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Management of human capital in the national economy: Estimation and simulation

Gestión del capital humano en la economía nacional: estimación y simulación

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Contents

ABSTRACT:
The article describes the essence of the social-economic environment of the human capital formation. In this regard, the article introduces the concept of social-economic environment of the human capital formation, its author's definition of this category. It is proved that to determine the effective formation of the human capital it is necessary to determine the possibilities of the indicative regulatory impact on the society. According to this aim, the conditions of this environment are assessed. The dynamics of investments in the human capital is determined as a research task. The educational potential of the country is estimated from the position of world trends. From the total number of indicators of the social-economic development revealed the maximum impact on the development of the human capital, and by polynomial approximation derived the model of the human capital efficiency.. The presented model can be used for the purpose of strategic impact on the national economy for effective management of human capital.
Keywords: social-economic environment, human capital, education, trend

RESUMEN:
El artículo describe la esencia del entorno socioeconómico de la formación de capital humano. En este sentido, el artículo introduce el concepto de entorno socioeconómico de la formación de capital humano, la definición de esta categoría por parte del autor. Se ha demostrado que para determinar la formación efectiva del capital humano es necesario determinar las posibilidades del impacto regulatorio indicativo en la sociedad. Según este objetivo, se evalúan las condiciones de este entorno. La dinámica de las inversiones en el capital humano se determina como una tarea de investigación. El potencial educativo del país se estima a partir de la posición de las tendencias mundiales. Del número total de indicadores del desarrollo socioeconómico se reveló el impacto máximo en el desarrollo del capital humano, y por aproximación polinómica se derivó el modelo de la eficiencia del capital humano. El modelo presentado se puede utilizar para el propósito del impacto estratégico. En la economía nacional para la gestión efectiva del capital humano.
Palabras clave: entorno socioeconómico, capital humano, educación, tendencia.

1. Introduction

The complex of the social conditions for the formation of human capital forms the social environment of human, and it must be understood not just the amount of life benefits and amenities, and a certain combination of them in the ratio, the most favorable for the human capital formation. Under the influence of the absence or lack of development in society of one or more elements of this environment, the quality of the human capital formation can be reduced. And, as a consequence, it can form the unattractive society for the human capital formation, and as a result, dissatisfaction with its society will inevitably be projected on the process of reproduction, formation and development of human capital, and vice versa, the more enriched the society with a variety of social benefits, the higher the return on human capital.

2. The convergence of knowledge on the essence of human capital

The emergence of the concept of human capital initially provoked many disputes and discussions in the scientific economic world. The Foundation of the classics of the economic thought of the importance of the immaterial part of reproduction V. Petty [Becker, 1964. R. 154], L. Thurow [Thurow, 1970. R. 15], reflecting a wide interpretation of the human factor in managing the economy. In the teachings of Schultz [Schultz,1970. R. 5], G. Becker [Becker, 1964. P. 90], J. Math. Mincer [Mincer, 1982. R. 145] and other followers of the second half of the twentieth century reflected the basic concepts of human capital valuation [Sveaass, 2013. R. 20; Umashanar, 2007. P. 54; Walters, 1995]. Thus, T. Schultz conducted a factor analysis of the economic growth dynamics at the country level, revealed a decrease in the structure of the share of capital and income and proved that only investments in education can favorably affect this ratio. T. Schultz assigned the special role of the human capital evaluation to higher education. G. Becker considered the estimation of human capital determined by multiplying the unit of simple living labor by the amount of human capital embodied in it [Becker, 1964. P. 393]. In this sense, human capital was estimated on the basis of income, as a longitudinal method of research.

J. Mincer modified the regression equation of G. Becker, introduced the variables of the production experience and

deepened further empirical studies of the human capital. Such a model was recognized as a classic model for the human capital assessing. However, and now there is a problem of impossibility of the quantitative influence assessment of all factors on the indicator of the income of the worker and, as a consequence, impossibility of an assessment of actions for investment in human capital. For this reason, the presented function of earnings, as an econometric tool, requires further elaboration, which requires a wider coverage of statistical indicators for the study of human capital. With the development of the insurance industry, new approaches to the measurement of human capital, developed by scientists L. Dublin and A. Lotka [Dublin, Lotka, 1930]:

$$V_0 = \Sigma V_x P_x (Y_x E_x - C_x),$$

where

V_0 - the value of a person at the time of birth;

V_x - discount factor;

P_x - probability of human survival to age x;

Y_x - annual wage from the age of x to x+1;

E_x - share of employed in production from x to x+1;

C_x – expenses during the life of a person from age of x to x+1.

