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ANALYSIS AND ASSESSMENT OF HUMAN CAPITAL IN THE REGIONS OF SLOVAKIA

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Introduction. The human capital of any country is a priority factor of national wealth and well-being, as it creates the necessary potential in knowledge, experience and skills of people. It also accelerates intellectual and technical progress in society and strengthens a country's international competitiveness. The international experience in human capital formation confirms the importance of intellectual potential, education quality, and the need to accumulate it. The major reason for concentrating the human capital is the growing role of the population`s social protection and providing favourable conditions for personal and overall country development.

Aim and tasks. The aim of the study is to develop a comprehensive approach to the analysis and evaluation of human capital by identifying its main components in the Slovakian regions. The average multivariate method was used for the research, considering the dynamics of the economic development indicator.

Results. Based on the proposed algorithm for human capital analysis, an assessment of the human capital development level in Slovakian regions was carried out using the average multivariate method, considering intellectual, educational, physical, science, and innovative capital. The calculations and comparative graphic analysis for the period 2018-2020 revealed a close connection between the dynamics of GDP and human capital development, which can be traced in each region of Slovakia. The change in GDP in the calculation period is proportional to the change in human capital assessment indicators. The synchronicity in the graph`s dynamics of the average multidimensional indicators of GDP and human capital in Slovakia for the period 2018-2020 is graphically substantiated. This confirms that the indicators selected for analysis and evaluation indicate a stable connection between investments in the individual components of human capital and the country's economic development.

Conclusions. The analysis and assessment show that Slovakia has significant reserves for human capital development, which must be realized by implementing institutional changes both at the national and regional levels. This can be realized through the implementation of state programs to support youth, increase the level of funding, develop a business incentive system, and activate people's creative potential. The methodology of the analysis and the proposed measures will help improve the level of human capital in the country. A set of measures to improve the efficiency of the use and development of a country's human capital was proposed.

Keywords: human resources, labour potential, intellectual capital, intangible assets.

1. Introduction.

The development of the modern world in the era of the knowledge economy is characterized by the predominant role of human capital, as it plays a decisive role in the growth of GDP in both highly developed and developing countries. Human capital is the most valuable reproduction factor for production. The quality of human capital is formed through investments in education, healthcare, science, art, and social services. As an economic concept, human capital theory emphasizes the need to invest in people and develop their capabilities to ensure the foundations of sustainable economic growth.

The study of the "human capital" factor makes it possible to identify a fundamentally important source of economic growth, which is knowledge and competence, and accordingly positively determines the economic role of intangible spheres of human activity, which have long been considered unproductive. The theory of human capital consists not only of realizing the decisive role of a man in the economic system of society but also of the need to invest in a person (supporting his development as a competent and professional worker).

The issue of human capital development has not lost its topicality and is still being considered and improved by almost all economic schools and directions. It stands alongside categories such as economic growth and labor productivity, and, in modern conditions, economists are considered the basis of the functioning of the world economic system as well as the ultimate goal of economic development.

Based on an analysis of scientific opinions, a theoretical model of creation and human capital use and its impact on the economic growth of the country is proposed in this paper. When determining the evaluation subjects, the specifics of the elements and forms of human capital were preliminarily considered, which became the basis for the development of a human capital analysis algorithm.

Most literature reviews are aimed at researching the effectiveness of human capital using a large volume of indicators, which only complicates the calculation methods but does not provide the desired result.

Therefore, it is expedient to assess the impact of human capital quality on economic growth by empirically testing the relationship between human capital (HC) and GDP in the country. The proposed method of calculation using the most appropriate indicators can be considered a methodological approach in researching the relationship between the level of human capital and economic development in the country. Thus, the proposed methodology expands the methods of calculating the impact of HC on economic development, which is already reflected in the scientific literature.

Based on statistical data and the proposed evaluation method, a comprehensive analysis of human capital by region of the country was conducted. Based on the results of the analysis, recommendations were made to increase the level of human capital as a factor that influences a country's economic development.

2. Literature review.

Economic and social development involves the productive use of professional knowledge, health, and motivation, which are formed as a result of investments. New interpretations of human capital and its properties should not contradict previous views on the nature of capital and should harmoniously complement them. Studying the properties of capital makes it possible to clarify the most effective approaches to the study of the creation and use of human capital and contributes to the specification of tools and mechanisms capable of ensuring the high efficiency of these processes in practice.

Capital and wealth problems have received considerable attention in recent years. The theory of human capital involves deep roots. According to Kovalev and Ataeva (2012), this concept in its modern form appeared in the middle of the 20th century in the studies of Schultz (1971) and Gary Becker (1993) however, the classic theory of labour cost still follows considering Smith (1962) and Marx (2015).

Although Marx (2015) considered the value of this category to be the price of labour. Marx et al. (1992) justified the appropriateness of using the term abstract labour because the monetary equivalent of the price of labour is supposedly the same for different types of professional activity.

