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*INVESTMENT IN HUMAN CAPITAL AND SOCIO-ECONOMIC DEVELOPMENT: RELATIONSHIP ANALYSIS AND IMPACT EVALUATION**

SUMMARY. This article is devoted to the analysis of human capital and seeks to assess the impact of human capital investments on the socio-economic territorial development. Based on specific modern approaches to human capital formation, the structure of human capital investments and human capital indicators are studied. The factor analysis methodology has enabled the authors to identify the following basic groups of human capital investments, namely: (a) investments in welfare capital and innovations, (b) investments in child healthcare capital, (c) public investments in educational capital, (d) government investments in educational and healthcare capital. In its turn, the regression analysis gives us grounds to conclude that the level of the socio-economic development of a specific country is greatly affected by investments in innovations and government investments in educational capital. The strategies specified in the article may be employed by the governmental authorities for selecting a range of appropriate socio-economic activities to achieve a desirable area development effect.

KEY WORDS. Socio-economic development, human potential, quality of living.

In accordance with the Presidential Decree of May 7, 2012 "On the long-term national economic policy" the following target socio-economic development indicators are set in the Russian Federation: creation and modernization of 25 million efficient workplaces by 2020; an increase in investments up to at least 25% of the gross domestic product by 2015 and to 27% of the gross domestic product by 2018; 1.3-fold high-tech product growth in the gross domestic product by the end 2018 compared to 2011; a 1.5-fold increase in labor productivity by the end 2018 compared to 2011;

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improved ranking of the Russian Federation in the World Bank Doing Business Rating by shifting from 120th position in 2011 to 50th position in 2015 and 20th position in 2018 [1].

To modernize the Russian economy, it appears critical to make large-scale investments in human capital [2; 70]. Currently, the country lags significantly behind the world leaders in the level of human development and occupies the 55th position in the world [3]. This situation is mainly the result of the country's underdeveloped healthcare and education systems. Despite the fact that the authorities recognize well the importance of human capital, there is no clear strategy for its development in Russia, while the objective to build competitive human capital is evaluated to be highly declarative.

The size and composition of human capital investment may be different. In particular, G. Becker thinks it logical to differentiate between general and specific human capital investments [4; 32]. C. McConell and S. Brue believe that there exist three types of human capital investments: (a) expenditure on education, including general, special, formal and informal education and on-the-job training, (b) expenditure on healthcare, including spending on disease prevention, medical services, nutrition and dietetic services and improvement of living conditions, and (c) costs of mobility which enable employees to deliberately migrate from the areas with low capital use efficiency to those with high capital use efficiency [5; 49].

A. Dobrynin and S. Dyatlov suppose that from a variety of investments in human capital the most important ones are those related to health and education. Health protection measures lead to a decrease in morbidity and mortality rates, make the human lifespan longer and, therefore, extend the durability of human capital. It is quite natural that human capital deteriorates during a human life, but investments in health protection delay the process [6]. The authors believe that investments in healthcare and education must be linked with motivation and patriotic upbringing.

Many researchers examined the relationship between human capital and the level of economic development. It must be noted that works by N. Mankiw, D. Romer and D. Weil [8], I. Benhabib and M. Spiegel [9], R. Barro [10] are of a particular interest. In his research of specific Russian territories N. Gabdullin claims that education and healthcare indicators have a positive impact on the GRP level per capita in all Federal Okrugs and there exists a direct correlation between a per-capita GRP level and investments in various elements of human capital [11]. A. Koritsky managed to identify a significant relationship between the level of education and personal income in Russia [12]. The approach to human capital investments shared by the authors of the present article is based on D. Karazhakova's works [7; 11] and the structure of human capital investments is represented in Figure 1 below.

However, some authors argue that the role of human capital in the dynamic development is exaggerated. According to P. Klenow and M. Bils [13], the contemporary models underestimate the feedback, i.e. the countries which demonstrate high or stable economic growth tend to increase spending on education and accumulate human capital faster.

