“Economic growth of the country and national intellectual capital (evidence from the post-socialist countries of the central and eastern Europe)”

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ECONOMIC GROWTH OF THE COUNTRY AND NATIONAL INTELLECTUAL CAPITAL (EVIDENCE FROM THE POST-SOCIALIST COUNTRIES OF THE CENTRAL AND EASTERN EUROPE)

Abstract

The purpose of the article is to study the innovation levers of developing the intellectual background for economic growth in two groups of post-socialist Central and Eastern European countries (middle-income and lower-middle-income countries). To achieve that, the quantitative effect of the national intellectual capital components (human capital, market capital, structural capital and capital of renewal and development) on the dynamics of the countries' economic growth was determined.

For both groups, multiple regressions have been constructed that reflect the quantitative relationship between the economic growth rates (in the regressions – the indicator of real gross domestic product per capita) and the components of national intellectual capital in 2010–2018. It has been established that the key innovative indicator of the economic growth of middle-income countries is the national capital of renewal and development, which in general corresponds to the pan-European model of innovation and investment development. Education is the main factor that provides the basis for the economic growth of lower-middle-income countries. Recommendations on improvement of national innovation policy are offered.

Keywords country, innovation levers, capital, linear production functions, correlation and regression models

JEL Classification C1, O38, O47, O57, P52

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INTRODUCTION

Currently, a gradual transition to a new technology, i.e., an information-innovation economy, or an economy based on knowledge, information and innovation, is taking place in the world. Its characteristic features are: creation of innovations, introduction of resource and energy saving technologies, state support for science-intensive industries and protection of intellectual property (patents, licenses, know-how, innovation projects, etc.). As a result, not only the sectoral structure of national economies changes, but also factors influencing the dynamics of their economic growth. The processes of creating and using new knowledge, ideas and information are key factors ensuring economic stability, sustainable economic development and technological competitiveness of modern macroeconomic systems. Highly skilled and educated workers with their knowledge, skills and abilities become the main driving force of social progress and provide the formation of a new, innovative type of economic systems.

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The research of innovation levers of the formation of the intellectual background for the economic growth of modern macro systems, as well as the definition of tools, methods and organizational and economic mechanisms for optimizing the relationship between the indicators characterizing these processes, is an urgent task. Awareness of this requires developing a new paradigm of knowledge about shaping the economic growth intellectual basis, which in the long run will allow to improve the state policy of innovation development based on increasing the efficient management of the national intellectual capital components.

1. LITERATURE REVIEW

The introduction of scientific and technological progress, the focus on the production of science-intensive products, which belongs to the fifth and sixth technological paradigms, paying particular attention to education, science, culture, healthcare, which form qualitative human capital, have provided the world's major economies with due basis for achieving economic stability and competitive advantages on world commodity markets. Therefore, it is not surprising that economies based on knowledge, information and innovation are the most successful and economically developed ones (see Table 1).

In the economic literature, identifying innovation levers of the country's economic growth can be considered at least in the context of the two groups of methodological approaches. The first group should include work in which the linear production functions are used to study the innovation levers of economic growth of the country. This allows determining the quantitative relationship between the volume of investment in intangible assets (utility models, inventions, software products, databases, trademarks, brands, etc.) and the level of social productivity of labor. This group includes the scientific works by Corrado, Hulten, and Sichel (CHS model) (2005, 2009), Barnes and McClure (2009), Castells and Himanen (2002), Ferreira and Hamilton (2010), and Edquist (2011) who calculated the quantitative effect of aggregate investment in non-physical capital (intellectual property objects and new technologies) on the growth rate of social productivity in the European Union countries and have concluded that such a connection is more noticeable in the leading European economies (Great Britain, Germany, France, Austria) and less noticeable in other countries (Sweden, Italy, Poland, Czech Republic).