Therefore, the impact of the corresponding costs on the price of the manufactured product should be the same for the same period of work activity. Considering this, Marx used the concept of abstract work, the value of which is measured by quantity over the duration, regardless of the professional, educational, and qualification training of the workers as well as the amount of investment aimed at its provision. Although the views of scientists were largely determined by the current reality of social and working life, this does not justify the limitations of the conclusions presented in this part of his theory (Everett, 2017).

Schultz (1958) found that the American economy has a long-term higher income from human capital than material capital. Schultz (1958) advocated that investments in education are no less important than capital investments in machines and equipment.

In the interpretation of Turow (1999), human capital comprises productive abilities, talents, and knowledge. Dean and Kretschmer (2007) rejecting the theory of the three factors of production, understood capital as everything capable of generating income over a certain period of time. Based on the theory of utility, he included a man in the composition of capital on an equal basis to other material objects.

Becker (1993) presented the results of a study on the relationship between investment in education and the income of citizens. Today, it is generally recognized that the Becker (1993) started a new scientific direction–the economics of education–which includes research on school and vocational training, problems and features of continuous education, issues of medical care, population migration, price policy and family income, and time distribution in the family.

Zingales and Rajan (2004) noted that the financial revolution in the 1960s and the 1970s increased the mobility of workers, expanded their economic freedom, changed attitudes towards them on the part of employers, and simplified access to financial resources for broad sections of the population. The relevance of this topic is increasing every year, as evidenced by the publications of modern scientists. Therefore, research by Khan et al. (2023) aimed to study the aggregate impact of natural resources on high-income economies. After reaching a steady state of economic growth, G-7 countries plan to invest billions of dollars in so-called "green growth".

Mengesha and Singh (2023) examine the long-term impact of HC accumulation on economic growth in developing countries. This study analysed factors such as level of secondary and higher education, life expectancy, and mortality. Pata et al. (2023) highlighted the feasibility of developing and targeting investments in clean energy technologies to achieve sustainable development goals.

Clean energy technologies should contribute to sustainable environmental quality and society can receive economic benefits from human capital. Shao and Razzaq (2022) provided valuable policy guidance on per capita resource consumption. In economics, two methods of valuing human capital are most often used: through the evaluation of production costs and through the capitalization of profit. The first option was to estimate the actual costs (the net of maintenance of a person), and the second consisted of estimating the present (adjusted for the present moment) value of the individual's future income stream (net and gross income). The quantitative assessment of a country's human capital at the macro level has methodological and statistical difficulties. Such generalized blocks must be considered for formation and use. The composition of each proposes introducing such groups of indicators that will make it possible to comprehensively characterize the processes of formation and use of human capital in the country.

The quantitative assessment of human capital is necessary for the following reasons: the costs of forming human capital of adequate quality are real, and therefore there is a need for free working capital, which reduces current consumption, and the result of the implementation of human capital in the production process leads to an increase in national wealth. Therefore, investments in the development of human capital increase the national wealth of the country and mainly contribute to economic growth. The formula "economic growth = human development" did not prove successful in the future and manifested in the increase in socio-political instability and poverty of the population (Chukhno, 2004). Human development is the same concept as improving the quality of human capital. Therefore, based on the principles of this concept (Marshall, 2013), a theoretical model of the formation and use of human capital and its impact on the economic growth of the country was created (Fig. 1).