In our opinion, the approach of estimating the person by L. Dublin and A. Lotka is the most perfect and clear of all stated approaches, besides, this method of capitalization of person's earnings with the expenses on its consumption and the contents gives the useful assessment for many purposes of research. However, due to the lack of necessary calculations in the formalization of this model it is problematic. In this regard, the scientific and practical search for representative indicators to assess the effectiveness of the use of human capital is very relevant, because it is impossible to manage what can not be measured.

3. Social-economic environment of the human capital formation

We pay attention on the problem of the formation of the human capital society from the positions of Western scientists on the conceptual basis of the quality of life. World practice in a number of developed countries and through the UN has shown the widespread concept of the quality of life, which formed the basis of the Russian idea of this concept. In particular, V. Bobkov, P. Mstislavsky reflect their conceptual approaches in the article on the quality of life: the essence and the indicators [Shirinkina, 2002. P. 19], as well as O. A. Platonov in the article on the concept of the quality of life: the theory and the practice [Platonov, 1991. P. 110], according to them the direct relationship between the concepts of the quality and the standard of living is obvious. Obviously, the conceptual basis of the assessment of the standard of living reflects the economic parameters of human life as a carrier of the human capital.

Thus, in 1961, according to the UN definition, the concept of living standards includes the following 9 indicators, which include indicators of health and consumption of food, education and employment, working and living conditions, etc. [Galiakhmetov, 1997. P. 480]. Various conceptual approaches of quality of life are discussed in the world scientific spheres of philosophical, sociological and economic research. E. Durkheim, M. Weber, E. Mayo, A. Maslow, F. Herzberg and others made a significant contribution to the formation of modern ideas in the concept of the quality of life in general and the quality of working life in particular. In recent times for a cross-country assessment of the level of life the index of human development gets spread which at its core is the arithmetic mean of the performance indexes of life expectancy, GDP per capita and level of education. However, as a criterion for assessing human capital, it does not take into account the labour component, such as productivity and wages, necessary to take into account the impact of both the educational capital and the human capital.

