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TRENDS IN THE DEVELOPMENT OF EDUCATION AND SCIENCE IN THE WESTERN BALKAN COUNTRIES IN THE SECOND AND THIRD DECADES OF THE XXI CENTURY

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Abstract

In this paper, trends in achieved results in education at all levels and scientific work are examined during the second and third decades of the 21st century in the countries of the Western Balkans (WB), from the perspective of PISA test results (primary and secondary education) and the ranking of universities on the ARWU list among the top 500 and in the 500–1000 range worldwide. In the field of science, the number of papers published in journals indexed in the JCR list, the number of citations (per million inhabitants), citations per paper, and the *h*-index are analyzed. A comparative analysis was conducted with several EU member states of similar size, also normalized per million inhabitants. The obtained results in education and science are compared with the GDP per capita of the observed countries. Multivariate analysis for the WB countries among the considered variables indicates a high degree of negative correlation between PISA results and GDP per capita, as well as a strong positive correlation between the *h*-index and the global position of universities with GDP per capita.

Keywords: education, science, GDP per capita, Western Balkans

1. INTRODUCTION

The educational system (from primary education to doctoral studies) forms the foundation for the development of innovative and scientific work, which contributes to the economic growth of every country. This, in turn, leads to the growth of GDP per capita, which is used to measure the achieved level of living standards (Drori, 2000). In countries with developed economies, significant funds are provided for the further advancement of the educational system and science, based on the principle of feedback, as schematically shown in Figure 1.

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The quality of the educational system (primary and secondary education) is assessed through PISA testing (Sulis et al., 2020), while the quality of higher education, including doctoral studies, is evaluated through university rankings. The most well-known is the Academic Ranking of World Universities (ARWU) list (Docampo, 2013). The quality of scientific work is measured by the number of publications in journals indexed in SCIe, SSCI, ESCI, and AHCI lists, or more recently, through SJR–SCImago (Falagas et al., 2008). Scientific work, if its results are not published, practically does not exist, and a publication that is not visible is not considered published (Živković, 2019). Verification of scientific results through globally defined categories of scientific journals has been accepted by all post-socialist countries and Russia (Moed et al., 2018; Hladchenko & Moed, 2021), and today it is used worldwide as a reliable tool for measuring the quality of each researcher's scientific output. The results achieved in scientific research represent a reflection of the quality of the entire educational system in each country.

The measurement of achieved scientific results is carried out through the number of published papers in indexed journals and citations recorded in Clarivate Analytics and Web of Science (WoS). More recently, the JCR list, SCOPUS, and Google Scholar (GS databases) are often used (Falagas et al., 2008; Živković & Panić, 2024).

2. THEORETICAL FRAMEWORK

In the countries of the Western Balkans (WB), the development of scientific research and the achievement of internationally recognized results, despite the established network of public and private educational systems, are not given sufficient attention, particularly in the field of social sciences and humanities (SSH), where modest results are achieved (publication of scientific results in journals from the SSCI list). This is often accompanied by statements such as

•"…Publishing management papers in journals whose publishers are from the USA, the UK, Germany… is not only impossible, but also equal to a feat" (Radić, 2018a), or

•"…Doctoral students do not have access to the latest literature, the highest-quality journals in libraries…"

•"…There are numerous plagiarisms, and since they cannot verify all citations taken from larger or smaller parts of other authors' texts…" (Radić, 2018b).

If we add to this the fact that a large number of dissertations were defended with published papers in predatory journals of publishers in Bosnia and Herzegovina (TTEM and HOLT MED), as well as in the Romanian Metallurgy International (papers in the SSH field mostly from the WB region), it clearly indicates the state of the educational system and science in the WB countries, especially in the SSH field, where the opportunities for publishing papers are much greater than in the fields of natural and

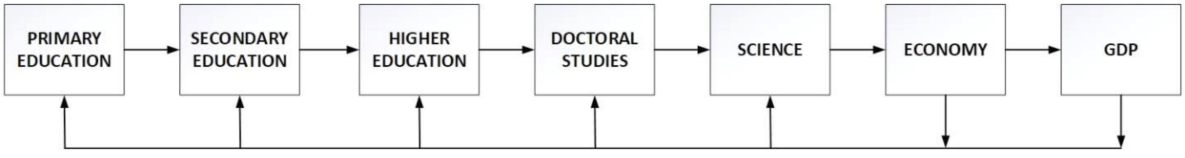

Figure 1. Interconnection of education, science, and economy

technical sciences. In those fields, publishing in the best journals is achieved without any problems, but not to a sufficient extent (Živković, 2019).