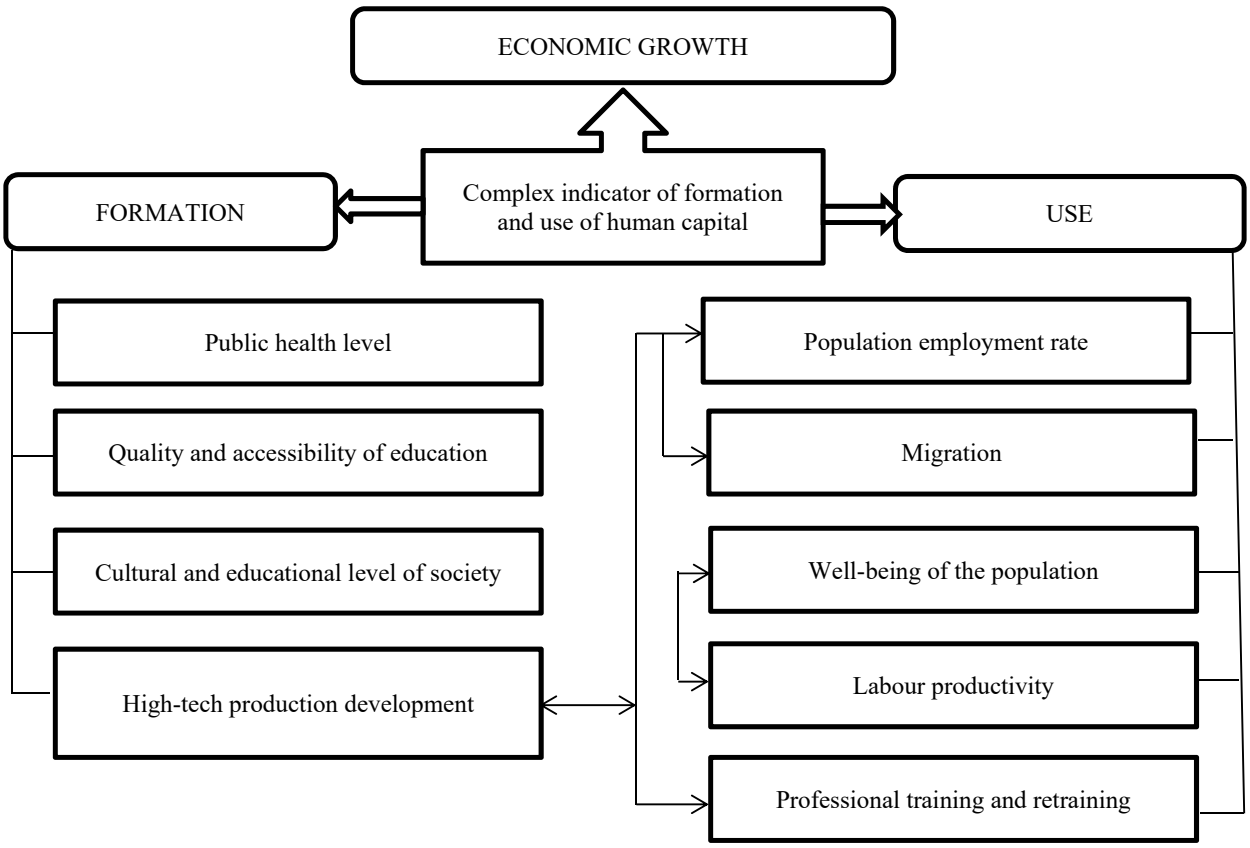

Fig. 1. Theoretical model of the influence of creation and use of human capital on economic development.

The concept of the development of human potential was introduced into international and scientific circulation by the United Nations (2003) as part of the preparation "Human Development Report". According to this concept, the development of human potential is the goal and criterion for social progress.

At the same time, human development is considered a mechanism for increasing labour productivity and income, but this growth acquires value status only when it affects people's well-being. This concept proves that the main indicators should be considered not only the volume of GDP, but also the parameters characterizing the state of healthcare, education, and access to information. With regard to the analysis and evaluation of human capital, further practical use of the results of these processes remains unresolved, especially in the development of recommendations to increase the efficiency of the creation and use of human capital and its main components.

3. Methodology.

For a complete analysis and evaluation of the state of the main structural components of human capital, the research used data tables of indicators of economic and socio-economic development, published by the Statistical Office of the Slovak Republic, processed statistically in the territorial structures of the Slovak Republic in regions and districts. Data from different statistical ranges are available in monthly, quarterly, or annual time series, allowing for the creation of data samples.

The research used general scientific methods of cognition, such as observation, analysis, synthesis, comparison, calculation, measurement, generalization, and modelling. The study compares the level of human capital development by region. The real process of the influence of the creation and use of human capital on economic development and the process of analysing human capital are shown in the form of logical schemes.

The calculation and measurement methods were applied for the general assessment of human capital using the index method. The use of methods of analysis and synthesis allows the determination of the level of HC by region, with further generalization and evaluation. The visual or graphic method of depicting the relationship between the dynamics of human capital and GDP in Slovakia allows us to obtain an idea of the researched object and its components, taking into account cause-and-effect relationships.

To evaluate the human capital of Slovakia by region, average multidimensionality was used. The multivariate average is the average value of several indicators for a population unit.

For the calculations, a multivariate average was used, which is a derived value calculated for a statistical population of N units with serial numbers i (i = 1,2, 3, …, N) that have k properties (x) a serial numbers j (j = 1, 2 ... k). First, the ratio Pij of the values of each element (x) in each value of the population to its average value is calculated according to formula 1 (Marmoza, 2013):

$$P_{ij} = \frac{X_{ij}}{X_j} \quad (1)$$

where X_{ij} is the value of the j^{th} evaluation indicator in the i^{th} population unit; X_j is the average value of the j^{th} evaluation indicator.

The mean of these ratios is then determined for each population unit, which is called the multivariate mean:

$$P_i = \sum_{i=0}^{n} \frac{P_{ij}}{k} \quad (2)$$

The assessment of human capital in the regions of Slovakia was carried out using the method of average multidimensionality according to its main structural components (intellectual,educational, physical, science and innovative capital), where: N is the region of Slovakia (name); n – number of regions (8); a – serial number of the region (i = 1,2...n); X is an indicator of the assessment of a certain capital component (name); k is the number of evaluation indicators (as many as are determined).

Specifically, was determined to be 3 for intellectual and educational capital, 3 for health capital, and 2 for science and innovation capital, and j is the serial number of the evaluation indicator (j = 1,2...k). Because it is not possible to calculate an average value based on the absolute values of various characteristics, the multidimensional average is determined from relative values. In fact, for the analysis and evaluation of the human capital of Slovakia from the point of view of its regions, we calculated the relative indicators according to the data from the Statistical Office of the Slovak Republic.