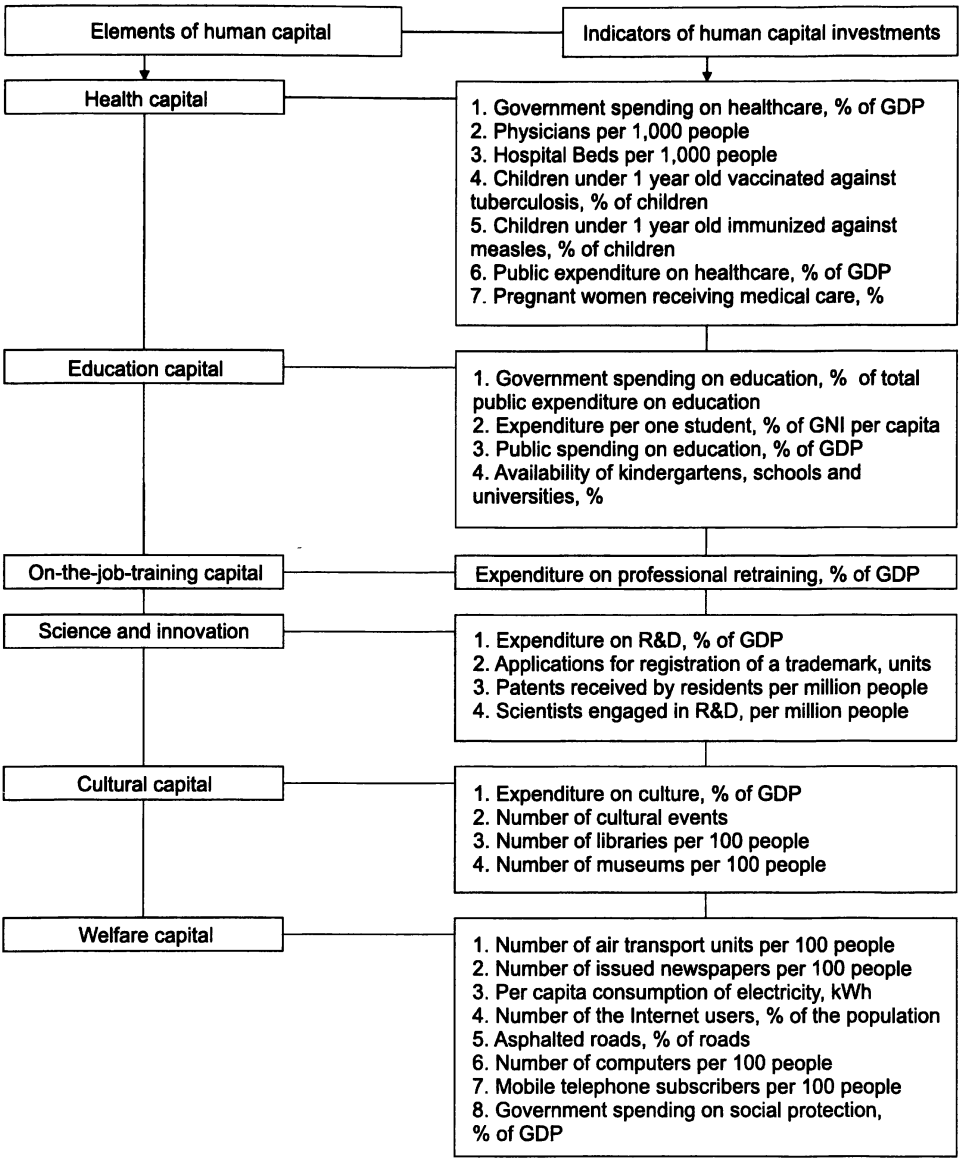

Figure 1. The Structure of Human Capital Investments

The aim of this research is to discover the factors which have the strongest influence on the socio-economic development. The sample is based on the data taken from 56 countries in 2010. The dependent variable is the Human Development Index, published annually by the UN Development Programme in a series of reports on human development. The indicator symbols employed in the research are given in Table 1.