In this paper, the achieved results in educational systems and science in the Western Balkan (WB) countries during the second decade of the 21st century are presented by comparing them with the results in EU countries of similar human potential (Table 1), which reliably reflects the EU perspective on the WB countries.

3. METHODOLOGY

To determine the impact of all levels of education on a country's economic development, reliably measured by GDP per capita, a comparative analysis was conducted between WB countries and EU countries of similar population size. The results of PISA testing provide an assessment of the quality of primary and secondary education, as well as its influence on the quality of university education, which is evaluated through the position and number of universities on the ARWU ranking list and the *h*-index. These indicators exert a dominant influence on GDP per capita.

The quality of primary and secondary education, measured by PISA results (most recently assessed in 2022), positively affects the quality of higher education and scientific research, which are evaluated through the outcomes of university graduates in the WB countries under consideration. A comparative analysis was performed with EU countries of approximately equal population size, representing the basic potential for these results. Ultimately, the h-index serves as a reliable indicator of the quality of scientific research, which is a fundamental prerequisite for the quality of university education (Živković & Panić, 2023).

A comparative analysis of PISA results in all three domains, Mathematics (I), Natural Sciences (II), and Reading Literacy (III), from the most recent test in 2022, alongside university rankings on the ARWU list (Top 500, 501–1000), the h-index, and GDP per capita of WB and comparable EU countries, was conducted using Pearson correlation

Table 1. Comparative view of WB countries with EU countries of similar human potential for 2021 and 2025

Countries		Number of inhabitans (x10^6)	GDP per capita 2021 (000$)	GDP per capita 2025 (000$)
1	Serbia	6.5	8.75	15.32
2	Albania	2.88	5.99	11.11
3	N. Macedonia	2.08	6.65	10.38
4	Bosnia and Herzegovina	3.30	6.73	9.65
5	Montenegro	0.63	9.06	14.99
6	Kosovo*	1.80	4.86	8.03
	Comparative countries:			
1	Slovenia	2.07	28.1	37.18
2	Croatia	4.13	16.25	26.99
3	Estonia	1.30	26.47	34.04
4	Lithuania	2.80	22.20	32.98
5	Denmark	5.5	67.20	76.58
6	Finland	6.00	54.33	56.08
7	Norway	5.30	81.99	91.88

* According to Resolution 1244 of the OUN, the status is not defined

coefficients. This analysis provides robust evidence of the impact of each level of education and science on GDP per capita. The correlation between PISA results (2022) and other indicators of higher education and scientific quality, as well as GDP per capita (2025), offers reliable proof of the influence of primary and secondary education on subsequent levels of education and, ultimately, on GDP per capita.

4. RESULTS AND DISCUSSION

Table 1 presents the comparative results of human potential and achieved GDP per capita in 2021 and 2025 in the WB countries, alongside EU countries of similar population size. The results indicate a visible disparity in both the level and growth of GDP per capita between WB countries and their EU counterparts. The initial GDP per capita level in 2021 ranged from 4.86 (Kosovo) to 9.06 (Montenegro) in the WB, while in the selected EU countries it ranged from 16.25 (Croatia) to 81.99 (Norway). The increase in GDP per capita during the period 2021–2025 in WB countries ranged from 2.92 (Bosnia and Herzegovina) to 6.57 (Serbia), whereas in the EU comparison group it ranged from 1.65 (Finland, reaching 56.08 in 2025) to 10.78 (Lithuania). The obtained results of GDP per capita growth in the period 2021–2025, as well as the achieved levels in 2025, point to a significantly more developed educational and scientific system in the EU comparison countries, accompanied by a substantially higher GDP per capita. These findings reflect the essence of the model illustrated in Figure 1, while also underscoring that WB countries remain on the path toward EU membership.