When choosing indicators that characterize the formation of human capital, we chose sets of indicators that characterize the level of health, culture, and education of the population and the development of scientific and research activities. An integral part of employment policy and labour market management in the near future is the formation of market-type employees who are oriented towards effective work, innovation and increasing professional skills. However, the lack of connection between the quality of the workforce and wages, and the low price of the workforce hinders the development of an innovative society.

Therefore, it is appropriate and necessary to include not only a block of indicators characterizing the state of well-being of the population but also indicators of scientific and research activity. Currently, scientists propose the use of various methods and tools for the analysis and evaluation of human capital using both quantitative and qualitative indicators. It was considered necessary to focus on the application of the methodology of analysis and evaluation of the human capital of the regions of Slovakia, taking into account its main components. To determine the research logic, we develop an information model for human capital analysis, as shown in Figure 2. In the political-economic aspect, economic growth means quantitative and qualitative improvement of the process of social reproduction in the organic unity of constitutional elements and the growth of national wealth.

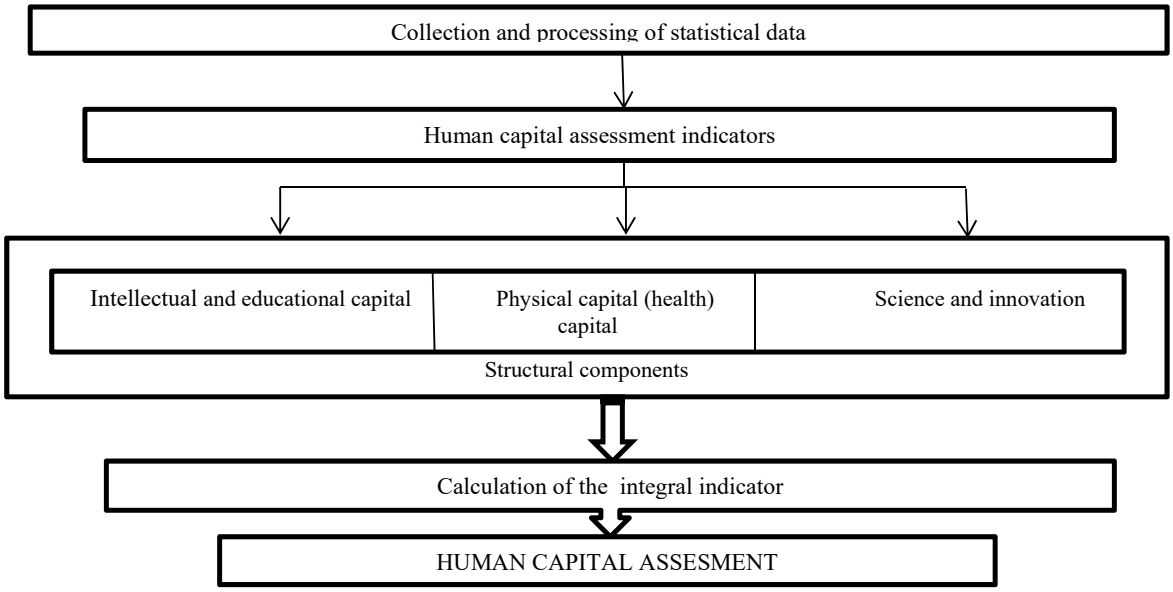

Fig. 2. Information model for human capital analysis.

In developed countries, such an integrating indicator is the increase in the volume of the gross domestic product. This indicator is more perfect compared to the national income indicator, as it does not take into account the results of people's activities in the field of non-material production. When studying the influence of the quality of human capital on the economic growth of a country, the basis is the neoclassical model of economic growth, which explains the long-term direction of economic growth in developed countries. This model emphasizes the possibility of capital accumulation, that is, in this case, capital growth in terms of human capital and technical change in explaining the potential real GDP. For calculations and drawing graphs, the functionality of MS Excel tables was used, which ensured the automation of some groups of analytical and visualization operations.

4. Results.

Modern market transformations in the economic environment motivate rapid economic development and require constant modernization of technological processes. For Slovakia in modern conditions, the main components of human capital are intellectual and educational capital, physical capital, and research capital or science and innovation capital. Such a choice of the main components of human capital is due to the fact that its formation and development depend on many factors: various production abilities, knowledge, health status, access to information, professional mobility, needs, desires to acquire and use knowledge, educational level of the population, etc. Indicators for evaluating the structural elements of human capital are grouped in Table 1.

Table 1. Individual indicators for human capital evaluation.

Structural components of human capital	Indicators of human capital assessment ("X")
Intellectual and educational capital	1. Number of 1st and 2nd degree students, persons. 2. Number of pedagogical employees with a scientific degree, persons. 3. Economically active population with university education, persons.
Physical capital (health)	1. Number of newly reported cases of incapacity for work, unit. 2. Number of beds in medical facilities, unit. 3. Number of working positions of independent health workers in medical facilities, unit.
Science and innovation capital	1. Research and development expenses, (Euro). 2. Research and development employees in natural persons.