Taking the basic provisions of the CHS model as a basis and using comparative statistics and indices for the Southern European countries, Corrado (2005), Roth and Thum (2010), and Piekkola (2011) found that the main tool of supporting economic growth in this region is an innovation lever, which requires increased spending on raising the educational and qualification level of employees, implementation of scientific and technical works, software development and organizational and marketing innovations. Corrado (2005), Roth and Thum (2010) confirmed their findings by the following statistical data: in 2005–2007, an increase in the cost of conducting fundamental research by 15% provided Italy, Spain and Portugal with steady economic growth of 3-5%.

Table 1. Main indicators of the innovative development of the world's major economies

Source: Compiled based on Data for the Sustainable Development (2017), The Global Innovation Index (2017) and World Development Indicators (2010–2017).

Country/economy	The Global Innovation Index		The Global Competitiveness Index		Real GDP per capita	
	Points	Rating	Points	Rating	USD	Rating
Singapore	59.83	5	83.5	2	98,014	4
Switzerland	68.41	1	82.6	4	63,380	11
USA	60.13	4	83.5	1	61,152	12
Netherlands	63.32	2	82.2	6	56,436	14
Denmark	58.39	8	80.6	10	51,643	22
Luxembourg	54.53	15	76.6	19	110,870	3
Hong Kong	54.62	14	82.3	7	64,533	10

Attention is drawn to studies focusing on innovation levers of economic growth based on quantitative assessment of the impact of individual components of the national intellectual capital on the economic growth rates in the leading world's economies. In particular, Corrado, Haskel, Jona-Lasinio, Iommi (2010, 2012, 2016), Piekkola (2011, 2014), Nadiri (2011), Nadiri and Nandi (2015), Chun and Nadiri (2016), Haskel and Westlake (2018) analyzed the quantitative effect of the type of intangible assets such as a national structural capital on the GDP dynamics of the economically developed countries. In their models, national structural capital is characterized by four indicators: the number of educational institutions per 1,000 people, the number of libraries per 1,000 people, the number of Internet providers per person, and the number of mobile operators per person. The aforementioned scholars have pointed out that such interconnection is closest in countries that are leaders according to "hidden" assets – South Korea and North America (the United States and Canada).

Hao, Manole, and Ark (2009), Halten and Hao (2012) investigated the relationship between the volume of investment in intangible assets and the dynamics of macroeconomic growth in the Chinese economy. They found that at the beginning of the 21st century, increased investment in the development of innovation and communication technologies and software development contributed to a significant increase in gross domestic product of China.Hao at al. (2009) pointed to the important role of investment in the main (physical) capital in the economic growth of China during 2003–2011.

In their further research, Ark at al. (2009), Nakamura (2010), Ark and Halten (2007) have proved that in China, as well as in the majority of other Asian countries (Thailand, the Philippines, Indonesia), the growth of real GDP in 2006–2009 was driven not by increased investment in the formation and development of innovative, structural and/or market capital, but by an increase in investment in the main (physical) capital, namely development of transport infrastructure, construction of new industrial facilities, production of heavy machinery, etc. Ultimately, Ark at al. (2010) concluded that the Chinese economy is currently on the way towards an information and innovation economy based on knowledge, information and intelligence.

Representatives of another group of scientific approaches to the analysis of economic growth are mainly using methods of economic and mathematical modeling, in particular regression, factor and discriminatory analysis. Thus, Bontis (2004) used a regression analysis as a tool for research on innovative levers of economic growth in the Middle Eastern countries (Egypt, Kuwait, Qatar, Tunisia, and the United Arab Emirates). He proved that the main innovation lever that has ensured the steady positive dynamics of the economic growth of countries located in the region is human capital represented as knowledge, skills and motivation of employees that bring them income in the form of labor rent. Based on Bontis' calculation results, Uziene (2014) has constructed a regression model to analyze innovation levers of economic growth in the Baltic economies (Latvia, Lithuania and Estonia), which are at the stage of transition to information and innovation drivers. Uziene (2014) has established that the global index of intellectual capital and the index of human development have the most significant impact on the level of national competitiveness of the Baltic countries.

