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INTELLECTUAL CAPITAL IN TERMS OF REGIONAL DEVELOPMENT OF THE REPUBLIC OF SERBIA

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Abstract: Empirical research of intellectual capital in term of regional development of the Republic of Serbia aims to show and explain the function of intellectual capital in the regional development of the Republic of Serbia, and point out the disparities of national regions in terms of economic development and intellectual capital resources. Intellectual capital today is one of the most important social subsystems, which, by its scope and influence, is gaining an increasing importance in the development of modern society. As a complex, dynamic human process of knowledge use, intellectual capital is tied to the notion of "new knowledge-based economy". Intellectual capital at the macroeconomic level is a new area of research that focuses on understanding, measuring, and reporting on intangible assets that may have an impact on the creation of national wealth. The concept of intellectual capital is abstract, unambiguous and complex, which leads to numerous differences in the interpretation of this economic category. The results of empirical research confirmed that intellectual capital is in a significant linear functional relationship with economic growth in the Republic of Serbia - in 63.5% of cases, economic growth is explained by intellectual capital resources in the period 2012-2018. Also, the research confirmed significant inequalities in the development and available resources of intellectual capital in the regions of the Republic of Serbia.

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1. Introduction

Given the advanced processes of globalization and liberalization in the world economy, the chance for countries or regions to gain a competitive advantage is to use their endogenous growth factors. A cleverly designed regional development policy is considered an instrument of defense against possible threats to globalization. The competitiveness of countries in attracting foreign investors is more often determined by their specific and unique intangible resources. The most important sources of influence are intangible investments in research and development, as well as innovation. The development potential of any type of organization lies in knowledge-based resources, in their intellectual capital. Knowledge is considered a basic resource for value creation, both at the enterprise and the regional and national level.

Investments in intellectual capital are considered the most important sources of results. Resources that are valuable, scarce, and impossible to copy or replace are a source of sustainable competitive advantage. This applies to both knowledge-based companies and geographical areas that build their competitive advantage on the application of national and regional innovation systems. In the last decade, companies around the world have implemented new knowledge management systems. At the same time, most regions and countries of the European Union are trying to introduce regional and national innovation strategies to make the European Union's economy the most competitive knowledge-based economy in the world. The Republic of Serbia, on its path of European integration towards a full membership in this supranational organization of European states, must improve national channels of support and financing of its intellectual capital. The process of transition, which is not so successfully managed, has been going on for a couple of decades, during which a large number of young, educated people left their homes and went to foreign countries in search for work and better living conditions. Thus, the Republic of Serbia has already suffered, moreover, continues to suffer huge losses in terms of the key factor of production.

In this regard, the paper discusses the research problem related to intellectual capital, which is in the function of sustainable development and improving the competitiveness of economies.

The subject of research in this paper is intellectual capital in terms of regional economic development of the Republic of Serbia. Contextually, the period of consideration of empirical research covers the period of the second decade of the XXI century. According to the objectified research problems, the basic goal of the empirical research is to show and explain the function of intellectual capital in the regional development of the Republic of Serbia. Additional objectives of the paper are reflected in the provision of evidence in favor of regional disparities in the Republic of Serbia in terms of economic (under)development of the region and intellectual capital resources.

In order to meet the set goals, further course in the empirical research implies the definition of the following research hypotheses:

Hypothesis 1: The regions of the Republic of Serbia are characterized by significant disparities in terms of the level of economic development.

Hypothesis 2: Human capital, in the form of a highly educated workforce, as a carrier of intellectual capital, has a significant impact on the economic development of the Republic of Serbia.

Hypothesis 3: The regions of the Republic of Serbia are characterized by disparities in terms of capacity of intellectual capital.

The quantitative method of empirical research is based on software statistical analysis IBM SPSS Statistics v26 software package of quantitative indicators, collected from online databases of established international organizations and statistical publications of the National Institute for Data Collection and Statistical Processing of the Republic of Serbia.

2. Importance of intellectual capital for regional development

Intellectual capital today is one of the most important social subsystems, which, by its scope and impact, is gaining an increasing importance in the development of modern society. What financial capital and manual labor presented for the industrial period, intellectual capital presents for the "new economy" of the XXI century. Intangible values (intellectual capital) are continuously gaining importance, both for the productivity and companies' competitiveness, and for the productivity of national economies and their global competitiveness. Namely, with the development of the knowledge-based economy, which is a consequence of the third technological revolution, the old industrial order is changing the society in which scientists and experts of the new intellectual technology will decide (Sundać, Škalamera-Alilović, Babić, 2016, 147).

The development and progress of an individual country will depend on how developed its knowledge-based economy is. Namely, the model of the economic system based on knowledge provides the best opportunities for dealing with the new global environment. Under these conditions, the intellectual capital of nations becomes their new wealth. Intellectual capital increases the value and the material benefit of every company and business system, only if it is strategically created and effectively managed, the prerequisite for this is an adequate environment and competent managers and economic policy makers (Sundać, Škalamera-Alilović, Babić, 2016, 147). .

Changes in society in the last fifteen years of the XX century have led to the transformation of society from industrial to information, i.e. the society based on knowledge, which completely changes the role of traditional factors of production

and introduces new - knowledge, i.e. its economically relevant form - intellectual capital, which becomes a basic economic resource. In this regard, the development of intellectual capital as an economic category has begun in the 1990s, when economists stated that the value of a company's physical assets differs from its market value and came to the conclusion that there must be some intangible value.

Since intellectual resources are completely important for private companies, i.e. in the microeconomic plan, they are also important for increasing the productivity and competitiveness of the region, the state, and the nation as a whole. Measuring national intellectual capital helps countries in diagnosing and comparing their qualifications and competencies, so that e.g. assessments can facilitate the adoption of quality national policies and practices for socio-economic development (Lin, Edvinsson, 2011, 8).

Regional intellectual capital is defined as directly imperceptible attributes of residents, companies, institutions, organizations, communities and administrative units, which are real and potential sources of improvement in future social well-being and economic growth. All available assets (mostly intangible, but also tangible) are components of regional intellectual capital, giving the region a relative advantage over other regions. Moreover, if these forms are used synergistically, they can bring concrete benefits in the foreseeable future (Lubacha-Sember, 2014, 2).

National intellectual capital management is as important as company-level intellectual capital management; this is because the creation of wealth in production increasingly stems from intellectual resources, such as: research and development, process and product design, logistics systems, marketing and management. Based on OECD estimates, more than half of the wealth in advanced industrial countries was created on the basis of intellectual capital, and the so-called “knowledge workers” make up as many as eight out of ten newly hired workers. While financial capital reflects a country's progress in the past, intellectual capital provides a more accurate picture of a country's growth and performance in the future.

In order to successfully manage intellectual capital at the nation level, it is necessary to improve the tools for the use of knowledge, in order to accelerate the process of long-term economic and social growth. Focusing on intellectual capital and its key components and indicators highlights key areas in which the country has a development potential. The "balance sheet" of national intellectual capital needs to be updated every year with a re-evaluation of the key success factors in increasing national intellectual capital and the related indicators to monitor that success. This is extremely important for the creation and implementation of a strategy for the growth and development of national intellectual capital.

3. Empirical research

3.1. Data and research methodology

The selection of empirical research data is conditioned by the chosen research method that is adequate for the defined research premises. The period of empirical research covers the period 2012-2018 - to prove the truth of Hypotheses 1 and 2, the verification of truth of Hypothesis 3 covers the following period 2011-2019, which is entirely conditioned by the availability of quantitative data from the secondary sources. The results of the quantitative analysis will be supplemented by qualitative insights.