Table 1

Indicator Symbols Employed in the Present Research

Symbol	Indicator's Full Title	Source
A	1	2
Y	Human Development Index	www.undp.org
	Health capital	
X_1	Physicians per 1,000 people	www.portal.euromonitor.com
X_2	Hospital Beds per 1,000 people	www.portal.euromonitor.com
X_3	Children under 1 year old vaccinated against tuberculosis, %	www.undp.org
X_4	Children under 1 year old immunized against measles, %	www.undp.org
X_5	Public expenditure on healthcare, % of GDP	www.worldbank.org
X_6	Pregnant women receiving medical care, %	www.undp.org
	Education capital	
X_7	Government expenditure on education, % of total government spending	www.undp.org
X_8	Public spending on education, % of GDP	www.undp.org
X_9	Kindergarten expenditure per child, % of GDP per capita	www.worldbank.org
X_{10}	Expenses for 1 student in school, % of GDP per capita	www.worldbank.org
X_{11}	Expenses for 1 university student, % of GDP per capita	www.worldbank.org
	Science	
X_{12}	Expenditure on R&D, % of GDP	www.undp.org
X_{13}	Patents received by residents per million people	www.undp.org
X_{14}	Scientists engaged in R&D, per million people	www.undp.org
	Welfare capital	
X_{15}	Consumption of electricity, kWh	www.undp.org
X_{16}	Number of computers per 100 people	www.undp.org
X_{17}	Government spending on social protection, dollars per 1,000 population	www.portal.euromonitor.com
X_{18}	Number of the Internet users, % of the population	www.portal.euromonitor.com

Pearson's correlation coefficient was used to establish the relationship between the selected indicators. The statistical processing was performed with the application of PASW Statistics 18 and STATISTICA 6.1. computer programs. The values of the Pearson correlation for the indicators under consideration are presented graphically (See Figure 2).

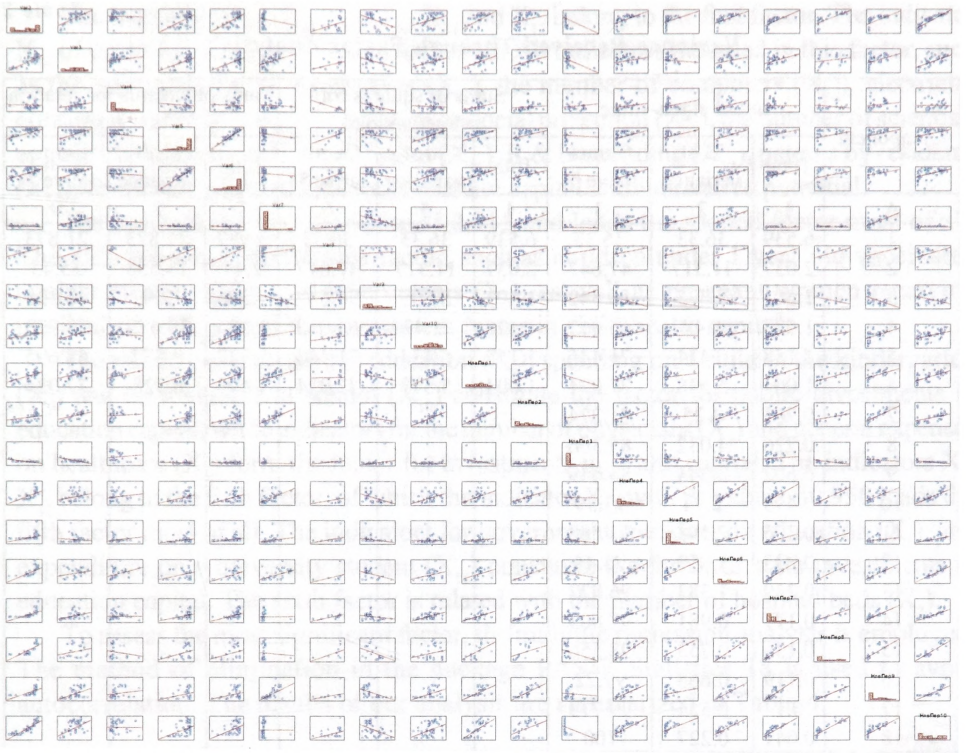

Figure 2. Graph Matrix of Linear Relationship between the Indicators

Each line of Figure 2 shows the dependence of the vertical axis in the row on the other indicators which are in the column on the horizontal axis. The lines in individual graphs are drawn with the least square method. Therefore, we can conclude that the majority of the analyzed parameters are interrelated, while the relationship between these indicators at a country level is described by both linear and nonlinear models.

