *Social Change*, 49(4), 643-658.
- [18]. Gryshchenko, V., & Gryshchenko, I. (2021). The impact of changes in the volume of freight and passenger transportation by water on the GDP of Ukraine. In *E3S Web of Conferences* (Vol. 255, p. 01036). EDP Sciences.
- [19]. Joseph Jeyaraj, J., Wald, N., & Harland, T. (2021). Higher education teachers' experiences of becoming research active: striving for university status in the Global South. *Asia Pacific Education Review*, 22(3), 417-425.
- [20]. Kioupi, V., & Voulvoulis, N. (2020). Sustainable Development Goals (SDGs): Assessing the Contribution of Higher Education Programmes. *Sustainability*, 12(17), 1-17.
- [21]. Kuzmin, Y., Yastrubskyy, Y., Stanasiuk, N. S., Synyutka, N. G., & Tsehelyk, G. G. (2020). Economic and mathematical modeling of management processes and financing the training of specialists by higher educational institutions. *Mathematical Modeling and Computing*, 7(2), 278-284.
- [22]. Kvitka, S., Starushenko, G., Koval, V., Deforz, H., & Prokopenko, O. (2019). Marketing of Ukrainian higher educational institutions representation based on modeling of Webometrics Ranking. *Marketing and Management of Innovations*, (3), 60- 72.
- [23]. Luque-Martinez, T., & Faraoni, N. (2020). Meta-ranking to position world universities. *Studies in Higher Education*, 45(4), 819-833.
- [24]. Liuta, O., Lieonov, S., Artyukhov, A., Sushko-Bezdenzhnykh, M., & Dluhopolskyi, O. (2021). Student Survey As A Tool For Quality Assurance In Higher Education: The Case Of Ukrainian University. *Науковий Вісник Національного Гірничого університету*, 2021(4), 158-164. doi:10.33271/nvngu/2021-4/158
- [25]. Lyeonov, S., & Liuta, O. (2016). Actual problems of finance teaching in Ukraine in the post-crisis period. In *The Financial Crisis* (pp. 145-152). Springer, Cham. https://doi.org/10.1007/978-3-319-20588-5_8
- [26]. Yuliia Matvieieva, Yuliia Opanasiuk, Olena Pavlenko, Iuliia Myroshnychenko (2021). 9 The Relationship Between Inequality and Socio-Economic Drivers as a Tool for Sustainable Territorial Development, in *Economic Inequality – Trends, Traps and Trade-offs*, River Publishers, 165-187.
- [27]. Mazurkiewicz, M., Liuta, O., & Kyrychenko, K. (2017). Internal Quality Assurance System for the Higher Education: Experience of Ukraine and Poland. *Business ethics and leadership*, 1(4), 74-83. doi: 10.21272/bel.1(4).74-83.2017
- [28]. Moskovicz, A. (2021). Post-pandemic Scenario for University Startup Accelerators. *Financial Markets, Institutions and Risks*, 5(2), 52-57. [https://doi.org/10.21272/fmir.5\(2\).52-57.2021](https://doi.org/10.21272/fmir.5(2).52-57.2021)
- [29]. Nacheva, R., & Sulova, S. (2020, June). Internationalization in Context of Education 4.0: AHP Ranking of Bulgarian Universities. In *Proceedings of the 21st International Conference on Computer Systems and Technologies' 20* (pp. 278-284). <https://doi.org/10.1145/3407982.3408006>
- [30]. Novikov, V.V. (2021). Digitalization of Economy and Education: Path to Business Leadership and National Security. *Business Ethics and Leadership*, 5(2), 147-155. [https://doi.org/10.21272/bel.5\(2\).147-155.2021](https://doi.org/10.21272/bel.5(2).147-155.2021)
- [31]. Novikov, V. (2021). Intercept of Financial, Economic and Educational Transformations: Bibliometric Analysis. *Financial Markets, Institutions and Risks*, 5(2), 120-129. [https://doi.org/10.21272/fmir.5\(2\).120-129.2021](https://doi.org/10.21272/fmir.5(2).120-129.2021)
- [32]. Osipov, G., Karepova, S., Ponkratov, V., Karaev, A., Masterov, A., & Vasiljeva, M. (2020). Economic and mathematical methods for ranking Eastern European universities. *Industrial Engineering & Management Systems*, 19(1), 273-288.
- [33]. Pavlenko, O., Martynets, V., Dreval, O., & Smolennikov, D. (2020). Analysis of influence of the quality of specialist training on social and economic development. *Calitatea*, 21(176), 81-86.
- [34]. Perchinunno, P., & Cazzolle, M. (2020). A clustering approach for classifying universities in a world sustainability ranking. *Environmental Impact Assessment Review*, 85, 106471.
- [35]. Perović, L. M., & Kosor, M. M. (2020). The efficiency of universities in achieving sustainable development goals. *Amfiteatru Economic*, 22(54), 516-532.

- [36]. Prisyanti, A., Nurhayati, O. D., & Widodo, A. P. (2020, April). Evaluation university ranking system using quacquarelli Symonds and integrated performance measurement system approach. In *Journal of Physics: Conference Series* (Vol. 1524, No. 1, p. 012098). IOP Publishing.
- [37]. Samusevych, Y. V., Novikov, V. V., Artyukhov, A. Y., & Vasylieva, T. A. (2021). Convergence Trends In The "Economy-Education-Digitalization-National Security" CHAIN. *Natsional'nyi Hirnychiy Universytet. Naukovyi Visnyk*, (6), 177-183.
- [38]. Shkarlet, S., Kholiavko, N., Dubyna, M. (2019). Information Economy: Management of Educational, Innovation, and Research Determinants. *Marketing and Management of Innovations*, (3), 126-141. <http://doi.org/10.21272/mmi.2019.3-10>
- [39]. Sarsenbayeva, A., & Makarikhina, I. (2020). Globalisation influence on higher education in Kazakhstan and Russia (on the example of Engineering University). In *E3S Web of Conferences* (Vol. 210, p. 22010). EDP Sciences.
- [40]. Times Higher Education.(2022). World University Rankings 2022. Retrieved from: <https://www.timeshighereducation.com/world-university-rankings/2022> [accessed: 16 March 2022].
- [41]. Vorontsova, A., Vasylieva, T., Bilan, Y., Ostasz, G., & Mayboroda, T. (2020). The influence of state regulation of education for achieving the sustainable development goals: case study of Central and Eastern European countries. *Administratie si Management Public*, (34), 6-26. doi:10.24818/amp/2020.34-01
- [42]. Vorontsova, A., Vasylieva, T., Lyeonov, S., Artyukhov, A., & Mayboroda, T. (2021, September). Education expenditures as a factor in bridging the gap at the level of digitalization. In *2021 11th International Conference on Advanced Computer Information Technologies (ACIT)* (pp. 242-245). IEEE. doi:10.1109/ACIT52158.2021.9548338
- [43]. World bank.(2022). World Bank Open Data. Retrieved from: <https://data.worldbank.org> [accessed: 16 January 2022].
- [44]. Xu, C. (2020). Towards a Framework for Evaluating the Research Performance of Chinese Double First-Class Universities. *Frontiers of Education in China*, 15(3), 369-402.