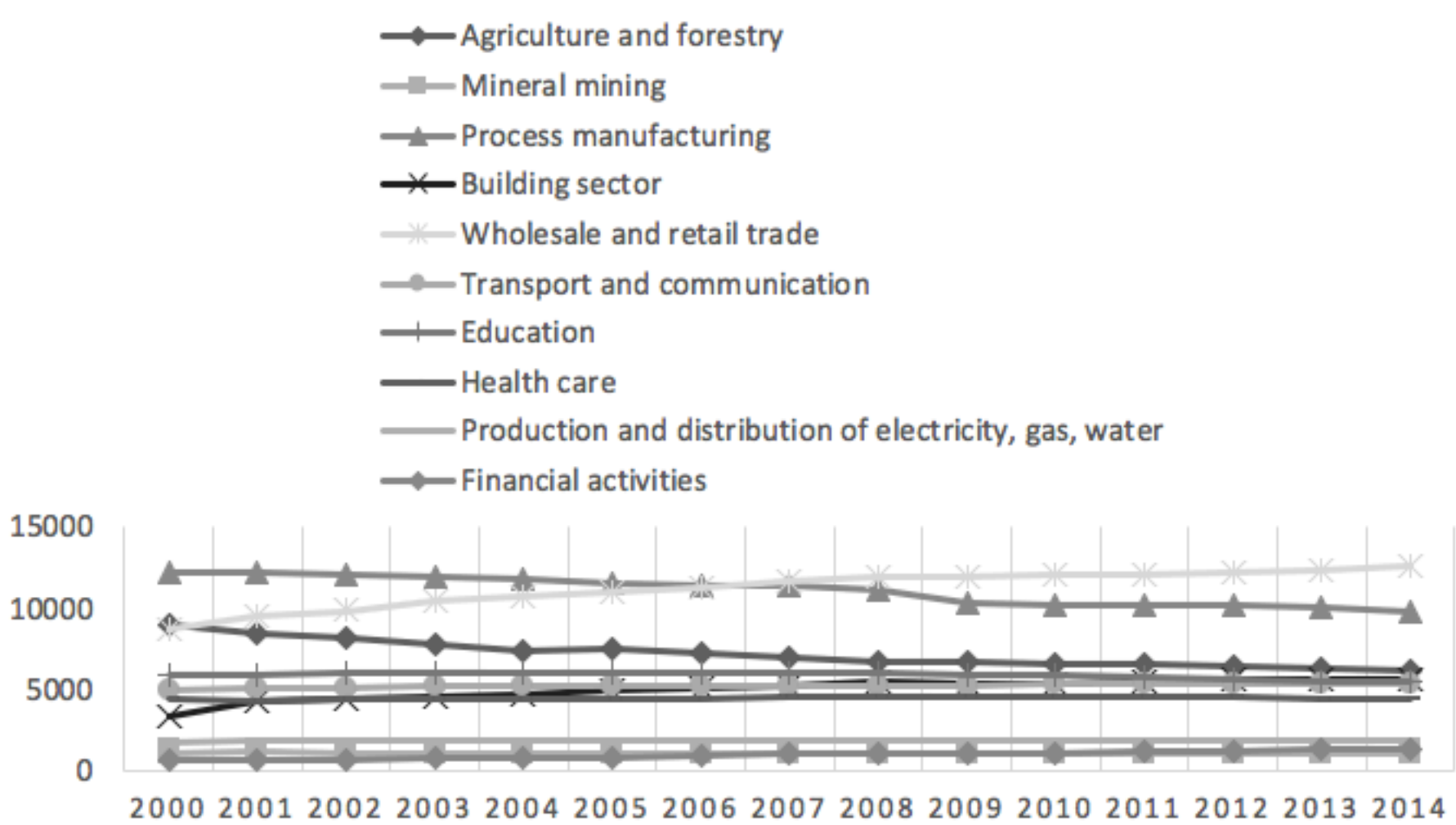
For the purpose of scientific analysis of the quality of life, first of all, it is necessary to take into account the fact that the assessment of the quality of any process can be established only with respect to a certain standard determined by the norm, standard, custom or tradition. In turn, under the social-economic environment of the human capital formation, as noted earlier, it is necessary to understand the totality of living conditions of a person and the effective activities of enterprises, since it is society that forms the quality of development of the territory and society as a whole from the perspective of its attractiveness as conditions for the development of the human capital.

Consequently, we can formulate our own definition of the quality of life as a social-economic environment of human capital – it is the conditions of reproduction, formation and development of the human capital, including the degree of satisfaction of human needs, estimated relative to the relevant norms, as well as providing a high return on investment in human capital.

The present-day trends in the human capital formation of human capital are evidenced by the dynamics of its value, level of education, level of development of the health care system, changes at different levels in the education system [Kelchevskaya, Chernenko, Shirinkina, 2017. P. 95]. It is obvious that when assessing the current state of human capital, it is necessary to monitor not so much the labor market as the human capital market with its qualitative changes in the state of the labor force as an indicator for management decisions in the field of human capital management.

The dynamics of employment of human capital is illustrated in Fig. 1.

Fig. 1
The dynamics of the number of people employed in the spheres of economic activity, thousand people.