In accordance with the accuracy test of Hypothesis 1, a statistical model of the T-test of paired samples (*Paired-samples T test*) was applied, a statistical tool that compares the averages, i.e. arithmetic means (means) and standard deviations of two related paired groups (samples) determining the existence of a significant difference between the quantitative data of the observed variable and the two groups (samples). The assumption of the T-test of paired samples is continuity in the data series of the variable (continuous data series in both observed samples), as well as that the data and differences of matching data pairs of the variable in the two samples follow a normal probability distribution. Samples can be "paired" when there is a "one to one" relationship between their values (data) of the analyzed variable, in such a way that each sample has the same number of variable data and that each data in one sample is related to only one data in another sample. The abovementioned criteria of the statistical model of the T-test of paired samples were tested and met. Namely, the selected statistical method of T-test of paired samples allows the identification of the significance of differences in regional GDP per capita, as a representative of the development of the regional economy, among the 2 observed regions in the Republic of Serbia. Out of the total of 5 statistical regions in the Republic of Serbia, the analysis was conducted on data for 4 regions (data for Kosovo and Metohija are not available), in such a way that the differences in the average of matching data by years of the reference period (2012-2018) of paired regions were analyzed on the principle of "every region with everyone". In other words, the test was performed 3 times on different combinations of pairs of regions. Similarly, if the results of the T-test of regional pairs show significant differences between the average matching data of the GDP variable per capita, exclusively in the case of all combinations of regional pairs, it can be stated that there is a sufficient evidence in favor of the truth of Hypothesis 1 out of the total of 4 regions, there will be no statistically significant difference in the level of economic development, and it cannot be claimed that there are significant regional disparities in terms of economic development in the Republic of Serbia. Quantitative indicators of the analyzed variable (regional GDP per capita in euros at purchasing power parity) within the T-test of the paired samples are given in Table 1.

Table 1. Regional GDP per capita in the Republic of Serbia (by PKS), 2012-2018

Year / *Region*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*
Belgrade	18.100 €	18.400 €	17.800 €	18.900 €	19.000 €	19.400 €	20.900 €
Vojvodina	10.700 €	11.000 €	11.100 €	11.200 €	11.300 €	11.500 €	11.900 €
Šumadija and Western Serbia	7.200 €	7.300 €	7.700 €	8.000 €	7.900 €	8.000 €	8.200 €
Southern and Eastern Serbia	6.700 €	6.800 €	6.800 €	7.000 €	7.100 €	7.400 €	8.000 €

Source: Eurostat (2021). Regional gross domestic product (PPS per inhabitant) by NUTS 2 regions. https://ec.europa.eu/eurostat/databrowser/view/tgs00005/settings_1/table?lang=en

Human capital is an essential component of intellectual capital and represents the competencies, knowledge and personality traits embodied in the ability to do business, so as to produce the economic value. In that sense, a model of simple linear regression analysis was applied to prove the truth of Hypothesis 2. The statistical analysis is designed to identify the functional relationship between GDP per capita and the share of highly educated labor force in the total labor force, indicators that represent the level of economic development and the bearer of intellectual capital, respectively. This model is suitable for determining the connection between two phenomena, exclusively, i.e. in the case when the goal is to examine in isolation the influence of only one independent variable on the dependent one, provided that the sample is greater than 30 or the data follow the normal distribution - the sampled time series takes into account the second stated condition. Although one of the important requirements of the regression model is to initially determine the variables as dependent and independent, it should be noted that the model cannot specify a cause-and-effect relationship between the analyzed variables. In this sense, the applied regression model provides a description of the relationship between the predictor and criterion variable, and allows the prediction of the criterion variable based on the effect of explanatory (independent). Namely, the main goal of the empirical research is to determine the behavior of GDP per capita (dependent variables) under the influence of the share of highly educated labor force, i.e. explanatory (independent) variables, and, accordingly, if the model verifies a statistically significant relationship between the analyzed variables, it is considered that a sufficient evidence has been collected to confirm the defined Hypothesis 2. Data on the variables of the regression model are presented in Table 2, while the quantitative indicators of the variables, for the analysis period 2012-2018, are found in Table 3.

Table 2. Variables of the statistical model of a simple linear regression

Variable	*Description*	*Source*
RS_GDP_pc	GDP per capita in the Republic of Serbia (in constant US dollars from 2010)	The World Bank (2021). World Development Indicators. Data Bank. Retrieved January 11, 2021. on the https://databank.world bank.org/source/world -development- indicators
RS _AWE	Workforce with advanced (tertiary) education in the Republic of Serbia (% of total working age population with advanced (tertiary) education)	

Source: Authors

Table 3. Data on variables used in the simple linear regression model

Year / Indicator	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*
GDP per capita in the Republic of Serbia (in constant US dollars from	5.886,89 USD	6086,73 USD	6018,17 USD	6157,25 USD	6396,22 USD	6565,46 USD	6898,18 USD
Workforce with advanced (tertiary) education in the Republic of Serbia (% of the total working age population with advanced education)	62.13%	63.38%	69.01%	69.61%	70.29%	71.94%	72.49%

Source: The World Bank (2021). World Development Indicators. *Data Bank*. https://databank.worldbank.org/source/world-development-indicators

For the purpose of confirming the truth of the third research point of view, i.e. Hypothesis 3, a descriptive statistical analysis of the collected quantitative data from the secondary sources was used for the selected indicators of the level of regional intellectual capital resources in the Republic of Serbia for the period 2011-2019. Quantitative data are given as a percentage of the EU average (EU-27), which is 100%, for the following indicators: regional employment in the medium and high-tech manufacturing sector and knowledge-intensive services - Table 4, regional innovation index - Table 5, regional percentage of the population aged 25-64 participating in lifelong learning - Table 6, regional percentage of the population aged 30-34 with completed tertiary education - Table 7, regional expenditures for research and development in the public sector as a percentage of regional GDP - Table 8, and regional expenditures for research and development in the private sector as a percentage of regional GDP - Table 9.

Table 4. Employment in medium-high / high-tech processing industry and knowledge-intensive services (% of total labor force) by regions of the Republic of Serbia as a percentage of the EU average (EU = 100)

Region	Employment in medium-high / high-tech manufacturing and knowledge-intensive services (% of total workforce) - percentage of EU average					
	2011 (% of EU-27 average from 2011)	2013 (% of EU-27 average from 2011)	2015 (% of EU-27 average from 2011)	2017 (% of EU-27 average from 2011)	2019 (% of EU-27 average from 2011)	2019 (% of EU-27 average from 2019)
Belgrade	84,30%	82,79%	100%	106,39%	124,63%	111,42%
Vojvodina	44,42%	42,37%	55,30%	52,56%	75,37%	67,38%
Šumadija and Western Serbia	33,12%	31,08%	42,53%	26,11%	22,46%	20,08%
Southern and Eastern Serbia	26,92%	25,27%	35,23%	40,70%	42,53%	38,02%

Source: Eurostat (2021). Region Profile. Regional Innovation Scoreboard 2019, Industrial Policy, https://interactivetool.eu/RIS/RIS_2.html#

Table 5. Innovation index of the region of the Republic of Serbia (% of EU average, EU = 100)

Region	Innovation index					
	2011 (% of EU-27 average from 2011)	2013 (% of EU-27 average from 2011)	2015 (% of EU-27 average from 2011)	2017 (% of EU-27 average from 2011)	2019 (% of EU-27 average from 2011)	2019 (% of EU-27 average from 2019)
Belgrade	50,82%	64,05%	67,93%	64,88%	68,67%	65,58%
Vojvodina	43,52%	54,99%	56,54%	57,18%	65,16%	62,22%
Šumadija and Western Serbia	40,19%	50,85%	51,55%	49,06%	51,24%	48,93%
Southern and Eastern Serbia	36,62%	46,43%	48,27%	47,97%	52,98%	50,06%

Source: Eurostat (2021). Region Profile. *Regional Innovation Scoreboard 2019*, *Industrial Policy*. https://interactivetool.eu/RIS/RIS_2.html#

Table 6. Percentage of population aged 25-64 participating in lifelong learning by regions of the Republic of Serbia (% of EU average, EU = 100)