To shorten a list of variables related to human capital investments, a special factor analysis program PASW Statistics 18 was applied. The research has enabled the authors to obtain the primary statistical data which are presented in Table 2 below.

According to Table 2, six factors have their own values exceeding over 1, and, consequently, only six factors have been selected for analysis. The first factor explains 36.330% of the total variance, the second factor – 11,317%, the third factor – 8.895%, the fourth factor – 8.470%, the fifth factor – 6.434% and the sixth factor – 5.578%.

The factor loads of six factors in a block form are shown in Table 3. The variables inside a specific block are displayed in the descending order of factor loads.

Table 2

Variance Received Through Factor Analysis

Component	Initial eigen-value			Sums of squares for extraction load			Sums of squares for rotation load		
	Total	% of variance	Cumu-lative %	Total	% of variance	Cumu-lative %	Total	% of variance	Cumu-lative %
A	1	2	3	4	5	6	7	8	9
1	6.539	36.33	36.33	6.539	36.33	36.33	3.937	21.873	21.873
2	2.037	11.317	47.647	2.037	11.317	47.647	2.44	13.558	35.43
3	1.601	8.895	56.542	1.601	8.895	56.542	2.326	12.92	48.351
4	1.525	8.47	65.012	1.525	8.,47	65.012	1.885	10.473	58.823
5	1.158	6.434	71.446	1.158	6.434	71.446	1.777	9.872	68.695
6	1.004	5.578	77.024	1.004	5.578	77.024	1.499	8.328	77.024
7	0.765	4.25	81.274						
8	0.726	4.032	85.306						
9	0.602	3.344	88.649						
10	0.493	2.74	91.39						
11	0.396	2.198	93.588						
12	0.333	1.852	95.44						
13	0.249	1.383	96.822						
14	0.177	0.981	97.803						
15	0.136	0.753	98.556						
16	0.119	0.663	99.22						
17	0.1	0.554	99.773						
18	0.041	0.227	100						

Table 3

Rotated Component Matrix

	Component					
A	1	2	3	4	5	6
X_{14}	0.838					
X_{13}	0.816					
X_{12}	0.755					
X_{16}	0.742					
X_{15}	0.62			0.464		
X_{17}	0.51					
X_3		0.915				
X_4		0.894				
X_6		0.504				-0.438
X_8			0.851			
X_9			0.804			
X_{10}			0.540	0.422		
X_5				0.733		
X_1				0.731		
X_{11}					0.91	
X_{18}	0.472					
X_7					0.476	
X_2						0.808

The indicators X_{14}, X_{13}, X_{12}, X_{16}, X_{15} and X_{17} belong to the first factor. The indicator X_{14} of 0,838 loads the first factor most of all. All indicators included in this factor, such as the number of the Internet users (X_{18}), the number of computers (X_{16}), electricity consumption (X_{15}), public expenditure on social protection (X_{17}), the number of scientists engaged in research and development (X_{14}), R & D spending (X_{12}), patents by residents (X_{13}), form the investment factor in welfare capital and innovative potential.

The indicator X_3 has the value of 0,915 and loads the second factor most of all. The indicators included in this factor, such as children under 1 year old vaccinated against measles (X_4), and tuberculosis (X_3), as well as pregnant women receiving medical care (X_6) form the investment factor in child health capital.

The public expenditure for education (X_8), spending on a child in the kindergarten (X_9) and on a student at school (X_{10}) constitute the factor for public investments in education capital, while indicators for the number of physicians (X_1) and general expenses on healthcare (X_5) form the factor for investments in health capital. The indicators X_7, X_{11} belong to the fifth factor, of which the indicator X_{11} with its value of 0,950 loads the fifth factor most of all. The indicators for government spending on education (X_1), and expenditure on a university student (X_{11}) constitute the factor of state investments in education capital. The sixth factor is related with the number of hospital beds (X_2).