While developing the idea of using the methods of economic and mathematical modeling to determine the innovation levers of the country's economic growth, P. Stahle and S. Stahle (2007, 2011) demonstrate the role of national intellectual capital and its innovative component in increasing the volume of domestic production. They found that such a relationship differs considerably at different stages of the country's economic development. In addition to the scientific developments of P. Stahle, S. Stahle, Ruiz, Navarro, and Pena (2016), based on the analysis of 70 countries, proved the importance of each of the four components of national intellectual capital (human capital, market capital, structural capital, and capital of renewal and development) and concluded that human capital and capital of renewal and development are the determining factors of economic growth only in the innovative world's economies, namely the USA, Japan, South Korea and most of the EU countries.

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At the same time, Stam and Andriessen (2009), Crass, Licht, and Peters (2010), Abdullaeva and Warden (2011), Dal-Borgo, Goodridge, Haskel, and Pesole (2011), Andrews and de Serres (2012), just to name a few, proved that national intellectual capital positively affects the level of social productivity of labor both in economically developed OECD countries and in the so-called third world countries.

The purpose of the article is to study the innovation levers of developing the intellectual basis of economic growth in two groups of post-socialist countries of the Central and Eastern Europe (middle-income countries (Belarus, Bulgaria, Estonia, Latvia, Lithuania, Poland, Russia, Romania, Slovakia, Slovenia, Hungary, Croatia, Czech Republic) and countries with below than middle incomes (Albania, Bosnia and Herzegovina, Macedonia, Moldova, Serbia, Ukraine, Montenegro) by determining the quantitative effect of the national intellectual capital components (human capital, market capital, structural capital, capital renewal and development) on the dynamics of their economic growth. The research is based on the following hypothesis: There is a close relationship between the country's economic growth rates and the national intellectual capital components (national human capital, national market capital, national structural capital, and national capital of renewal and development). This correlation is varying in different types of economic systems: the major world's countries, economically developed countries, post-socialist countries and developing countries.

2. METHODS

The study uses a method of regression analysis, which will determine the quantitative relationship between the economic growth rates of the country and the components of national intellectual capital. Regression models take into account four components of national intellectual capital, namely human capital, market capital, structural capital, and capital of renewal and development. The economic value of the factors (regressors) consists in the fact that they show how much (in percentage terms) the dependent factor will change (in the models of the current study, the amount of real GDP per capita), if independent factors (indicators characterizing the national intellectual capital components) change by one percent.

3. RESULTS

The research of innovation levers of developing the intellectual basis for economic growth in post-socialist countries involves several stages (see Figure 1).