Region	Percentage of population aged 25-64 participating in lifelong learning					
	2011 (% of EU-27 average from 2011)	2013 (% of EU-27 average from 2011)	2015 (% of EU-27 average from 2011)	2017 (% of EU-27 average from 2011)	2019 (% of EU-27 average from 2011)	2019 (% of EU-27 average from 2019)
Belgrade	65,35%	65,35%	65,35%	65,35%	55,45%	54,37%
Vojvodina	36,63%	36,63%	36,63%	40,59%	41,58%	40,78%
Šumadija and Western Serbia	25,74%	25,74%	25,74%	27,72%	24,75%	24,27%
Southern and Eastern Serbia	24,75%	24,75%	24,75%	32,67%	26,73%	26,21%

Source: Eurostat (2021). Region Profile. *Regional Innovation Scoreboard 2019*, *Industrial Policy*, https://interactivetool.eu/RIS/RIS_2.html#

Table 7. Percentage of population aged 30-34 with completed tertiary education by regions of the Republic of Serbia (% of EU average, EU = 100)

Region	Percentage of population aged 30-34 with completed tertiary education					
	2011 (% of EU-27 average from 2011)	2013 (% of EU-27 average from 2011)	2015 (% of EU-27 average from 2011)	2017 (% of EU-27 average from 2011)	2019 (% of EU-27 average from 2011)	2019 (% of EU-27 average from 2019)
Belgrade	112,66%	112,66%	112,66%	114,35%	132,07%	122,27%
Vojvodina	40,08%	40,08%	40,08%	55,7%	54,01%	50,00%
Šumadija and Western Serbia	19,83%	19,83%	19,83%	24,89%	41,77%	38,67%
Southern and Eastern Serbia	36,29%	36,29%	36,29%	43,46%	52,32%	48,44%

Source: Eurostat (2021). Region Profile. *Regional Innovation Scoreboard 2019*, *Industrial Policy*. https://interactivetool.eu/RIS/RIS_2.html#

Table 8. Regional expenditures for research and development in the public sector as a percentage of regional GDP in the Republic of Serbia (% of EU average, EU = 100)

Region	Regional expenditure on research and development in the public sector as a percentage of regional GDP					
	2011 (% of EU-27 average from 2011)	2013 (% of EU-27 average from 2011)	2015 (% of EU-27 average from 2011)	2017 (% of EU-27 average from 2011)	2019 (% of EU-27 average from 2011)	2019 (% of EU-27 average from 2019)
Belgrade	135,20%	135,20%	133,45%	119,21%	116,39%	113,48%
Vojvodina	84,54%	84,54%	90,89%	79,39%	84,83%	82,71%
Šumadija and Western Serbia	32,69%	32,69%	36,07%	29,86%	31,21%	30,43%
Southern and Eastern Serbia	37,37%	37,37%	45,52%	37,20%	45,16%	44,03%

Source: Eurostat (2021). Region Profile. *Regional Innovation Scoreboard 2019*, *Industrial Policy*, https://interactivetool.eu/RIS/RIS_2.html#

Table 9. Regional expenditures for research and development in the private sector as a percentage of regional GDP in the Republic of Serbia (% of EU average, EU = 100)

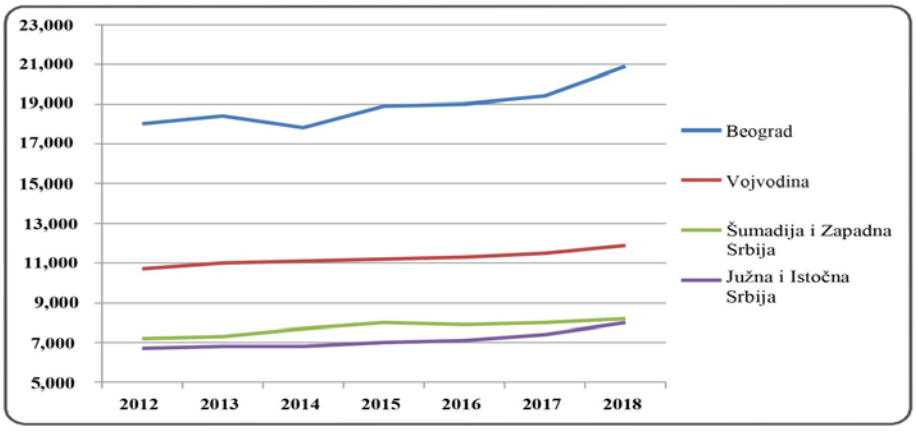
Region	Regional expenditure on research and development in the private sector as a percentage of regional GDP					
	2011 (% of EU-27 average from 2011)	2013 (% of EU-27 average from 2011)	2015 (% of EU-27 average from 2011)	2017 (% of EU-27 average from 2011)	2019 (% of EU-27 average from 2011)	2019 (% of EU-27 average from 2019)
Belgrade	31,86%	31,86%	63,69%	53,60%	61,17%	56,81%
Vojvodina	2,94%	2,94%	0%	35,59%	59,99%	52,00%
Šumadija i Western Serbia	15,02%	15,02%	3,43%	3,21%	7,75%	7,20%
Southern and Eastern Serbia	7,86%	7,86%	9,95%	21,44%	16,80%	15,60%

Source: Eurostat (2021). Region Profile. *Regional Innovation Scoreboard 2019*, *Industrial Policy*, https://interactivetool.eu/RIS/RIS_2.html#

3.2. Research results

Based on the data from Table 1, Graph 1 was constructed, which depicts the trend of regional GDP per capita in the Republic of Serbia for the period 2012-2018. It can be seen from the attached that the region of Belgrade leads in the achieved level of GDP per capita in the last year of the period (€ 20,000 at purchasing power parity) over other national regions. The region of Southern and Eastern Serbia is the most underdeveloped in the Republic of Serbia during the entire period. With a GDP per capita of only € 8,000 (at purchasing power parity) in 2018, the region of Southern and Eastern Serbia in relation to the most developed Belgrade is in the ratio 1: 2.61, it is more than twice as poor in the reference year. There was no significant growth trend of regional GDP per capita during the period, except for the increase in the case of Belgrade of € 1,500 at the end of the analyzed period. Therefore, the regions of Southern and Eastern Serbia and Šumadija and Western Serbia are the least developed in the Republic of Serbia in the period 2012-2018.

Graph 1. Regional GDP per capita in the Republic of Serbia (by SCC)



Source: Authors, according to Eurostat (2021). Regional gross domestic product (PPS per inhabitant) by NUTS 2 regions. https://ec.europa.eu/eurostat/databrowser/view/tgs00005/settings_1/table?lang=en

Table 10. Descriptive statistics of regional GDP per capita in the Republic of Serbia for the period 2012-2018

Region	Arithmetic mean (Mean)	Standard deviation (Std. Deviation)	Sample size (N)
Belgrade	18.928,5714	1.029,10039	7
Vojvodina	11.242,8571	382,34863	7
Šumadija i Western Serbia	7.757,1429	377,96447	7
Southern and Eastern Serbia	7.114,2857	456,17457	7

Source: Authors.

Table 10 shows that the average regional GDP per capita in the analyzed period for the Belgrade region was € 18,928.57, in Vojvodina € 11,242.86, while in the region of Šumadija and Western Serbia it was € 7,757.14, and in the East and South Serbia only € 7,114.29 at purchasing power parity. The average deviation of the value of regional GDP per capita from the central value of the same from the entire period is the highest in the region of Belgrade, while in the region of Šumadija and Western Serbia, GDP per capita recorded the smallest deviation from its average for the seven-year period.

Table 11 presents the results of the conducted statistical T-tests of the analysis of the significance of differences between regional GDP per capita for the period 2012-2018 in the Republic of Serbia.

The statistics of the assumption on the significance of distinctions between the differences of paired regional GDP per capita of all combinations of pairs of regions in the Republic of Serbia are as follows: for the pair Belgrade-Vojvodina, t = 29.206, for the pair Belgrade-Sumadija and Western Serbia, t = 37,668, for the pair Vojvodina-Southern and Eastern Serbia, t = 79,146, for the pair Belgrade-Southern and Eastern Serbia, t = 52,728 and for the pair Vojvodina-Sumadija and Western Serbia, t = 52,021. At the confidence level, α = 0.01 of the conducted T-tests, the significance (p - value) of the difference between all the matched data of the variable of regional GDP per capita is less than 0.01 (p - value (Sig. (2-tailed)) = 0.00 <0.01), which indicates that all t statistics of pairs of regions are statistically significant. In other words, there is a sufficient evidence in favor of affirming the truth of Hypothesis 1.