The calculation of the evaluation of individual structural components of human capital (intellectual and educational capital, physical capital, science and innovative capital) is presented in Tables 2-4 (Statistical Office of the Slovak Republic, 2022; World Bank, 2022).

Table 2. Intellectual and educational capital in the regions of Slovakia.

Regions	Capital indicators						Final score
	X_1	P_{i1}	X_2	P_{i2}	X_3	P_{i3}	
2018							
1.Bratislava region	5541,0	3,7	1916	3,46	153,6	2,32	3,2
2.Trnava region	367,0	0,2	273	0,49	61,2	0,93	0,5
3. Trenčín region	603,0	0,4	74	0,13	65,0	0,98	0,5
4.Nitra region	871,0	0,6	480	0,87	69,8	1,06	0,8
5. Žilina region	395,0	0,3	407	0,74	73,6	1,11	0,7
6.Banská Bystrica region	457,0	0,3	371	0,67	72,7	1,10	0,7
7. Prešov region	870,0	0,6	199	0,36	89,9	1,36	0,8
8. Košice region	2904,0	1,9	705	1,27	96,6	1,46	1,5
Total	12008,0	-	4425	-	528,80	-	-
Average indicator	1501,0	-	553,13	-	66,10	-	-
2019							
1.Bratislava region	5883,0	3,27	1918	3,46	166,3	2,39	3,0
2.Trnava region	385,0	0,21	276	0,5	63,8	0,92	0,5
3. Trenčín region	543,0	0,3	78	0,14	65,2	0,94	0,5
4.Nitra region	948,0	0,53	479	0,86	75,0	1,08	0,8
5. Žilina region	1491,0	0,83	408	0,74	79,8	1,15	0,9
6.Banská Bystrica region	596,0	0,33	367	0,66	79,7	1,15	0,7
7. Prešov region	1057,0	0,59	200	0,36	91,3	1,31	0,8
8. Košice region	3502,0	1,94	708	1,28	101,8	1,46	1,6
Total	14405,0	-	4434	-	556,6	-	-
Average indicator	1800,63	-	554,25	-	69,58	-	-
2020							
1.Bratislava region	6673,0	3,46	1875	3,42	163,0	2,25	3,0
2.Trnava region	530,0	0,27	271	0,49	63,4	0,87	0,5
3. Trenčín region	682,0	0,35	81	0,15	68,2	0,94	0,5
4.Nitra region	1150,0	0,60	474	0,86	74,0	1,02	0,8
5. Žilina region	657,0	0,34	402	0,73	80,2	1,11	0,7
6.Banská Bystrica region	744,0	0,39	368	0,67	80,4	1,11	0,7
7. Prešov region	1096,0	0,57	206	0,38	99,7	1,37	0,8
8. Košice region	3900,0	2,02	715	1,30	114,4	1,58	1,6
Total	15432,0	-	4392	-	580,3	-	-
Average indicator	1929,0	-	549,00	-	72,54	-	-

Source: based on Statistical Office of the Slovak Republic (2022).

Table 3. Physical capital assessment in the regions of Slovakia.

Regions	Capital indicators						Final score
	X_1	P_{i1}	X_2	P_{i2}	X_3	P_{i3}	
2018							
1.Bratislava region	96 723	0,93	4 811	0,93	3 471,67	1,43	1,10
2.Trnava region	100 587	0,97	4 475	0,87	1 580,07	0,65	0,83
3. Trenčín region	102 701	0,99	4 429	0,86	1 783,89	0,74	0,86
4.Nitra region	113 388	1,09	3 562	0,69	2 044,84	0,84	0,87
5. Žilina region	109 087	1,05	4 765	0,92	2 558,94	1,06	1,01
6.Banská Bystrica region	87 362	0,84	6 073	1,18	2 203,50	0,91	0,98
7. Prešov region	112 664	1,09	7 690	1,49	2 684,32	1,11	1,23
8. Košice region	105 928	1,02	5485	1,06	3 066,37	1,26	1,11
Total	828440,0	-	41290,0	-	19393,6	-	-
Average indicator	103555,0	-	5161,3	-	2424,2	-	-
2019							
1.Bratislava region	92 243	0,91	4 843	0,93	3 773,34	1,53	1,12
2.Trnava region	97 425	0,96	4 916	0,95	1 526,51	0,62	0,84
3. Trenčín region	98 144	0,97	4 406	0,85	1 785,24	0,72	0,85
4.Nitra region	110 779	1,09	3 525	0,68	2 052,53	0,83	0,87
5. Žilina region	106 910	1,05	4 650	0,90	2 609,31	1,06	1,0
6.Banská Bystrica region	88 646	0,87	5 896	1,14	2 143,98	0,87	0,96
7. Prešov region	112 094	1,1	7 798	1,5	2 801,78	1,14	1,25
8. Košice region	105 325	1,04	5510	1,06	3 047,86	1,24	1,11
Total	811566,0		41544,0	-	19740,6	-	
Average indicator	101445,8		5193,0	-	2467,6	-	
2020							
1.Bratislava region	90 140	0,73	4 743	0,93	4 040,16	1,58	1,08
2.Trnava region	111 007	0,9	4 776	0,93	1 604,28	0,63	0,82
3. Trenčín region	130 413	1,06	4 246	0,83	1 794,73	0,7	0,86
4.Nitra region	131 958	1,07	3 475	0,68	2 089,95	0,82	0,86
5. Žilina region	144 285	1,17	4 705	0,92	2 708,4	1,06	1,05
6.Banská Bystrica region	101 725	0,82	5 924	1,16	2 235,3	0,87	0,95
7. Prešov region	157 040	1,27	7 610	1,48	2 795,99	1,09	1,28
8. Košice region	120 133	0,97	5536	1,08	3 173,67	1,24	1,1
Total	986701,0	-	41015,0	-	20442,5	-	-
Average indicator	123337,6	-	5126,9	-	2555,3	-	-