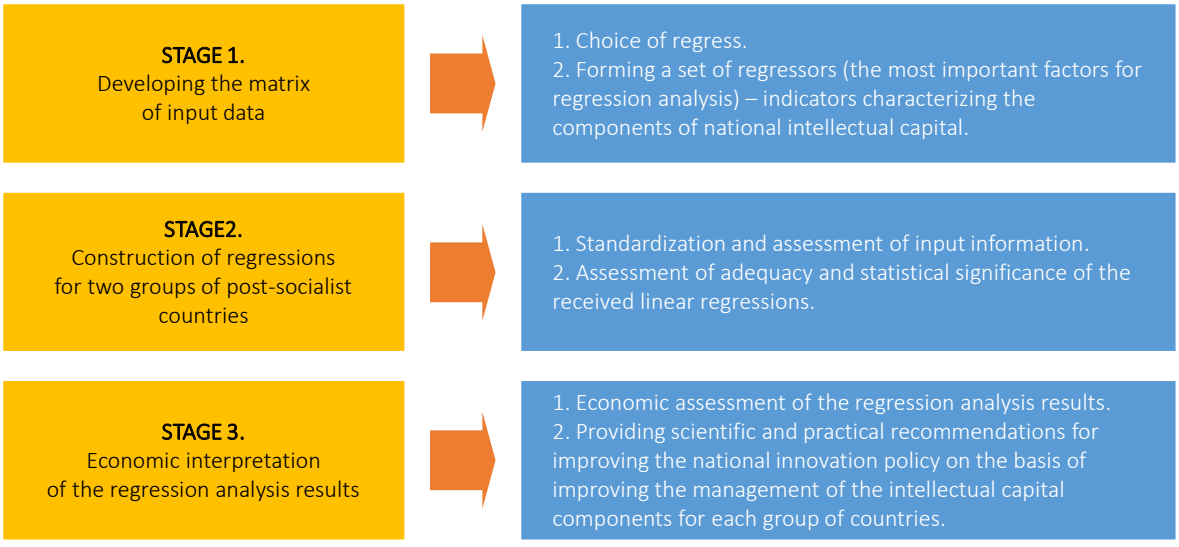

Figure 1. Stages of the study of innovation levers for developing the intellectual basis of countries' economic growth

Table 2. Indicators characterizing the components of national intellectual capital

National intellectual capital components	Indicators
National human capital	The number of teachers per 1,000 people (X_1), the number of teachers in higher educational institutions per 1,000 people (X_2), the share of people with higher education in the total population (X_3), the number of health care workers per 1,000 people (X_4), the expected lifespan (X_5)
National market capital	The balance of intellectual property purchase and sale transactions (X_6), the number of acquired or transmitted technologies (X_7), the number of economically active population aged 16 to 60, who traveled abroad for study or internship throughout the year, per 1,000 people (X_8)
National structural capital	The number of educational institutions per 1,000 people (X_9), the number of libraries per 1,000 people (X_{10}), the number of telephone lines per person (X_{11}), the number of Internet providers per person (X_{12}), the number of social media per person (X_{13})
National capital of renewal and development (or innovation capital)	The amount of internal expenses for scientific and innovative activity (X_{14}), the volume of foreign investment in scientific and innovative activity (X_{15}), the number of employed in high-tech sectors of the domestic economy per 1,000 people (X_{16}), the share of venture enterprises in the total number of economic entities (X_{17}), the number of patents issued by the United States Patent and Trademark Office (X_{18}), the number of employees who upgraded their qualifications during the year, per 1,000 people (X_{19})

At the first stage, based on the analysis of research (Ark & Hulten, 2009; Barnes & McClure, 2009; Chun & Nadiri, 2016; Corrado, Hao, Hulten, & Ark, 2009; Ferreira & Hamilton, 2010; Majcen, Verbič, & Polanec, 2011; Piekkola, 2011, 2014; P. Stahle & S. Stahle, 2007; Cherkashyna, 2016, 2017), the regress and and the appropriate regressors were chosen. As a regress, the amount of real GDP per capita is determined, and regressors (the most significant factors) are indicators that characterize the national intellectual capital components (see Table 2).

Hereafter, an input matrix is formed that characterizes the process of forming the intellectual basis for economic growth in post-socialist countries during 2010–2018. As a research object, 20 countries of Central and Eastern Europe were selected, which, depending on the per capita GDP values, were divided into two subgroups (clusters): middle-income countries (> 15 thousand dollars) and lower-middle-income countries (< 15 thousand dollars) (see Table 3).

Table 3. Dynamics of real per capita GDP in post-socialist Central and Eastern European countries

Source: Data for the Sustainable Development (2017) and World Development Indicators (2010–2017).