Table 11. Results of the T-test of paired samples of regional GDP per capita in the Republic of Serbia for the period 2012-2018

Pair	Paired samples	The arithmetic mean of the difference (*Mean*)	Standard deviation of difference (*Std. Deviation*)	Test statistics (*t*)	Significance level p - value (*Sig. (2-tailed*))
1	Belgrade Vojvodina	7.685,71429	696,24845	29,206	0,000
2	Šumadija i Western Serbia South and Eastern Serbia	642,85714	276,02622	6,162	0,001
3	Belgrade Šumadija i Western Serbia	11.171,42857	784,67464	37,668	0,000
4	Vojvodina Southern and Eastern Serbia	4.128,57143	138,01311	79,146	0,000
5	Belgrade South and Eastern Serbia	11.814,28571	592,81411	52,728	0,000
6	Vojvodina Šumadija i Western Serbia	3.485,71429	177,28105	52,021	0,000

Source: Authors.

• *T test reliability level α = 0.01 (p value <0.01)*

Table 12 shows the results of descriptive statistical analysis of variables used in the statistical model of simple linear regression for the affirmation of the truth of Hypothesis 2 series of their arithmetic mean (average) and sample size data (number of years of the analyzed period), respectively. In the sample of 7 years (N) time series from 2012 to 2018, the average GDP per capita in the Republic of Serbia (arithmetic mean) is 6,286.98 USD, while the average share of the workforce with advanced (tertiary) education in the Republic of Serbia amounted to approximately 68.41% of the total working age population with advanced (tertiary) education. The average deviation of GDP per capita from its central value for the reference seven-year period (standard deviation) is approximately 354,097 USD, while the share of the labor force with advanced (tertiary) education in the Republic of Serbia deviated on average by 4.068% from its central value for the period 2012-2018.

Table 12. Results of descriptive statistical analysis

Variable	Arithmetic mean (Mean)	Standard deviation (Std. Deviation)	Sample size (N)
RS_GDP_pc	6.286,9848	354,09689	7
RS _AWE	68,4074	4,06842	7

Source: Authors.

In order to determine the justification of conducting the regression analysis, the existence of a linear relationship between GDP per capita and the share of the labor force with advanced (tertiary) education in the Republic of Serbia in the period 2012-2018 was previously tested. In the model of simple linear correlation, the existence, direction and intensity of the relationship between the observed variables were tested, and the results of the correlation test are presented in Table 13.

Table 13. Results of free linear correlation

Variable	RS_GDP_pc	RS _AWE
RS_GDP_pc	1	0,797*
RS _AWE	0,797*	1

Source: Authors.

***. Correlation is significant at the 0,05 level (2-tailed): Pearson correlation coefficient (R) = 0,797; p value (Sig. (2-tailed)=0,032) < 0,05*

The correlation analysis results in the high value of Pearson's correlation coefficient R = 0.797 (at the level of significance p value <0.05) and shows that between GDP per capita and the share of labor with advanced (tertiary) education in the Republic of Serbia there is a statistically significant linear, secondary strong (almost solid bond, R ~ 0.80) and direct (positive) correlation.

Given the existence of a moderately strong linear correlation between the analyzed variables of the time series of data, a linear regression test was performed. The results of the simple linear regression model are shown in Table 14.

According to the data from Table 14, the manifestation of multicollinearity among the data of variables in the time series (sample) does not exist (VIF = 1,000 <5), which is one of the preconditions for conducting the regression analysis, so in this respect it is possible and fully justified to test the linear regression connections. With an error risk of 5% (α = 0.05), the coefficient of determination R2 has a value of 0.635 (statistically significant at the level (Sig. = 0.032) <0.05), which proves a medium strong (almost solid bond, R2 ~ 0.64) the reaction of the dependent variable to the action of the predictor. The medium-strong regression relationship, affirmed by the high value of the regression coefficient (R2), testifies that the regression model is good, because the choice of the share of labor with advanced (tertiary) education for the independent variable describes about 63.5% of GDP per capita in the Republic of Serbia (dependent variables) during the observed period 2012-2018. In other words, approximately 63.5% of GDP dynamics per capita in the Republic of Serbia can be attributed (statistically significant) to variations in the share of the labor force with advanced (tertiary) education in the period from 2012 to 2018. In this regard, in the reference period, an increase in labor force participation with advanced (tertiary) education by 1% leads to an increase in GDP per capita by approximately 0.797% in the case of the Republic of Serbia (Standardized Coefficient Beta = 0.797, p value (Sig. = 0.032) <0.05). In this context, sufficient evidence has been gathered in favor of confirming the truth of Hypothesis 2.

Table 14. Results of the regression model and the statistics of regression coefficients

Regression	Coefficient of determination *(R Square)*	Corrected coefficient of determination *(Adjusted R Square)*	Test statistics *(F)*	Significance level b *(Sig.)*	REGRESSION COEFFICIENTS [a]			
					Unstandardized Coefficient Beta	*Standardized Coefficients Beta*	Test statistics *(t)*	Multicollinearity coefficient *(VIF)*
	0,635	0,562	8,707	0,032				
RS_GDP_pc (Constant)					1.541,704			
RS _AWE					69,368	0,797**	2,951	1,000

Source: Authors.

**. Risk of error α = 0,05*

***. p value (Sig. = 0,032) < 0,05*

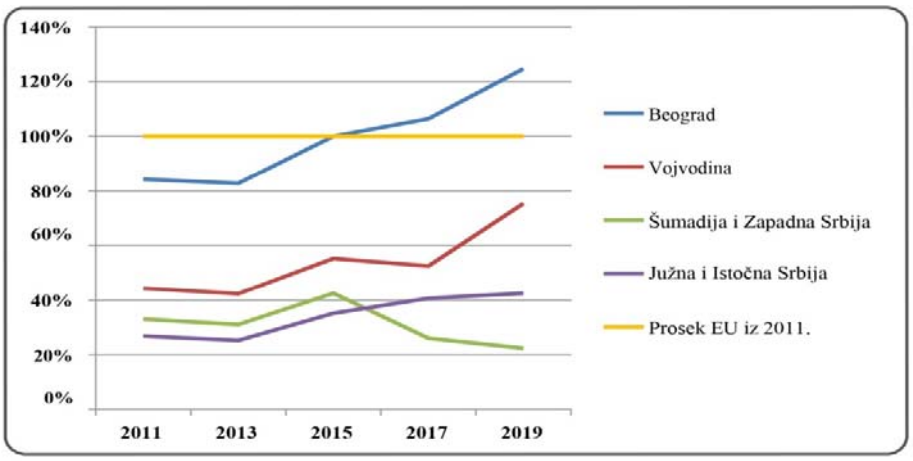
a. *Dependent variable (criterion): RS_BDP_pc (Constant)*

b. *Independent variable (predictor): RS_nap_obr_rs (Constant)*

Graph 2 provides a visual representation of the value of regional employment in the medium-high / high-tech manufacturing industry and knowledge-intensive services from Table 4. The share of labor employment in high-tech industrial sectors in the region is an indicator of the development of the manufacturing industry innovation through creative, inventive activities. Knowledge-based services are provided directly to consumers (for example, telecommunications) and provide input for other companies in the region and the country, as well as all sectors of the economy. Knowledge-intensive services. such as telecommunications, therefore, can increase productivity throughout the economy and support the spread of a range of innovations, especially those based on information and communication technologies. From the attached material, there is an evident regional disproportion in terms of the reference indicator in the Republic of Serbia - especially at the end of the observed period in 2019, as well as a significant deviation of all regions from the European Union average from 2011.