4.1. Quality of Primary and Secondary Education

The quality of primary and secondary education worldwide is assessed through the so-called PISA (Programme for International Student Assessment) testing, which has been conducted every three years since 2000. Regular PISA testing was not carried out in

Table 2. Results of PISA testing in the period 2009–2022 in the countries of the WB and comparative EU countries with similar human potential

Countries	2009			2012			2015			2018			2022		
	I	II	III	I	II	III	I	II	III	I	II	III	I	II	III
Serbia	44	41	45	43	46	45	-	-	-	47	47	46	42	41	40
B&H	-	-	-	-	-	-	-	-	-	63	68	63	-	-	-
Albania	57	54	55	54	58	58	57	54	63	49-	60	62	68	70	73
N.Macedonia	65	66	66	57	62	62	69	70	70	68	63	67	61	69	72
Montenegro	49	53	50	51	53	50	54	68	55	52	62	53	55	63	56
Kosovo*	-	-	-	-	-	-	71	71	72	76	76	75	75	78	78
Comparative countries:															
Slovenia	18	15	29	19	18	36	14	13	14	13	14	22	19	14	33
Croatia	38	35	34	38	32	33	41	37	31	41	37	30	36	31	27
Estonia	15	8	12	9	5	10	9	3	6	8	5	5	7	6	6
Lithuania	35	31	38	35	28	37	36	36	39	35	32	33	25	29	32
Denmark	17	24	22	20	25	23	12	21	18	13	25	19	13	19	15
Finland	5	1	2	10	4	5	13	5	4	16	7	6	20	9	14
Norway	19	23	11	28	29	20	19	24	9	19	28	20	32	32	24

*According to Resolution 1244 of the OUN, the status is not defined
Areas: I – Mathematics; II – Natural sciences, III – Reading literacy
Number of participating countries in PISA testing: 2000 – 40; 2003 – 39; 2006 – 51; 2009 – 57; 2012 – 65; 2015 – 72; 2018 – 79; 2022 – 81.

2021 due to the Covid-19 pandemic. The results of PISA testing of 15-year-olds from around the world (in the 2018 testing, about 600,000 students globally and around 8,000 from Serbia participated), as well as the results from 2009, 2012, 2015, and 2018, are presented in Table 2.

Among the WB countries, Serbia achieved the best results, but they remain very poor compared with selected EU countries. The obtained results indicate that, on average, every third high school student in Serbia is functionally illiterate, while in other WB countries this applies to every second student. Table 2 also shows a declining trend in the quality of secondary education in all WB countries, while comparable EU countries show a visible upward trend, particularly in post-socialist countries.

Since the beginning of PISA testing (2000), the studied countries include Finland, Norway, Denmark, Albania, North Macedonia (which did not participate in 2003), Serbia (under the name Serbia and Montenegro) in 2003, and from 2006 onwards, Montenegro, Croatia, Estonia, and Lithuania. Serbia did not participate in 2015.

The results of PISA testing after the Covid-19 pandemic would be particularly interesting, given the irregular implementation of teaching, a combination of online and traditional classes. Due to the overall level of development in WB countries, the implementation of online teaching could not be adequately realized in all parts of the countries because of a lack of computers, a lack of internet access, untrained teachers, untrained students, a lack of teacher motivation, and inadequate education of some parents to assist their children. There is a justified fear that the consequences of the pandemic in WB countries will leave long-term negative effects on the quality of education as a whole, and especially on the quality of primary and secondary education.

4.2. Assessment of Higher Education Quality

Higher education generally includes post-secondary education, bachelor's, master's, and doctoral studies. In the WB countries, private post-secondary and higher education, culminating in doctoral studies, is particularly developed. The criteria and requirements for academic promotion and doctoral dissertation vary, which implies different outputs at the end of schooling within the same country, and especially when WB countries are compared with each other. Cases of plagiarism of all kinds are present at all levels of study, as well as the purchase of diplomas without the "student" ever attending a faculty (Živkovioć & Panić, 2024). The consequence is that diplomas from numerous higher education institutions in WB countries are not recognized at many universities in the EU, either for the purpose of continuing education or for nostrification.