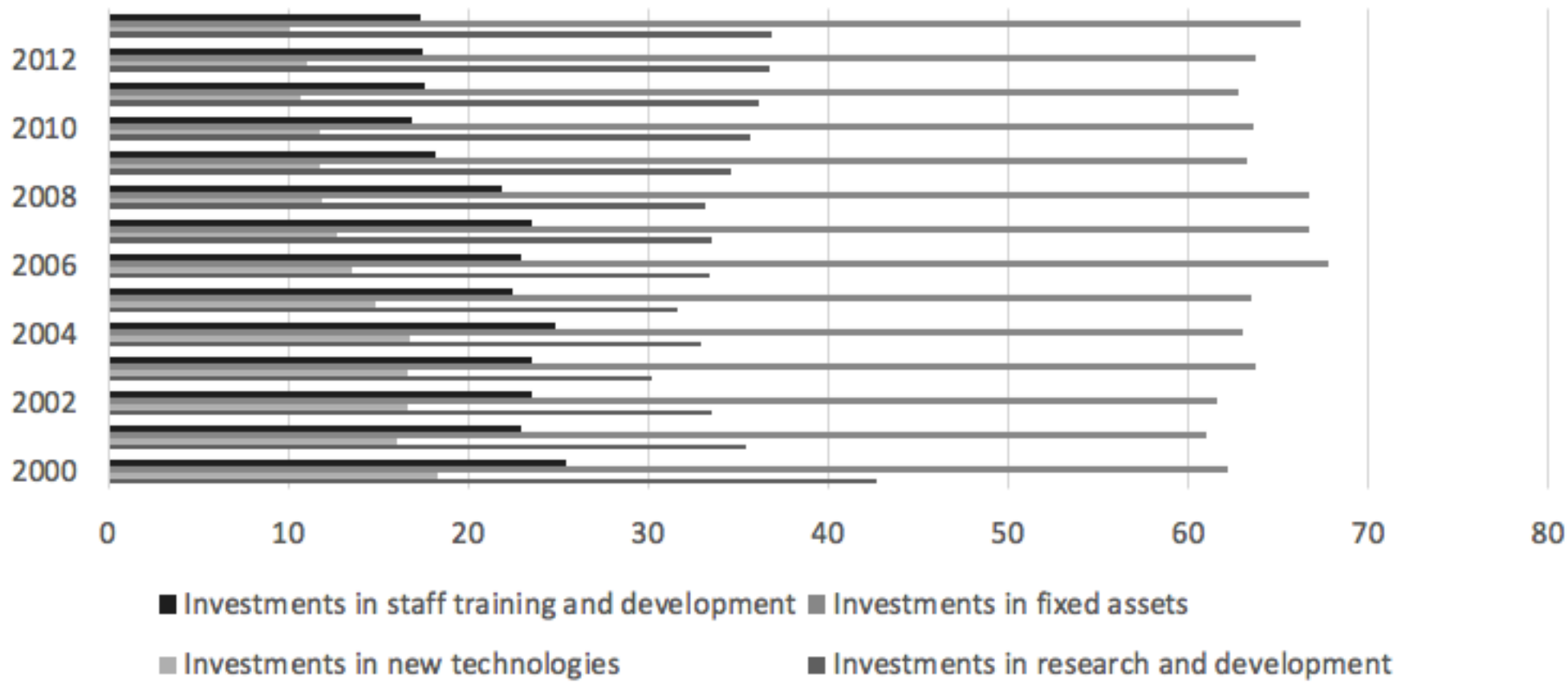
Compiled by the author on the basis of the source: Science of Russia in figures - 2014. Stat. SB. M.: CISN, 2016.- P. 22.

According to the figure, the increase in the employed in the wholesale and retail trade, construction and financial activities for 2000-2014, respectively, is evident: 44, 2%, 39,9%, 99,6%. A significant reduction in employment occurs in agriculture-by 30.5%, in manufacturing – by 19.7%, due to the decline in agriculture, the process of urbanization.

The degree of the human capital use is evidenced by the degree of intellectual capacity of various industries [Shirinkina, Kaufman, 2018. P. 30; Shirinkina, 2017. P. 260]. The intensity of the development of innovative enterprises can serve as an indirect assessment of the use of human capital, as innovation involves the transformation of ideas into innovative products and services. It is obvious that over time, the process of allocation of intellectual functions from the general process of labor and production, and as a result, leads to the emergence of a new form of labor, such as intellectual labor, requiring certain qualities of human capital.

The share of investments in human capital of the organizations in the branch of the extracting, processing productions performing innovative activity is presented in Fig. 2.