The region of Belgrade in 2015 was at the level of the average of the European Union from 2011, in order to further significantly exceed it. The region of Vojvodina records a significant increase in the value of indicators and is increasingly converging towards the European Union average from 2011. As for the region of Southern and Eastern Serbia, it has slightly increased the value of the indicator since 2013, while the region of Šumadija and Western Serbia has recorded a significant deterioration since 2017. However, both are in the worst position from the European Union average from 2011.

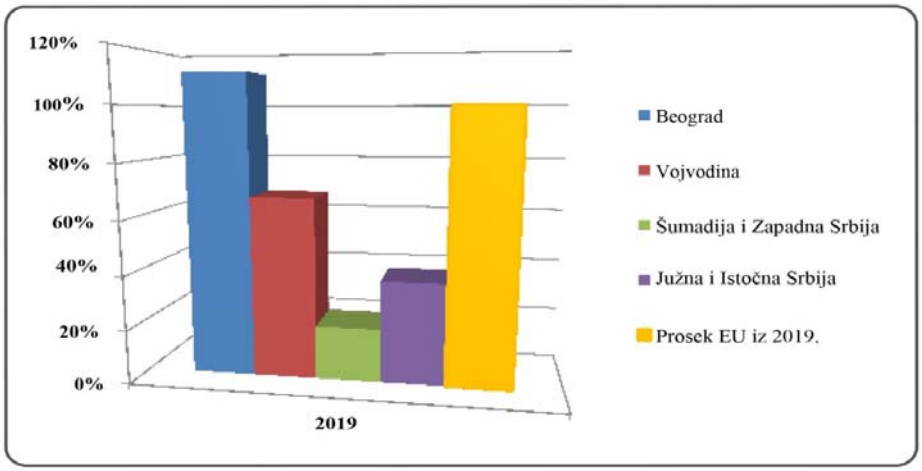
Graph 2. Employment in medium-high / high-tech manufacturing industry and knowledge-intensive services (% of total labor force) by regions of the Republic of Serbia as a percentage of the EU average from 2011 (EU 2011 = 100)



Source: Authors, according to Eurostat (2021). Region Profile. Regional Innovation Scoreboard 2019, Industrial Policy, https://interactivetool.eu/RIS/RIS_2.html#

When it comes to the European Union average from 2019, in terms of employment in the medium-high / high-tech manufacturing industry and knowledge-intensive services, Graph 3 (according to the data in Table 4) presents the employment situation in the medium-high / high-tech manufacturing industry and knowledge of intensive services in the regions of the Republic of Serbia compared to that average. From the visual presentation, it should be noted that the region of Belgrade has surpassed the level of the European Union average from 2019, while the remaining 3 regions are significantly behind it and the European Union average.

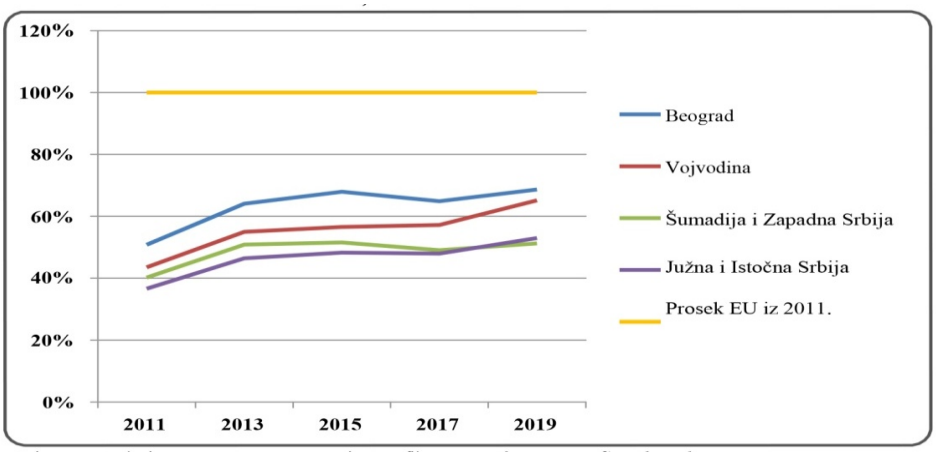
Graph 3. Employment in medium-high / high-tech processing industry and knowledge-intensive services (% of total labor force) by regions of the Republic of Serbia as a percentage of the EU Average (EU 2019 =100)



Source: Authors, according to Eurostat (2021). Region Profile. Regional Innovation Scoreboard 2019, Industrial Policy, https://interactivetool.eu/RIS/RIS_2.html#

Graph 4 (according to the data from Table 5) gives a regional overview of the innovation index conceived by the European Union (Regional Innovation Scoreboard) with the aim of comparing the performance of European regions and regions of candidate countries for full membership. The value of this index, presented in relation to the average for the European Union, provides an opportunity to group regions by innovation and compare structural economic, business and socio-demographic structural differences between the regions in Europe. During the entire period of analysis, the regions in the Republic of Serbia are far below the average of the European Union from 2011. It is noticeable that in the Republic of Serbia, the region of Belgrade and the region of Vojvodina stand out from the region of Šumadija and Western Serbia and the region of Southern and Eastern Serbia, which, in turn, are at a much lower level of the regional innovation index.

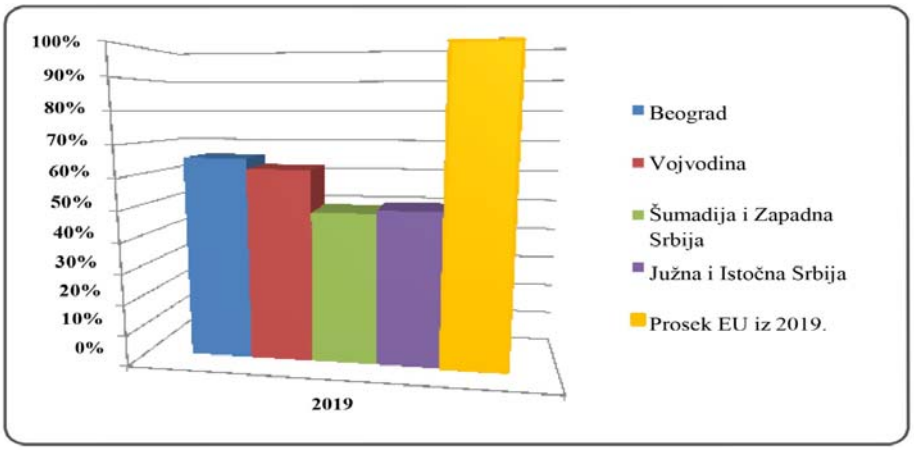
Graph 4. Innovation index of the region of the Republic of Serbia (% of EU average, EU 2011 = 100)



Source: Authors, according to Eurostat (2021). Region Profile. Regional Innovation Scoreboard 2019, Industrial Policy, https://interactivetool.eu/RIS/RIS_2.html#

The situation of the region of the Republic of Serbia in terms of the regional innovation index in 2019 in relation to the average of the European Union in 2019 is shown in Graph 5 (according to the data from Table 5). According to the values of the regional innovation index for 2019, all national regions are at a disadvantage compared to the European Union average from 2019.