At the same time, at the same university (University of Belgrade, the highest-ranked in WB countries), different criteria exist for academic promotion in certain scientific fields. For example, in the Social Sciences and Humanities (SSH) field (economics, law, political science), papers published in journals issued by the faculties themselves are accepted. It is often claimed that in these fields there are no journals where researchers could publish, which is absolutely incorrect. For example, in 2021, the number of journals with impact factor was: economics – 376 titles, management – 226, law – 151, political science – 131; while in mining

engineering – 21, and metallurgical engineering – 80. Nevertheless, regardless of the number of available journals, researchers in mining and metallurgical engineering publish their scientific results without difficulty in the world's best journals. In 2019, the University of Belgrade was ranked 76–100 worldwide in mining engineering and 151–200 in metallurgical engineering. Interestingly, not a single paper from WB countries has been published in Nature or Science, which are particularly valued for determining a university's position on the ARWU list.

The quality of doctoral studies has a direct impact on the quality of future university professors, which, in WB countries, and especially in Serbia in recent times, has become highly problematic (Živković & Panić, 2024). This situation may have long-term consequences because: "The beginning of the end of a nation is the moment when the unlearned begin to teach others" (Živković, 2023).

Based on achieved scientific results (published papers and citations) as well as international awards for scientific contributions, universities are ranked on the

Table 3. Number of universities on the ARWU list for comparative EU countries

Countries	Year	In top 100	In the 101-500	In the 501-1000
Serbia	2020	-	1	-
	2021	-	-	2
	2025	-	1	-
	2026	-	-	1
Slovenia	2020	-	-	1
	2021	-	-	1
	2025	-	-	1
	2026	-	-	1
Croatia	2020	-	1	-
	2021	-	-	1
	2025	-	-	1
	2026	-	-	1
Estonia	2020	-	1	-
	2021	-	1	1
	2025	-	-	1
	2026	-	-	1
Lithuania	2020	-	-	1
	2021	-	-	2
	2025	-	--	1
	2026	-	1	-
Finland	2020	1	2	5
	2021	1	3	6
	2025	1	1	3
	2026	-	4	3
Denmark	2020	2	3	1
	2021	2	3	2
	2025	2	3	1
	2026	2	3	1
Norway	2020	1	2	2
	2021	1	2	3
	2025	2	1	2
	2026	1	2	2

Note: Data for Albania, Montenegro, Bosnia and Herzegovina, North Macedonia and Kosovo is omitted because no university from these countries is ranked in the top 1,000*

prestigious ARWU list. Only the University of Belgrade (UB) from WB countries was ranked among the top 500 universities in the world from 2012 to 2020, after which it dropped off the list, and in 2021 it was ranked 501–600, while the University of Novi Sad was ranked 901–1000. Table 3 presents the ranking results of universities from WB countries on the ARWU list, as well as the ranking of universities from comparable EU countries.

The position of the University of Belgrade on the ARWU list varied between 2012 and 2025 – in 2012: 401-500; 2013, 2014, and 2015: 301-400; 2016 and 2017: 201-300; 2018: 301-400; 2019 and 2020: 401-500; 2021: 501-600; 2022: 301-400; 2023, 2024, and 2025: 401-500; 2026: 501-600. The position of the University of Novi Sad in 2019 and 2021 was 901-1,000. Other universities in Serbia and other WB countries were not ranked among the top 1,000 worldwide.

In 2025, among the WB countries, only universities from Serbia were ranked within the top 500 worldwide in specialized fields. Out of 57 subject areas evaluated, the University of Belgrade was ranked in 18 fields, the University of Novi Sad in two fields, and the University of Kragujevac in one field (Table 4). This achievement represents the most reliable indicator of the quality of scientific research and teaching at these institutions.

The University of Belgrade holds a dominant position compared to other universities in the Western Balkans, and its standing is competitive with leading universities globally. Furthermore, graduates of the University of Belgrade are highly sought after for PhD programs worldwide, as well as by top international companies.