Source: based on Statistical Office of the Slovak Republic (2022).

Table 4. Science and innovation capital assessment in the regions of Slovakia.

Regions	Capital indicators						Final score
	X_1	P_{i1}	X_2	P_{i2}	X_3	P_{i3}	
2018							
1.Bratislava region	13 892	3,55	360 835 833		0,38		1,31
2.Trnava region	1 821	0,47	43 918 718		0,05		0,17
3. Trenčín region	2 347	0,60	80 615 087		0,09		0,23
4.Nitra region	2 415	0,62	66 239 476		0,07		0,23
5. Žilina region	3 295	0,84	65 422 490		0,07		0,30
6.Banská Bystrica region	2 094	0,54	41 406 162		0,04		0,19
7. Prešov region	1 302	0,33	26 804 388		0,03		0,12
8. Košice region	4 099	1,05	65 704 580		0,07		0,37
Total	31265	-	750946734,0		-		-
Average indicator	3908,1	-	93868341,75		-		-
2019							
1.Bratislava region	14 291	3,6	374 848 137		3,86		2,49
2.Trnava region	1 927	0,48	51 325 606		0,53		0,34
3. Trenčín region	2 385	0,6	94 105 096		0,97		0,52
4.Nitra region	2 260	0,57	36 578 285		0,38		0,32
5. Žilina region	3 321	0,84	77 943 886		0,8		0,55
6.Banská Bystrica region	2 127	0,54	43 724 537		0,45		0,33
7. Prešov region	1 276	0,32	26 705 004		0,28		0,2
8. Košice region	4 202	1,06	71 358 969		0,74		0,6
Total	31789		776589520		-		-
Average indicator	3973,6		97073690		-		-
2020							
1.Bratislava region	15 127	3,6	393 853 050		3,76		2,45
2.Trnava region	2 000	0,48	51 182 533		0,49		0,32
3. Trenčín region	2 350	0,56	88 865 267		0,85		0,47
4.Nitra region	2 263	0,54	44 788 836		0,43		0,32
5. Žilina region	3 320	0,79	83 863 397		0,8		0,53
6.Banská Bystrica region	2 418	0,58	49 497 983		0,47		0,35
7. Prešov region	1 328	0,32	26 133 005		0,25		0,19
8. Košice region	4 778	1,14	100 743 219		0,96		0,7
Total	33584	-	838927290		-		-
Average indicator	4198	-	104865911,3		-		-

Source: based on Statistical Office of the Slovak Republic (2022).

Using the proposed methodology for evaluating the structural components of human capital according to selected indicators in the regions of Slovakia for the years 2018–2020, the result shown in Table 5 was obtained (World Economic Forum, 2016).

Table 5. Human capital assessment in the regions of Slovakia for 2018-2020.

	Intellectual and educational capital			Physical capital			Science and innovation capital			General assessment of human capital		
Bratislava region	3,2	3	3	1,1	1,12	1,08	1,31	2,49	2,45	5,61	6,61	6,53
Trnava region	0,5	0,5	0,5	0,83	0,84	0,82	0,17	0,34	0,32	1,5	1,68	1,64
Trenčín region	0,5	0,5	0,5	0,86	0,85	0,86	0,23	0,52	0,47	1,59	1,87	1,83
Nitra region	0,8	0,8	0,8	0,87	0,87	0,86	0,23	0,32	0,32	1,9	1,99	1,98
Žilina region	0,7	0,9	0,7	1,01	1	1,05	0,3	0,55	0,53	2,01	2,45	2,28
Banská Bystrica region	0,7	0,7	0,7	0,98	0,96	0,95	0,19	0,33	0,35	1,87	1,99	2
Prešov region	0,8	0,8	0,8	1,23	1,25	1,28	0,12	0,2	0,19	2,15	2,25	2,27
Košice region	1,5	1,6	1,6	1,11	1,11	1,1	0,37	0,6	0,7	2,98	3,31	3,4

Source: based on Statistical Office of the Slovak Republic (2022).