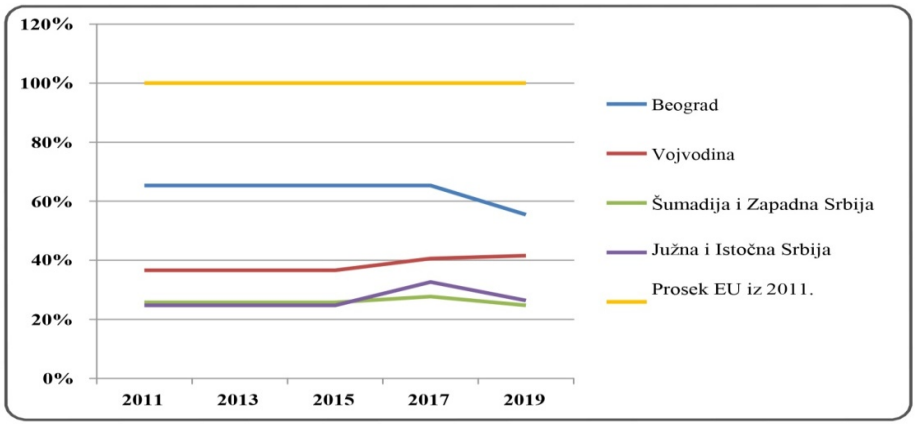
Graph 5. Innovation index of the region of the Republic of Serbia (% of EU average, EU 2019 = 100)



Source: Authors, according to Eurostat (2021). Region Profile. Regional Innovation Scoreboard 2019, Industrial Policy, https://interactivetool.eu/RIS/RIS_2.html#

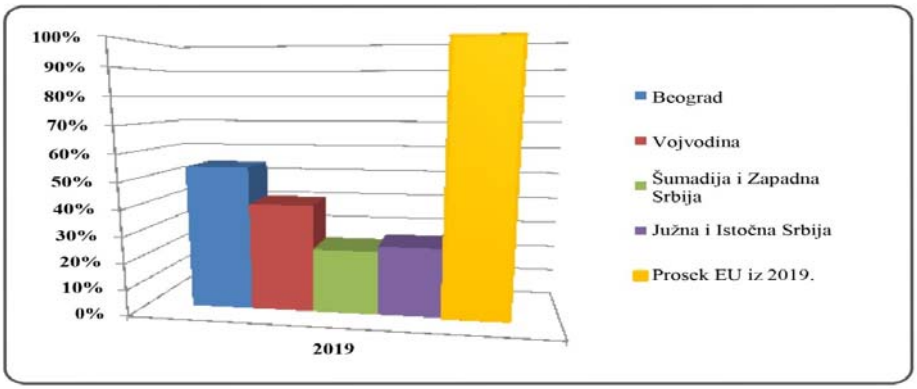
Graph 6 (according to the data from Table 6) gives a visual presentation of the regional estimates of the population aged 25-64 who participate in lifelong learning. This indicator represents the share of people aged 25-64 who practice all purposeful learning activities - whether formal or informal, whether relevant to their job or not, which they continuously approach in order to improve knowledge, skills and competencies. The intention and / or goal of learning is actually a critical point that distinguishes these activities (lifelong learning) from activities that are not undertaken for the sake of learning, such as cultural or sports activities, for example.

Graph 6. Percentage of population aged 25-64 participating in lifelong learning by regions of the Republic of Serbia (% of EU average, EU 2011 = 100)



Source: Authors, according to Eurostat (2021). Region Profile. Regional Innovation Scoreboard 2019, Industrial Policy, https://interactivetool.eu/RIS/RIS_2.html#

Graph 7. Percentage of population aged 25-64 participating in lifelong learning by regions of the Republic of Serbia (% of EU average, EU 2019 = 100)

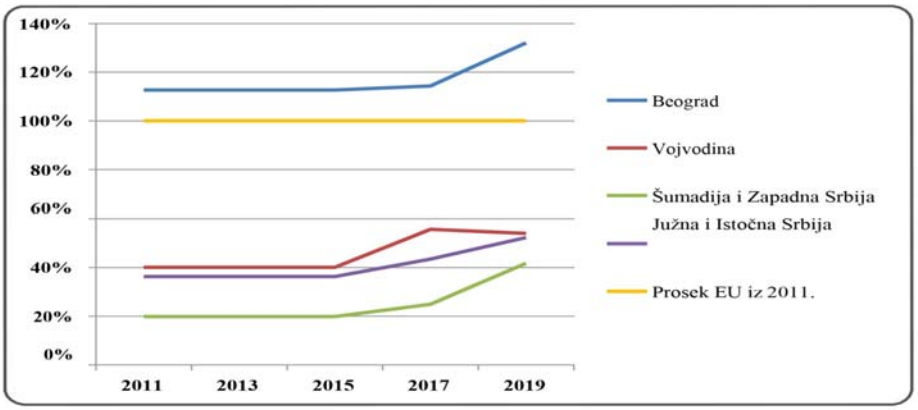


Source: Authors, according to Eurostat (2021). Region Profile. Regional Innovation Scoreboard 2019, Industrial Policy, https://interactivetool.eu/RIS/RIS_2.html#

Graph 7 shows the state of the regional estimates of the population aged between 25 and 64, who participate in lifelong learning in 2019, compared to the average of the European Union in 2019 (according to the data in Table 6). Accordingly, all regions in the Republic of Serbia are in a worse relationship compared to the European average of the reference year. The region of Šumadija and Western Serbia, in relation to the average of the European Union and other national regions, occupies the lowest percentages of the population aged between 25 and 64, who participate in lifelong learning.

Graph 8 shows the visual presentation of the data from Table 7 and refers to the regional percentage of the population aged 30-34 with completed tertiary level of education (graduates, masters and doctors of science). This is a general indicator of the supply of human capital of advanced knowledge and competencies. The indicator is not limited to the field of technology and the domain of science, because the adoption of innovations in many areas, especially in the service sectors, depends on a wide range of skills that highly educated strength is meant to abound. The indicator is focused on the narrow share of the population aged 30 to 34 because it relatively quickly reflects possible changes in educational policies (and the efficiency of their implementation) that lead to an increase in its share in the observed population, i.e. a larger number of highly educated people. In the analyzed period 2011-2019, the region of Belgrade recorded impressive results in terms of the percentage of highly educated workforce, compared to other national regional entities and the average of the European Union. The region of Šumadija and Western Serbia has the smallest shares of highly educated labor force aged 30-34 in the observed period, while the region of Southern and Eastern Serbia at the end of the period reduces the gap and catches up with the region of Vojvodina.

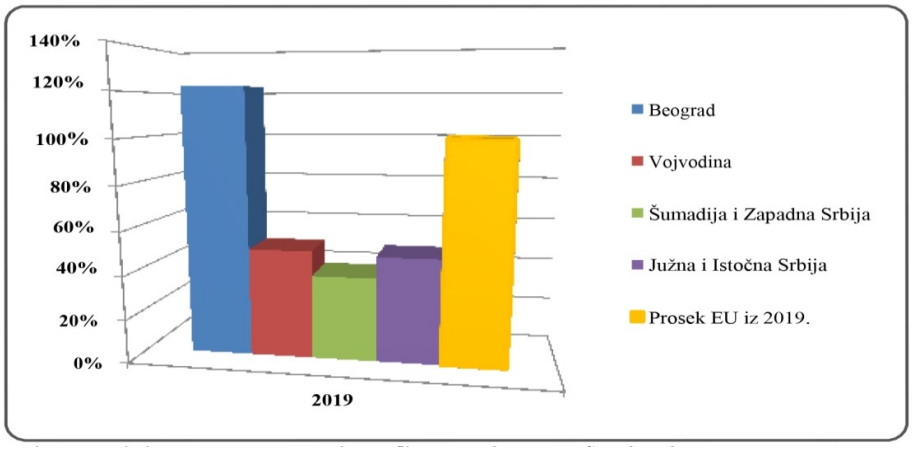
Graph 8. Percentage of population aged 30-34 with completed tertiary education by regions of the Republic of Serbia (% of EU average, EU 2011 = 100)



Source: Authors, according to Eurostat (2021). Region Profile. Regional Innovation Scoreboard 2019, Industrial Policy, https://interactivetool.eu/RIS/RIS_2.html#

Graph 9 shows the regional percentage of the population aged 30 to 34 with completed tertiary level of education in 2019 in relation to the average of the European Union from 2019 (according to the data from Table 7). Judging by the given graphic presentation, the region of Belgrade exceeds the average of the European Union from 2019, leaving the remaining national regions behind in a slightly worse relation in relation to the reference average of the European Union (than it was the case with the same from 2011).