To assess the most significant factor, the multiple regression analysis is employed. The method of elimination in the package PASW Statistics 18 is used to avoid autocorrelation. The results of our analysis are summarized in Table 4.

Table 4

Collected Results for a Regression Model

Model	H	R-squared	Adjusted R-square	STD. error of estimate	Durbin-Watson
1	.894	0.799	0.773	0.10149	
2	.888	0.789	0.768	0.10275	1.871

It is shown in Table 4 that the variables are excluded from the calculations in two steps. For each step, the multiple regression coefficients, measures of certainty, biased certainty and of the standard error are identified.

It can be seen from Table 4 that the value of the multiple determination coefficient R^2 stands at 0,789. It means that 78.9% of the total variation in the efficiency is explained by variations in the factor characteristics. Accordingly, the selected factors significantly affect the level of socio-economic development of countries. The coefficients of the regression equation are shown in Table 5.

The obtained coefficients are significant. This conclusion is confirmed by the magnitude of the R-value, which is less than the significance level of 0.05. The nonzero values of t-statistics speak well of statistical source data. The analysis of variance to check the regression equation significance has demonstrated that the p-level value is 0.000. Therefore, this value can be regarded as a good proof to underline significance of the equation obtained in the process of our analysis:

Table 5

Coefficients of Regression Equation

Model		Unstandardized coefficients		Standardized coefficients	t	Value
		B	STD. error	Beta		
A		1	2	3	4	5
1	(Constant)	.675	.014		49.301	.000
	REGR factor 1	.098	.014	.462	7.129	.000
	REGR factor 2	.082	.014	.386	5.959	.000
	REGR factor 3	.047	.014	.222	3.424	.001
	REGR factor 4	.052	.014	.247	3.815	.000
	REGR factor 5	-.120	.014	-.564	-8.706	.000
	REGR factor 6	-.020	.014	-.097	-1.492	.142
2	(Constant)	.675	.014		48.705	.000
	REGR factor 1	.098	.014	.462	7.040	.000
	REGR factor 2	.082	.014	.386	5.886	.000
	REGR factor 3	.047	.014	.222	3.381	.001
	REGR factor 4	.052	.014	.247	3.768	.000
	REGR factor 5	-.119	.014	-.564	-8.594	.000

$$Y = 0.675 + 0.098*F1 + 0.082*F2 + 0.047*F3 + 0.052*F4 - 0.119*F5, \quad (1)$$

where Y is HDI (dependent parameter) and F1, F2, F3, F4, F5 represent factors 1, 2, 3, 4, 5 which have been selected by means of the factor analysis.

The results of the regression analysis have enabled us to come to the conclusion that the level of socio-economic development is affected for the most part by investments in innovation capacity and investments in welfare capital, followed by public investment in education capital. In addition, the resulting regression equation provides us with the opportunity to measure an impact weight of each factor on the level of socio-economic development.

As it has been stressed above, factors 1 and 5 have the greatest impact; their contribution to the socio-economic development of countries is 24.6% and 29.9%, respectively. The other factors are characterized by the following influence: factor 2–20.6%, factor 3–11.8% and factor 4–13%. Besides, in line with the regression equation several other indicators, which are beyond the scope of this article, strongly affect the level of socio-economic development due to their impact weight of 21.1%. This can be explained by the fact that, firstly, the investments in culture capital are not included in the analysis of the indicators because of the lack of appropriate indicators in the databases. In our opinion, culture, nurture and mentality have a great impact on the socio-economic development of countries. Secondly, the efficiency of investments in human capital is not taken into account. Finally, some qualitative parameters related to education and health care are not analyzed, since appropriate information is not available in the databases. In this context, a special research aimed at measuring quality in education and healthcare seems to be challenging but at the same time very promising.

It must be said in conclusion that the regression equation is characterized by the presence of indicators which are for the most part related to investments in health and education capital investments. The regression equation also contains a number of other indicators. It confirms our hypothesis that it is necessary to invest in every element of human capital. The comprehensive strategy must be designed and launched in order to develop human capital in Russia. The local authorities must work hard to develop human potential and create suitable conditions for its accumulation [14, 110].

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