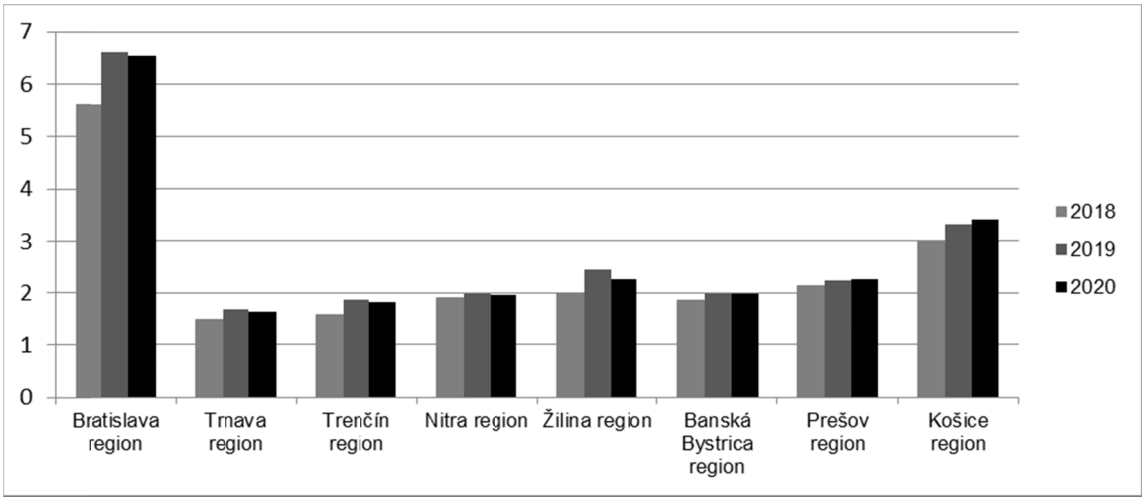

Fig. 3. Results of the human capital assessment in the regions of Slovakia for 2018 – 2020.

From Figure 3, it can be concluded that among the regions of Slovakia, the leaders in terms of the level of development of human capital in the years 2018–2020 are Bratislava, Košice, and Žilina regions, as the named regions have high values for all the components, especially the educational component. Trnava and Trenčín regions are behind in the level of human capital development.

Slovakia needs to create an effective internal investment system, for example, through the establishment of social development funds, which in the future should transform into strong investment institutions and attract citizens' savings. It is also appropriate to introduce certain measures for the development of human capital: gradually increase the level of funding for human development (increase spending on education, healthcare, and culture) to the level of a group of countries with a high level of human capital development; develop targeted programs to stimulate self-employment and micro-entrepreneurship; activate the creative potential of people and the development of a highly qualified workforce. It is a significant contribution of education to economic growth that it provides the workforce with productive knowledge, promotes the accumulation of new knowledge, and stimulates the process of generating new ideas and their implementation.

The theory of human capital is a solid foundation for applied economics (Shultz, 1971; Becker, 1993), meaning that based on the theoretical models built into it, it is possible to quantitatively compare the effectiveness of investments in the development of human capital. As a result of calculations (Table 6) and comparative graphic analysis (Figure 4), a close relationship between the dynamics of GDP and the dynamics of human capital development was found.

Table 6. Regional gross domestic product per inhabitant of Slovakia (in Euros).

Regions	2018		2019		2020	
	X_1	P_{HDP1}	X_2	P_{HDP2}	X_3	P_{HDP3}
Bratislava region	39 020,630	2,34	39 805,133	2,27	38 894,338	2,28
Trnava region	17 727,020	1,06	19 492,973	1,11	18 495,791	1,08
Trenčín region	13 638,947	0,82	14 010,729	0,80	13 953,836	0,82
Nitra region	13 388,190	0,80	14 749,677	0,84	14 493,379	0,85
Žilina region	14 135,945	0,85	15 418,147	0,88	14 630,758	0,86
Banská Bystrica region	12 021,484	0,72	12 459,438	0,71	12 098,496	0,71
Prešov region	10 435,171	0,62	10 551,454	0,60	10 291,022	0,60
Košice region	13 306,718	0,80	13 758,739	0,78	13 847,666	0,81
Total	133674,11	-	140246,29	-	136705,29	-
Average indicator	16709,26	-	17530,786	-	17088,161	-

Source: based on Statistical Office of the Slovak Republic (2022).