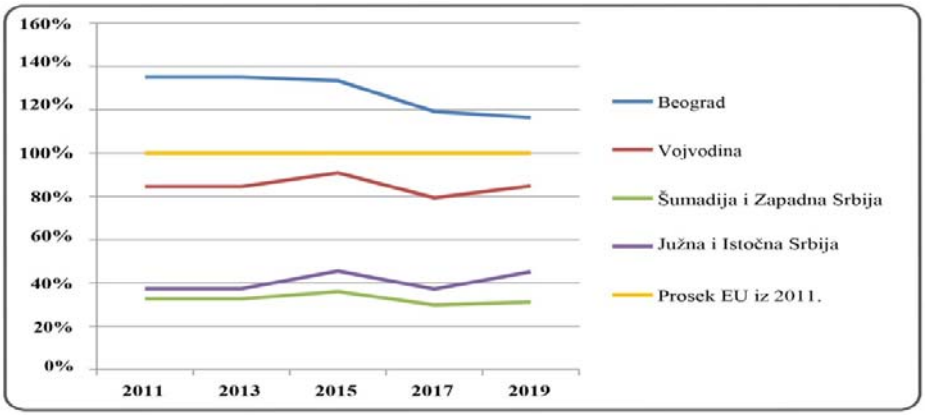
Graph 9. Percentage of population aged 30-34 with completed tertiary education by regions of the Republic of Serbia (% of EU average, EU 2019 = 100)



Source: Authors, according to Eurostat (2021). Region Profile. Regional Innovation Scoreboard 2019, Industrial Policy, https://interactivetool.eu/RIS/RIS_2.html#

Graph 10 gives a visual presentation of the data from Table 8 on regional public expenditures for research and development activities as a percentage of regional GDP in the Republic of Serbia. Research and development expenditures are one of the main drivers of economic growth in the knowledge-based economy. As such, trends in the R&D expenditure indicator provide key indications of the region's future competitiveness and wealth. Public spending on research and development is essential for the transition to a knowledge-based economy, as well as for improving production technologies and fostering sustainable economic growth and development. In the region of Belgrade, expenditures in the public sector are at a significantly higher level than the average regional level at the level of the European Union from 2011. The region of Vojvodina converges towards the average of the European Union, while the percentages of expenditures in the public sector of Šumadija and Western Serbia and Southern and Eastern Serbia do not reach even 50% of the average public expenditures of the region for research and development in the European Union.

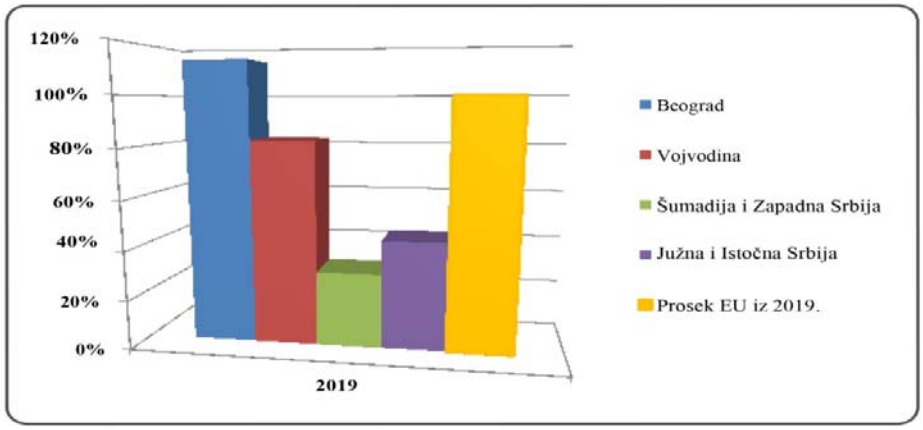
Graph 10. Regional expenditures for research and development in the public sector as a percentage of regional GDP in the Republic of Serbia (% of EU average, EU 2011 = 100)



Source: Authors, according to Eurostat (2021). Region Profile. Regional Innovation Scoreboard 2019, Industrial Policy, https://interactivetool.eu/RIS/RIS_2.html#

The level of regional expenditure on research and development in the public sector of the region in the Republic of Serbia in 2019 compared to the European Union average in 2019 is shown in Figure 11. As in the case of highly educated workforce and employment in high technology industry and / or knowledge intensive service sectors, the Belgrade region exceeds the regional average of the European Union from 2019 and the averages of other national regions.

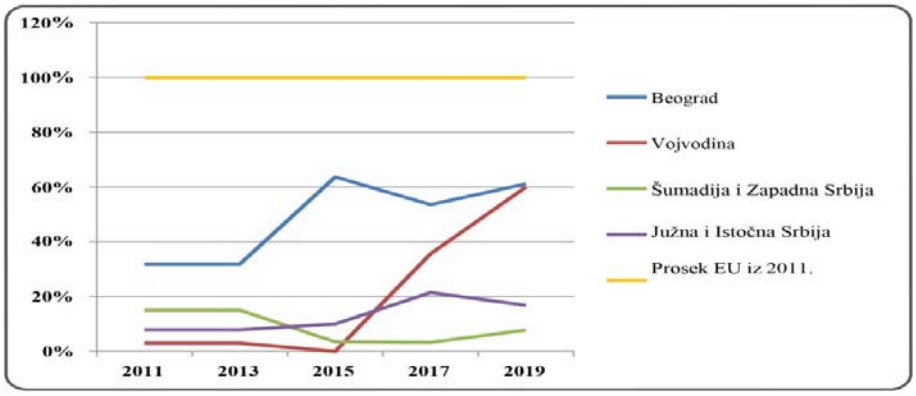
Graph 11. Regional expenditures for research and development in the public sector as a percentage of regional GDP in the Republic of Serbia (% of EU average, EU 2019 = 100)



Source: Authors, according to Eurostat (2021). Region Profile. Regional Innovation Scoreboard 2019, Industrial Policy, https://interactivetool.eu/RIS/RIS_2.html#

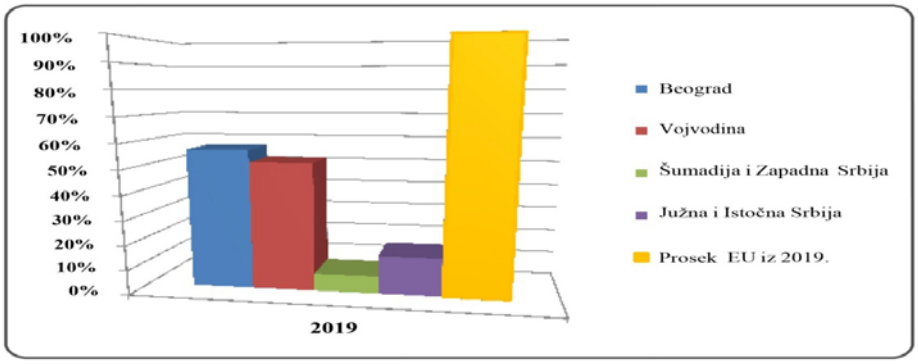
Graph 12 presents a visual representation of the data from Table 9 that refer to the private sector expenditure of the region for research and development activities. This indicator records the formal creation of new knowledge in private sector companies within the region. This is especially important in knowledge-based industrial sectors (pharmaceutical and chemical products and certain areas of electronics), where most new knowledge is generated within or near research and development laboratories. In all regions of the Republic of Serbia, these private sector expenditures are significantly below the EU average in 2011. This testifies to the poorly developed investment of the private sector in the region in research and development activities, possibly also to rely predominantly on public finances for them.

Graph 12. Regional expenditures for research and development in the public sector as a percentage of regional GDP in the Republic of Serbia (% of EU average, EU 2011 = 100)



Source: Authors, according to Eurostat (2021). Region Profile. Regional Innovation Scoreboard 2019, Industrial Policy, https://interactivetool.eu/RIS/RIS_2.html

Graph 13. Regional expenditures for research and development in the private sector as a percentage of regional GDP in the Republic of Serbia (% of EU average, EU 2019 = 100)



Source: Authors, according to Eurostat (2021). Region Profile. Regional Innovation Scoreboard 2019, Industrial Policy, https://interactivetool.eu/RIS/RIS_2.html#

The level of regional expenditures for research and development within the private sector of the region in the Republic of Serbia in 2019 compared to the European Union average from 2019 is given in Graph 13. Almost identical to the previous graph, the region of Belgrade and Vojvodina just exceeds 50% of the regional average of the European Union from 2019, while the region of Šumadija and Western Serbia reaches barely 7.2% of the same.