The results achieved by the University of Belgrade on the ARWU ranking list in 2025 and 2026 deserve particular recognition, especially when viewed against the backdrop of Serbia's limited investment in research and development. The Republic of Serbia

Table 4. Ranking of Serbian universities in 2025 among the top 500 in the ARWU list, selected specialized fields (out of 57 total subject areas)

Field	University of Belgrade	Unevisity of Novi Sad	University of Kragujevac
Mathematics	151-200	-	-
Chemistry	301-400	-	-
Metallurgical Engineering	76 -100	-	-
Chemical Engineering	201-300	-	-
Energy Science &Engineering	201-300	-	-
Food Science & Technology	101-150	201-300	-
Artificial Intelligence	301-400	-	-
Biological Science	201-300	-	-
Agricultural Science	151-200	301-400	-
Veterinary Science	101-150	-	-
Clinical Medicine	301-400	-	
Public Health	201-300	-	201-300
Dentistry & Oral Science	201-300	-	-
Pharmacy & Pharmaceutical Science	201-300	-	-
Education	401-500	-	-
Psychology	301-400	-	-
Physics	301-400	-	-
Water Resources	201-300	-	-

Universities from other Western Balkan countries were not included in the results, as none were ranked among the top 500 in any of the evaluated fields.

allocates only 0.41% of GDP to scientific research in 2025, with the same proportion planned for 2026. Of this amount, universities receive merely 24%, while 65% is directed to the state sector. By contrast, Slovenia allocated 2.5% of GDP for science in 2025, with a planned increase to 3.5% in 2026, while the EU average stands at 2.3% of GDP. It should also be emphasized that Slovenia's GDP in 2026 is 2.14 times higher than Serbia's, while the number of users is three times smaller.

At the same time, Serbia invests 0.8% of GDP in higher education, compared to 1.5% in Slovenia and the EU average of 1.5%. The cost of research equipment and of publishing in leading international journals is uniform worldwide, which places Serbian universities in a structurally disadvantaged position. Despite these constraints, the University of Belgrade continues to produce high quality research outputs, contributing to knowledge production that is globally visible and citable. This achievement underscores the resilience and dedication of Serbian researchers, who succeed in advancing scientific excellence under conditions of systemic underfunding.

The obtained results indicate that the quality of universities in WB countries (especially the best-ranked UB) has shown a declining trend since 2018. Given the current attitude of the states toward universities in WB countries, a further decline can be expected. In comparison, analyzing the trend of quality change in comparable EU countries shows an undeniable difference and a trend of increasing university quality. This difference is much more pronounced when considering countries with greater human potential, such as Austria, Switzerland, and the Netherlands.

4.3. Measuring the Results of Scientific Work

Scientific research is nurtured and developed at the level corresponding to the quality of personnel educated within the educational system of a given country. The essence of existence and the fundamental content of the work of every professor in the higher education system and scientific institutes is scientific research and the publication of achieved results in leading international journals with an impact factor (SCIe, SSCI, ESCI, and AHCI). This serves as a form of self-control of research quality, while citations and verification of the influence of a particular individual on the development of science worldwide follow the maxim "Publish or perish", which represents the very essence of engaging in scientific work (Lane, 2010). In order for professors to educate their students in a modern way, they themselves must be modernly educated, with significant scientific results verified in relevant journals.

In Table 5, the achieved scientific results in 2010, 2016, 2020, and 2024 in the WB countries are presented, while in Table 6, the results are shown for comparable EU countries with similar human potential. The comparison is based on the number of published papers in SJR journals, the number of cited papers, and the number of citations normalized per million inhabitants (to enable comparison), as well as the number of citations per paper and the *h*-index.

The obtained results indicate that, within the WB countries during the observed period, Serbia achieved the best scientific results, several times higher compared to other countries, but still significantly lower in relation to many EU countries. A clear increase in scientific research output is

evident in the WB countries during the observed period. However, the achieved results remain at a much lower level compared to the EU countries used for comparison.

In the analyzed EU countries, there is a noticeable trend of growth in both the volume and quality of scientific publications, which is largely in strong correlation with the quality outcomes of the entire educational process (primary-secondary-higher education). These facts are positively correlated with economic growth in these countries, as reflected in the achieved GDP per capita values.