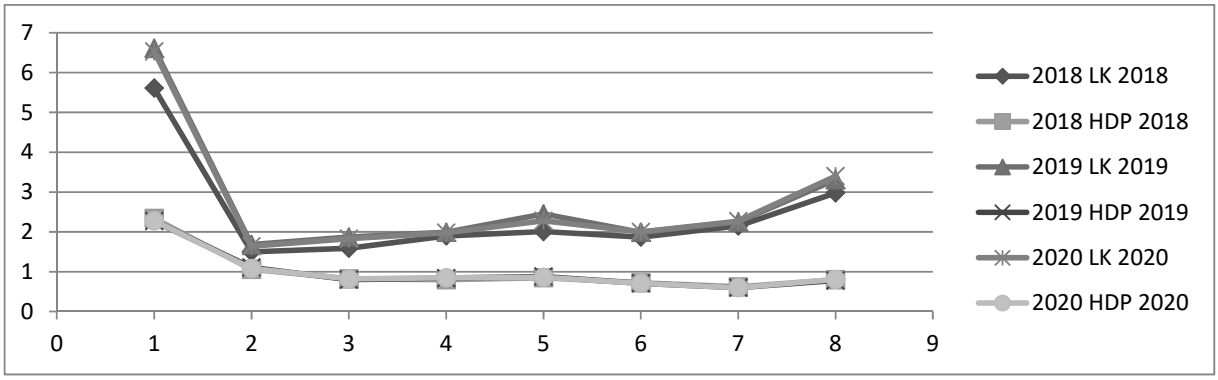

Fig. 4. Graph of the ratio of human capital dynamics and GDP in Slovakia for 2018 – 2020.
Source: based on Statistical Office of the Slovak Republic (2022).

The synchronicity of the graphs of the dynamics of the average multidimensional indicators of GDP and human capital confirms that the indicators chosen for analysis and evaluation quite accurately indicate a stable relationship between investments in certain components of human capital and the economic development of the country.

Based on the conducted research, it is possible to confidently recommend such structural components of human capital for investment as factors of economic development: the number of students with 1st and 2nd degrees, the number of pedagogical employees with scientific degrees, the economically active population with university education, the number of newly reported cases of incapacity for work, the number of beds in health facilities, the number of working positions of independent health workers in health facilities, research and development expenses, and research and development employees in natural persons.

The proposed method of calculation, considering the science and innovative, physical and intellectual-educational capital from the point of view of certain indicators and based on the average multidimensional method, once again confirms that human capital consists of those characteristics, knowledge, skills, and abilities of a person, with the effective use of which the growth of economic development of a society is ensured. Taking into account the above, in the conditions of strengthening globalization processes in the world, it is appropriate to introduce the following measures for the development and effective use of human capital, namely:

– develop support programs for young professionals on the part of the state;

– ensure the gradual approximation of the level of human development funding (expenditure on health care and education) to the level of countries with a high level of human capital development;

- develop a targeted program to stimulate self-employment and the development of small businesses for persons returning from work abroad to reduce the extent of mass labour migration abroad;

– to develop a motivational mechanism for activating the creative potential of people, which will contribute to the development of innovative work and the improvement of personnel qualifications;

– all-round state support for increasing the social responsibility of business and the introduction of the principle of employers' economic interest;

– support the creation of new working positions in technologically advanced and innovative sectors of the economy, etc.

It can therefore be argued that there are significant reserves for the development of human capital in Slovakia, but it is necessary to carry out a significant number of institutional transformations at the macro- and micro-level in the socio-economic sphere to increase the level of competitiveness of domestic human capital and occupy high positions in the world rankings.

5. Conclusions.

The effective use of resources and capital is the basis of the economic development of countries, regions, and companies. In connection with world trends in the acceleration of technological and innovative development, as well as in the field of introducing information and communication technologies into production, the effective use of human capital is becoming more and more important. The conducted research allows us to draw the following conclusions.

Firstly, the current innovative model of the economy is taking on a completely new form, changing its structure with a shift in emphasis from material property to intellectual property. The dominant position in this model is occupied by human capital, which is rich not only in its opportunities and ideas but also in innovative processes, which in turn improve the technological possibilities of using the key characteristics of a person to generate new knowledge.

Secondly, according to analytical calculations, human capital in Slovakia is characterized by polarity and asymmetric development and is not able to fully ensure a sustainable rate of economic growth. As a result of calculations and a comparative graphic analysis based on the statistical data of Slovakia, a close connection was established between the dynamics of GDP and the dynamics of human capital development: a significant decrease in the value of GDP in the calculation period corresponds to changes in the indicators of human capital assessment. The proposed and used method of human capital analysis based on selected indicators once again proved that to optimize and simplify calculations, it is advisable to use such indicators indicating the level of intellectual and educational capital, physical capital, science capital, and innovative capital. The work proves and graphically displays the proportionality of the dynamics between these indicators and the economic development of the country. The creation and development of educational capital and the ability to implement and accept innovations in one's work are also key sources of successful and rapid economic development.

Thirdly, without creating the conditions for the development of human capital, no modern economic system will be able to be competitive on a global scale. The analysis of the level of development of human capital from the point of view of its contribution to the economic development of Slovakia points to insufficiently effective use of the available potential. It is necessary to implement a set of proposed measures in the field of complex support for the development of innovative infrastructure, the social sphere, business initiatives, and giving preferences to organizations that implement innovative projects. Due to the spread and implementation of new technologies, the production process becomes more efficient, and the added value of products increases due to the transition from a resource-intensive economy to a technology-intensive one. The high level of technical and technological development in production presupposes the use of employees with an appropriate level of education and qualification in enterprises.

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