4. Discussion of results

Differences in the level of development of the region in the Republic of Serbia have existed for decades and are not new. The region of Belgrade is traditionally the most developed, while the region of Southern and Eastern Serbia is traditionally the least developed, although the region of Šumadija and Western Serbia does not lag behind it in terms of underdevelopment. Disparities in terms of economic growth and development and living standards of people in the regions, and at the national level in general, can be attributed to inadequately implemented socio-economic policy in the Republic of Serbia. The statistical analysis of regional incomes per capita indicated that the development inequalities of national regions are significant, even in the case of the regions of Šumadija and Western Serbia and Southern and Eastern Serbia, which apparently do not differ much. This result provides a sufficient evidence to make Research Hypothesis 1 valid.

The Republic of Serbia has suffered significant damage from war conflicts on its territory over the past few decades. The transition process began just over three decades ago and has been still ongoing, with no clear indication of its successful completion. In this regard, a large number of qualified and competent people have left their homes and jobs and generally sought better living conditions in foreign countries. For the economy of the Republic of Serbia, the emigration of highly educated labor force ("brain drain") is still a very big problem. Namely, due to turbulent political, social and economic events, the Republic of Serbia fails to preserve and effectively develop national intellectual capital resources, which are of strategic importance for sustainable growth and development and competitiveness of the national economy, both in the region and in the global market in the prevalence of the “new knowledge-based economy”. In this context, examining the existence of a functional link between intellectual capital and economic development in the Republic of Serbia has provided a significant evidence in favor of the importance of this resource for the sustainability of growth and development in the future. Valja points out that, in addition to the fact that the research Hypothesis 2 has been affirmed, the conducted quantitative statistical method cannot shed light on the cause-and-effect character of this relation, i.e. it cannot be argued that intellectual capital encourages economic development, or conversely, that economic development encourages the development of intellectual capital.

The results of the empirical research further indicated that in addition to developmental regional inequalities, the regions of the Republic of Serbia are also characterized by inequality in terms of intellectual capital resources, which verifies the truth of Hypothesis 3. In the context of European integration, national regions note that the Belgrade region in terms of three, out of a total of six analyzed indicators of intellectual capital: employment in knowledge-intensive sectors of the economy, the share of highly educated people in the most active labor force group – aged 30-34, and public expenditure on research and development activities and processes, exceeds the regional average within the European Union. This, to some extent, improves the picture of the state of national regions in the process of European integration.

Generally speaking, the Republic of Serbia has the potential to improve and develop national intellectual capital in the future. By applying adequate national policy measures, the Republic of Serbia should stop further divergence of the region's development, towards each other and towards the European Union region, which will ensure more stable growth and development and enhance the competitiveness of the national economy on the world market.

5. Conclusion

Intellectual capital is everything that exists in people, or comes from them. This resource includes individual knowledge and skills, norms and values, employee culture and behavior, databases, methodologies, standards and procedures, licenses, trademarks. It is often called invisible, "intangible" capital, with the aim of differentiation from visible, "tangible" capital, i.e. material capital. Intellectual capital is, therefore, in people's minds. It is not the property of an organization, region or nation, i.e. it is not under the control of management and policy makers and cannot be the subject of trade.

The main results of the research indicate that the Republic of Serbia is characterized by significant disproportions in the economic development of its regions, and, in addition to developmental disparities, is symbolized by the unbalanced capacity of regional intellectual capital resources, apparently a key factor in the new knowledge-based economy. In this regard, the evidence gathered in the empirical research affirmed the existence of a functional link between the human resource - the bearer of intellectual capital, and economic development in the Republic of Serbia. In accordance with all the above-mentioned, it can be stated that the conducted empirical analysis has achieved the fulfillment of the basic and additional goals in the paper.

The position that equality in regional development reflects on the sustainability of socio-economic development of economies has been scientifically well researched and confirmed. This is one of the most consistent discoveries in macroeconomics,

and has been consistent over the years. In that sense, the relevance of the paper is reflected in the affirmation of the importance of intellectual capital resources for the sustainability of growth and development of the socio-economic system, and pointing out the developmental disparities of national regional entities in order to overcome them. Today, on the path of European integration towards full membership in the regional supranational organization - the European Union, the Republic of Serbia, undoubtedly, has the task of overcoming decades-long disparities in the development of its regions and converging towards the average standard of living of EU citizens. In that sense, it is worth emphasizing that the importance of convergence in the region is reflected in the overall efforts of European policy makers based on the vision and strategy of "Europe of the region, not Europe of the nations or the states".

The contribution of the conducted research can be considered a critical consideration of the functional connection of intellectual capital resources and the process of economic development, as well as a critical analysis of the phenomenon of regional disparities in the New Economy and the convergence process within the European integration. What distinguishes the conducted quantitative analysis from the previous ones is the application of extremely simple statistical techniques and tools that, in a certain way, can measure the observed phenomena within the framework of the subject matter.

The research process is accompanied by certain limitations, primarily in terms of the unavailability of quantitative data for more accurate measurement of the effects of the analyzed phenomena and the formation of a longer time series for observation in empirical research. From the aspect of the qualitative component of work, the lack of a unified position on the resource of intellectual capital, and, consequently, the arbitrariness of scientific researchers in terms of its definition and metrics, leads to the insufficient quantum and unavailability of more research studies on the implications of intellectual capital on economic development.

After the conducted empirical research, there are plenty of open questions regarding the role and importance of intellectual capital in regional development in the Republic of Serbia. Thus, for example, it remains to be considered to what extent it is possible to improve and strengthen the regional intellectual capital capacities in the foreseeable future, and whether this new capacity will really lead to regional convergence within national borders, and, ultimately, to convergence with regions within the European Union. In the context of the previous, the main issue that remains open for further analysis refers to the complexity and metrics of the implications of intellectual capital resources on the regional development of the Republic of Serbia, and the very functionality of the relationship of these phenomena in future periods. Undoubtedly, these are some of the many issues that will continue to capture the attention of scientific researchers in the reference domain of economics.

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INTELEKTUALNI KAPITAL U FUNKCIJI REGIONALNOG RAZVOJA REPUBLIKE SRBIJE

Rezime: Empirijsko istraživanje intelektualnog kapitala u funkciji regionalnog razvoja Republike Srbije ima za cilj da pokaže i objasni funkciju intelektualnog kapitala u regionalnom razvoju Republike Srbije, i ukaže na disparitete nacionalnih regiona u pogledu ekonomske razvijenosti i resursa intelektualnog kapitala. Intelektualni kapital danas je jedan od najznačajnijih društvenih podsistema koji po svom opsegu i uticaju stiče sve veći značaj u razvoju modernog društva. Kao složen, dinamičan ljudski proces upotrebe znanja, intelektualni kapital se veže uz pojam „Nove ekonomije" zasnovane na znanju. Intelektualni kapital na makroekonomskom nivou je novo područje istraživanja koje se fokusira na razumevanje, merenje i izveštavanje o nematerijalnoj imovini koja može imati uticaj na stvaranje nacionalnog bogatstva. Koncept intelektualnog kapitala je apstraktan, nedvosmislen i složen, što dovodi do brojnih razlika u tumačenju ove ekonomske kategorije. Rezultati empirijskog istraživanja potvrdili su da je intelektualni kapital u značajnoj linearnoj funkcionalnoj relaciji sa ekonomskim rastom u Republici Srbiji - u 63,5% slučajeva ekonomski rast je objašnjen resursima intelektualnog kapitala u periodu 2012-2018. Isto tako, istraživanje je potvrdilo značajne neravnomernosti u razvijenosti i raspoloživim resursima intelektualnog kapitala u regionima Republike Srbije.

Ključne reči: intelektualni kapital, regionalni razvoj, makroekonomski nivo, ekonomija zasnovana na znanju.

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