Country	Years								
	2010	2011	2012	2013	2014	2015	2016	2017	2018
Middle-income countries									
Belarus	15.919	17.153	17.790	18.257	18.901	18.345	18.060	18.349	20.140
Bulgaria	15.670	16.695	17.113	17.645	18.291	18.249	19.199	21.499	22.410
Estonia	23.919	25.494	26.373	27.694	28.451	28.947	29.365	30.765	33.842
Latvia	19.817	21.296	22.439	23.585	24675	24.919	26.031	27.190	29.011
Lithuania	22.752	24.384	25.908	27.529	28588	28.936	29.966	31.849	34.596
Poland	21.084	22.575	23.360	24.068	25333	26.856	27.811	29.349	31.430
Russia	22.639	24.032	25.323	26.046	26691	23.703	23.163	27.466	28.140
Romania	17.326	17.850	18.850	19.844	20934	22.071	23.626	23.598	24.190
Slovakia	24.555	25.759	26.610	27.409	28590	29.907	30.632	33.055	35.095
Slovenia	28.055	28.774	28.443	28.542	29.922	301.933	32.885	33.579	35.044
Hungary	21.906	22.811	22.983	23.904	25399	26436	26681	28965	31.370
Croatia	20.433	20.416	20.583	20.937	21684	22489	23596	24053	25.111
Czech Republic	28.561	28.803	29.097	30.432	32.076	33.743	34.711	34.849	37.546
Lower-middle-income countries									
Albania	10.196	10.234	10.697	11156	11.058	11.505	11.929	12.568	12.756
Bosnia and Herzegovina	9.017	9.303	9.389	9.784	10.084	11.687	12.075	11.565	11.895
Macedonia	12.064	12.215	12.754	13.432	14.083	14.023	15.121	15.381	16.324
Moldova	4.180	4.226	4.700	5.017	5.053	5.054	5.334	5.697	5.925
Serbia	12.628	12.792	13.398	13.454	13.790	14.112	14.512	15.321	15.836
Ukraine	8.328	8.517	8.676	8.733	7.966	7.948	8.772	8.768	9.180
Montenegro	14.273	14.129	14.852	15.373	16.058	16.183	16.854	17.554	17.869

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Table 4. Relationship between the dynamics of economic growth and the national intellectual capital components in the Central and Eastern European post-socialist countries

Components of the national intellectual capital	All countries under study		Middle-income countries		Lower-middle-income countries	
	Regression equation	Determination coefficient (R^2)	Regression equation	Determination coefficient (R^2)	Regression equation	Determination coefficient (R^2)
National human capital	$Y = 0.7428X_1 + 0.3482X_2 + 0.1911X_4$	0,8185	$Y = 0.7212X_1 + 0.6431X_2 + 1.0345X_3 + 0.2526X_4 + 0.1988X_5$	0,7893	$Y = 0.7885X_1 + 0.7486X_2 + 1.0019X_3$	0.8483
National market capital	$Y = 0.1192X_7$	0.7771	$Y = 0.9896X_7$	0.8184	$Y = 0.3536X_7 + 0.2956X_8$	0.9124
National structural capital	$Y = 0.0811X_9 + 1.0194X_{10}$	0.9112	$Y = 0.3126X_9 + 0.2539X_{10}$	0.8685	$Y = 0.9536X_9 + 0.8423X_{10} + 0.1656X_{11} + 0.0012X_{12} + 0.0078X_{13}$	0.8789
National capital of renewal and development (or innovation capital)	$Y = 0.7186X_{14} + 0.1234X_{15} + 1.2529X_{16} + 0.6589X_{19}$	0.8208	$Y = 0.6411X_{14} + 1.7685X_{16} + 1.1123X_{19}$	0.9113	$Y = 0.5658X_{14} + 0.6413_{15} + 0.4125X_{16}$	0.8689

Statistical information was processed in the Stat Graphic Centurion software environment (module – Regression Analysis) and tested for accuracy, homogeneity and compliance with the normal distribution law. The research has shown that in the regressions obtained, there is a clear tendency of grouping the input data close to the center. Positive and negative deviations from the center are equally probable, with the frequency of deviations decreasing rapidly in the event of a significant increase in deviations from the center. Accordingly, it was concluded that the distribution of the feature investigated, namely the volume of real GDP per capita, is close to normal with a more acute peak of distribution.