4.4. Multivariate Analysis

Based on the bivariate analysis of GDP per capita, PISA results, university rankings (top 500 and 501–1,000), and the h-index for WB countries and comparative EU countries, as presented in Tables 7 and 8, Pearson's correlation coefficients were calculated and are shown in Table 6. Statistical significance levels were determined using the SPSS software package (Ho, 2013).

A strong positive correlation was observed for WB countries (0.97–0.99) between PISA parameters (I, II, and III), with high reliability (p<0.01). A positive correlation was also found between university rankings (top 500 and 501–1,000) and the *h*-index (0.74–0.88), as well as between these values and GDP per capita (0.71–0.95). In contrast, correlations between PISA test results (I, II, III) and university rankings, as well as the h-index, were significantly negative (-0.61 to -0.81). Similarly, correlations with GDP per capita were negative (-0.82 to -0.84). It should be noted that PISA results are ranked such that a higher numerical position indicates poorer performance (with rank 1 being the best and the last rank the worst among participants).

For comparative EU countries, correlations between PISA parameters (I, II, III) were also positive (0.69–0.94). However, correlations between PISA parameters and university rankings or the h-index were negative (-0.17 to -0.53), as were correlations with GDP per capita (-0.13 to -0.55).

The obtained correlation coefficients indicate that PISA testing (I, II, III) shows positive correlations in both cases, suggesting that student knowledge across the three domains is achieved at approximately the same level. The weaker negative correlations between PISA results and university rankings/h-index in EU countries

Table 5. Achieved scientific results in the WB countries during the period 2024–2025

Countries	Year	Number of published papers (per 10^6 inhabitants)	Number of cited papers (per 10^6 inhabitants)	Number of citations (per 10^6 inhabitants)	Number citations per paper	*h*-index
Serbia	2024	23,628	22,126	358,567	15.8	384
	2025	25,513	23,759	418,379	16.4	411
Albania	2024	3,759	3,466	44,378	11.9	117
	2025	4,595	4,169	54,596	11.88	129
N.Macedonia	2024	9,447	8,789	149,117	15.60	184
	2025	10,315	9,352	173,470	16.79	200
Bosnia and Herzegovina	2024	7,684	7,096	78,044	10.55	158
	2025	8,504	7,807	97,939	11.52	172
Montenegro	2024	12,888	12,128	161,923	12.50	105
	2025	14,353	13,466	199,382	13.89	114

Table 6. Achieved scientific results in the comparative countries during the period 2024–2025

Countries	Year	Number of published papers (per 10 ^{6} inhabitants)	Number of cited papers (per 10^{6} inhabitants)	Number of citations (per 10^{6} inhabitants)	Number citations per paper	*h*-index
Slovenia	2024	70,320	65,770	1,437,370	20.40	439
	2025	74,910	69,702	1,627,369	21.72	470
Croatia	2024	40,330	37,910	588,220	14.60	413
	2025	43,163	40,368	676,252	15.67	448
Estonia	2024	52,100	48,080	1,398,961	26.80	612
	2025	56,183	67,944	1,608,821	28.63	446
Lithuania	2024	30,800	29,301	487,602	15.80	391
	2025	33,406	31,545	552,870	16.93	342
Denmark	2024	110,933	99,821	4,061,740	36.60	1,081
	2025	118,247	105,741	4,559,149	38.55	1,147
Finland	2024	82,650	75,401	2,598,840	31.40	897
	2025	87,793	79,511	2,859,656	32.99	950
Norway	2024	94,110	83,710	2,820,000	29.90	896
	2025	100,609	88,929	3,185,064	31.66	953

compared to WB countries reflect the fact that PISA results are reported as descending ranks. This suggests that the impact of primary and secondary education on the quality of higher education and scientific output (*h*-index), as well as on GDP per capita, is more favorable in EU countries than in WB countries.

5. CONCLUSION

The presented results achieved in the field of education and science in the Western Balkan (WB) countries, compared with EU countries of similar population size, allow the following conclusions to be drawn:

1. The results of PISA testing indicate that primary and secondary education in WB countries is at a much lower level compared to EU countries, which shows that numerous essential reforms must be carried out in this part of the educational system in WB countries so that learning outcomes become compatible with those of their peers in EU countries.