The statistical significance of the regressions obtained is confirmed by many indicators. First of all, the parameters of *t*-statistics (*T*-Stat) were calculated. Thus, it is proved that it is necessary to exclude those indicators from the regression equations whose values exceed the maximum acceptable norms. In this regard, the following indicators were excluded from the regressions that determine the relationship between economic growth rates and the national intellectual capital components in the middle-income countries: the number of telephone lines per person (X_{11}), the number of Internet providers per person (X_{12}) and the number of patents issued by the United States Patent and Trademark Office (X_{18}). And from regressions determining the relationship between economic growth rates and the components of national intellectual capital in the Central and Eastern European post-socialist countries with lower than middle income of the population, the following indicators were excluded – the expected lifespan (X_5), the share of venture capital enterprises in the total number of economic entities (X_{17}), the number of patents issued by the United States Patent and Trademark Office (X_{18}). After that, the variation coefficient was calculated. This made it possible to conclude that the balance of intellectual property purchase and sale transactions (X_6) should be excluded from both clusters of post-socialist countries, and the number of employees who upgraded their qualifications during the year, per 1,000 people (X_{19}) should be excluded from the cluster of lower-middle-income countries. In addition, interconnected factors should be excluded from the models. For this purpose, the matrix of pair coefficients was constructed, which indicated that all factors included in the model (X_1, X_2, X_3, X_4, X_5, X_7, X_8, X_{10}, X_{13}, X_{14}, X_{16}, X_{19} – in the first the cluster of countries, X_1, X_2, X_3, X_7, X_9, X_{10}, X_{11}, X_{12}, X_{13}, X_{15}, X_{16} – in the second cluster) are not very closely interconnected ($R < 0.85$). This provision was also confirmed by calculations of the criterion of statistical significance of the estimated correlation (*P*-value > 0.05). Also, the Durbin-Watson (DW) statistics were used. In particular, the boundaries of DW statistics for the studied countries were de-

termined ($1.35 \leq DW \leq 1.9$), indicating no autocorrelation of the first-order residues. The statistical significance of the constructed regressions has been confirmed by the values of the determination coefficients varying from 0.7771 to 0.9112 and making it possible to assert that the models obtained are adequate and explain the dynamics of the dependent variable (real GDP per capita) from 77.11% to 91.12% (see Table 4).

4. DISCUSSION

Formation use and reproduction of human capital is the main lever of developing the intellectual basis for economic growth of the countries under investigation. This is confirmed by the quantitative effect of the following indicators: the number of teachers per 1,000 people ($0.7428X_1$), the number of teachers at higher educational institutions per 1,000 people ($0.3482X_2$), the number of health care workers per 1,000 people ($0.1911X_4$).

Another lever for the innovation and investment model of development is the national capital of renewal and development, that is, the national innovation capital, which in the regressions received is characterized by indicators such as the amount of internal expenses for scientific and innovation activity ($0.7186X_{14}$), the number of employed in high-tech sectors of the national economy per 1,000 people ($0,1234X_{16}$) and the number of employees who upgraded their qualifications during the year, per 1,000 people ($0.6589X_{19}$). It has also been established that financing of innovation infrastructure objects (design bureaus, research institutes, technoparks, technopoles, technoecopoles) ($0.7186X_{14}$, $0.7934X_{15}$) contributes to the implementation of innovative projects, the production of high-tech industrial products, the development of knowledge-intensive business, and hence, and to an increase of the technological competitiveness of countries belonging to this cluster.

At the same time, there are some differences between the multiple regression equations obtained for the two groups of post-socialist countries: middle-income countries and lower-middle-income countries. The results obtained for middle-income countries (Belarus, Bulgaria, Latvia, Lithuania, Estonia, Poland, Russia, Romania, Slovakia, Slovenia, Hungary, Czech Republic) are generally in line with the pan-European model of innovation and investment development, which is based on the commercialization of new scientific and technical knowledge, introduction of modern information and communication technologies, organization of science-intensive business and development of high-tech sectors of the domestic economy. It is, therefore, not surprising that the objects of innovation infrastructure (technopoles, technoecopoles, venture companies, knowledge consortia, knowledge and technology transfer centers, centers of excellence, business incubators) have been recognized as the main factor for successful economic development and social progress by the governments of the "new members" of the European Union (Bulgaria, Estonia, Latvia, Lithuania, Poland, Romania, Slovakia, Slovenia, Croatia, Czech Republic).