2. The ranking of universities on the ARWU list indicates that the quality of teaching staff, and consequently the quality of learning outcomes in higher education in

Table 7. Pearson Correlation Coefficients for Western Balkan Countries

Variables	GDP per capita 2025	PISA – I 2022	PISA II 2022	PISA III 2022	University rank: 101-500 2025	University rank: 501-1,000 2025	*h*-index 2025
GDP per capita 2025	1						
PISA – I 2022	-0.82	1					
PISA – II 2025	-0.84	0.99	1				
PISA – III 2025	-0.83	0.97	0.98	1			
University rank: 101-500 2025	0.71	-0.63	-0.65	-0.61	1		
University rank: 501-1,000 2025	0.77	-0.68	-0.70	-0.65	0.88	1	
h–index	0.95	- 0.79	-0.81	- 0.78	0.74	0.80	1

Table 8. Pearson Correlation Coefficients for Selected EU Comparison Countries

Variables	GDP per capita 2025	PISA – I 2022	PISA II 2022	PISA III 2022	University rank: 101-500 2025	University rank: 501-1,000 2025	*h*-index 2025
GDP per capita 2025	1						
PISA – I 2022	-0.13	1					
PISA – II 2025	-0.29	0.94	1				
PISA – III 2025	-0.55	0.69	0.75	1			
University rank: 101-500 2025	0.89	-0.28	-0.44	-0.63	1		
University rank: 501-1,000 2025	0.71	-0.17	-0.28	-0.53	0.84	1	
h–index	0.94	-0.33	-0.47	-0.47	0.92	0.77	1

WB countries, is at a much lower level compared to EU countries of similar population size. In the context of globalization and digitalization, this represents a problem for the future integration of personnel from these countries into the global labor market (Živković & Panić, 2020). A particular problem is the Social Sciences and Humanities (SSH) field, where researchers from WB countries remain on the margins of scientific developments in the developed world.

3. The results of scientific research, despite a slight upward trend in WB countries, are still much lower compared to the selected EU countries, which negatively affects sustainable economic growth and the achievement of GDP per capita levels comparable to those in the EU.

4. On the path toward EU integration, WB countries must undertake dramatic changes in the development of the educational system and scientific research, placing these areas in focus as a primary developmental potential, to become equal partners in relations with EU countries (Živković & Panić, 2020). As models, they should choose benchmarking partners from developed EU countries.

5. The University of Belgrade's success on the ARWU ranking list in 2025 and 2026 demonstrates that globally visible research outputs can be achieved even under systemic underfunding. Yet, sustaining competitiveness requires a strategic increase in national investment in research and higher education. Aligning Serbia's funding levels with European standards is essential to ensure that its universities can continue to produce knowledge that is internationally recognized, citable, and impactful.

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ТРЕНДОВИ У РАЗВОЈУ ОБРАЗОВАЊА И НАУКЕ У ЗЕМЉАМА ЗАПАДНОГ БАЛКАНА У ДРУГОЈ И ТРЕЋОЈ ДЕЦЕНИЈИ XXI ВЕКА

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Извод

У овом раду се испитују трендови постигнутих резултата у образовању на свим нивоима и научном раду током друге и треће деценије 21. века у земљама Западног Балкана (ЗБ), из перспективе резултата ПИСА тестова (основно и средње образовање) и рангирања универзитета на ARWU листи међу 500 најбољих и у распону од 500 до 1000 широм света. У области науке, анализирани су број објављених радова у часописима индексираним на JCR листи, број цитата (на милион становника), цитати по раду и h-индекс. Спроведена је упоредна анализа са неколико земаља чланица ЕУ сличне величине, такође нормализованих на милион становника. Добијени резултати у образовању и науци упоређују се са БДП-ом по глави становника посматраних земаља. Мултиваријантна анализа за земље Западног Балкана међу разматраним варијаблама указује на висок степен негативне корелације између резултата ПИСА и БДП-а по глави становника, као и на јаку позитивну корелацију између *h*-индекса и глобалне позиције универзитета са БДП-ом по глави становника.

Кључне речи: образовање, наука, БДП по глави становника, Западни Балкан

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