In addition, the national human capital has a significant positive impact on the dynamics of economic growth in the Central and Eastern European post-socialist middle-income countries. This is manifested in the quantitative effect of the following indicators: the number of teachers per 1,000 people ($0.7122X_1$), the number of teachers of higher educational institutions per 1,000 people ($0.6431X_2$), the share of people with higher education in the general structure of the country's population ($0.0345X_3$), the number of health care workers per 1,000 people ($0.2526X_4$), the expected lifespan ($0.1988X_5$). These results are explained by the fact that the governments of this group of countries recognize the knowledge, skills, and motivation of people as the main productive force of the national economy, and proper financing of the branches of education, culture and healthcare is an integral part of the national innovation policy of these countries. Therefore, in countries with "fast-growing markets" (Poland, Slovakia and Hungary), significant budget funds are allocated to the industries that form human capital, thus providing training for highly skilled professionals capable of producing new ideas, developing and implementing innovative products, which belong to the fifth and sixth technological patterns and are competitive on world commodity markets. The dynamics of the economic growth of the Central and Eastern European post-socialist middle-income countries is significantly influenced by in-

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dicators that characterize the national structural capital, namely the number of educational institutions per 1,000 people ($0.3226X_9$) and the number of libraries per 1,000 people ($0.2539X_{10}$)

In addition, the multiple regression equation obtained for middle-income countries points to the important role of information and communication technologies, the latest electronic communications, as well as global, regional and local systems in providing structural and innovation transformations and the formation of the intellectual basis of economic growth, as they promote the interest of domestic investors in the Central and Eastern European markets ($0.6911X_{14}$), the inflow of foreign direct investment and accelerating the pace of technological progress and economic growth.

Instead, the regression equations determining the relationship between the dynamics of economic growth and the national intellectual capital components of the Central and Eastern European post-socialist lower-middle-income countries differ significantly from the previous ones. First of all, the obtained equations confirm and deepen the preliminary conclusions (Cherkashyna, 2016, 2017) that, despite the fact that Albania, Bosnia and Herzegovina, Macedonia, Moldova, Ukraine and Montenegro, in terms of state financing of education, science, culture, and health care are still significantly behind more developed post-socialist countries of the Central and Eastern Europe (Poland, Slovakia, Slovenia, Hungary, etc.), it is in lower-middle-income countries that an innovative lever of economic growth such as education has the greatest positive impact on the dynamics of economic growth. This makes it possible to recognize the knowledge, intelligence, erudition, emotions, creativity and system thinking of people as key factors in shaping the basis for the successful economic development and social progress of this group of countries.

Considerable attention is also paid to the fact that national market capital does not play a key role in ensuring economic growth of the Central and Eastern European countries with lower than middle incomes. That is these countries do not actively participate in international scientific and technological exchanges. This is evidenced by the following data: in 2017, the number of persons who arrived in Moldova for study and/or internship was 4,278, in Belarus – 20,504, and in Romania – 27,908. As a comparison, the number of persons who arrived in Poland for study and/or training during the same period was 65,904, in Russia – 240,509, in Hungary – 57,632, and 47,232 came to Czech Republic. This is also confirmed by the value of the corresponding regressor – the number of economically active population aged 16 to 60 who traveled abroad for study or internship during the year, per 1,000 people ($0.2956X_8$), which has a serious impact on the dynamics of economic growth in this group of countries. In addition, the number of acquired (transferred) technologies ($0.3536X_7$) plays an important role in shaping the intellectual basis of the economic growth of the post-socialist countries of this region. This is a very important point as it statistically confirms the need for finding more effective mechanisms for innovative transformations and technological modernization of industrial complexes in the Central and Eastern post-socialist countries with lower than middle incomes.

At the same time, despite the considerable scientific and technical potential, the national capital of renewal and development (or innovation capital) does not have a very significant effect on the dynamics of economic growth in Central and Eastern European countries with lower than middle incomes. This is evidenced by the relevant indicators: the volume of internal expenses for scientific and innovative activity ($0.5658X_{14}$), the volume of foreign investment in scientific and innovation activity ($0.6413X_{15}$) and the number of people employed in the science-intensive sector per 1,000 people ($0.4125X_{16}$). Albania, Bosnia and Herzegovina, Macedonia, Moldova, Ukraine and Montenegro are still almost indifferent to innovation as reflected in imperfect regulatory framework for science-intensive businesses, ineffectiveness of the institutional structure of innovation entrepreneurship and high-tech technologies, unfavorable investment climate, underdevelopment of the venture capital market, lack of financial resources for the conduct and commercialization of fundamental research, and low financial literacy of scientific and technical personnel. As a result, innovative ideas and projects developed in lower-middle-income countries are being introduced in other, more advanced economies – the USA,

China, Germany, Switzerland, creating the gross domestic product of these countries and thus increasing their national wealth.

It should also be noted that the regression equations determining the relationship between the national intellectual capital components and the dynamics of economic growth in countries with lower than middle incomes, in part duplicate results obtained for middle-income countries. Thus, the dynamics of economic growth in the 20 surveyed countries are influenced by indicators characterizing the national structural capital, namely the number of educational institutions per 1,000 people ($0.9536X_9$), the number of libraries per person ($0.8423X_{10}$) and the number of telephone lines per one person ($0.1656X_{11}$). This is due to the fact that in the context of the modern information and technological revolution in most world's countries, including post-socialist ones, a new social pattern is being shaped – an innovation and information society, which creates favorable conditions for the effective use of scientific and technical knowledge in solving urgent economic problems. Social media (social networks, blogs, microblogging, etc.) play a key role in this process. They result from convergence and development of information and communication technologies and global computer networks and serve as an effective tool for the exchange of experience and faster dissemination and introduction of innovative ideas, projects and technologies. In the future, the development of precisely national structural capital can be a boost to the rapid economic growth of Central and Eastern European lower-middle-income countries (Albania, Bosnia and Herzegovina, Macedonia, Moldova, Ukraine, Montenegro) and increase their role and significance in the global economy.

CONCLUSION

National capital of renewal and development (that is the national innovation capital) is the main lever of shaping the intellectual basis for the economic growth of middle-income countries (Belarus, Bulgaria, Estonia, Latvia, Lithuania, Poland, Russia, Romania, Slovakia, Slovenia, Hungary, Croatia, Czech Republic). Therefore, the strategic task of the state policy in these countries is shaping an innovation-investment model of "catchup" economic growth dominated by science-intensive industries in the structure of national economy.

Equally important for middle-income countries is the formation and efficient use of high-quality human capital. In view of this, the main priorities of governments should be, on the one hand, economic and social motivation of every citizen to be healthy, educated, highly moral and building on this basis an innovation and information society of highly educated and creative people. On the other hand, the state should ensure legal, economic, organizational and infrastructural conditions for following the appropriate way of life. As a result, these countries will be able to solve the main task, i.e. developing effective innovative systems and achieving high rates of economic growth based on the unity and balance of public policy in the fields of education, culture and health care.

Human capital is also the main driver of the economic growth in the Central and Eastern European post-socialist countries with lower than middle incomes. It is necessary to improve the quality and competitiveness of national innovation systems and thus solve two pressing problems: to lower the drain of highly skilled scientific and technical personnel, which is characteristic for lower-middle-income countries; and to increase the efficiency of the system for transferring new knowledge and technologies from the scientific sector to the manufacturing sector and accelerate the process of convergence. The development of national structural capital through the spread of global computer networks, Internet technologies, electronic communications, mass media, social networks and artificial intelligence systems is important for shaping the intellectual basis for economic growth.

In the long run, the implementation of the identified measures in the economic policy of the post-socialist countries under investigation will make it possible to significantly improve the efficiency of national

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innovation systems and, based on the balance of the three interconnected components (economic, social and environmental), create all the necessary conditions for the transition to a new technological structure, i.e. the information and innovation economy based on knowledge, information and intelligence.

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