Fig. 2
The structure of investments of innovative enterprises,
including investments in human capital,%

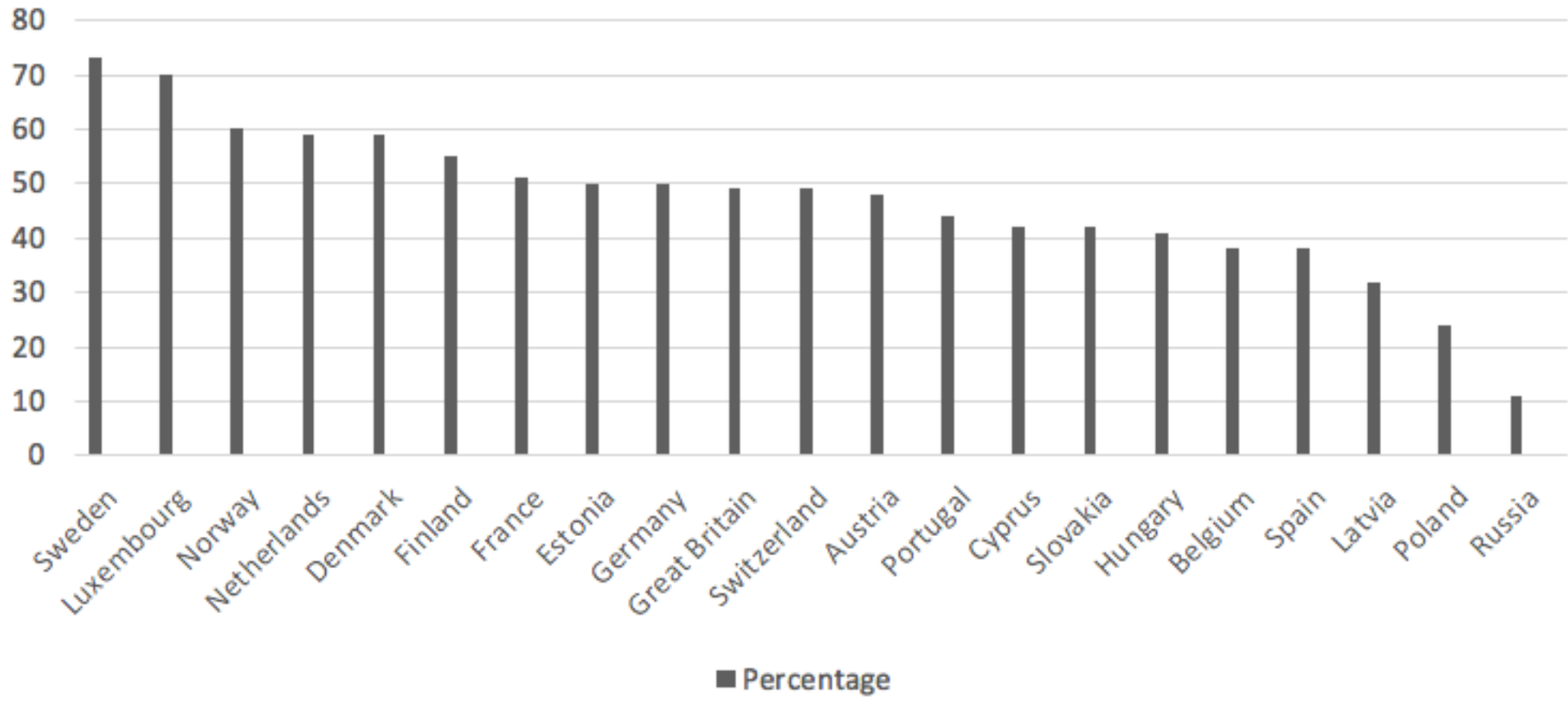


Compiled by the author on the basis of the source: indicators of innovation activity: 2015. Statistical compendium. HSE. URL: https://www.hse.ru/ (accessed: 23.09.2016).

The data in the figure illustrate that the share of investment in human capital organizations in the industry of producing and processing industries engaged in innovation activities, is in 2013, 17.4 percent of the total amount of investment, and this figure compared with 2000 decreased by 8%. As well as investment in research and development – by 5,8%, in new technologies – by 82%, and only investments in fixed assets slightly increased - by 0,9 %.

It should be noted that the knowledge economy is characterized not only by the level of intellectual capacity of production activity, but also by the state of the educational capital [Shirinkina, 2017. P. 70, 610]. In this regard, it is important to assess the state of the educational component of human capital characterized by the share of population in continuing education, compared with European countries (see Fig. 3), the share of enterprises in continuing education is also insignificant.

Fig. 3
The share of population participation in continuing education in Russia and European countries,%.



Compiled by the author on the basis of the source: results of research "Adult Education Survey - AES". Eurostat. URL: http: // epp.eurostat.ec.europa.eu (accessed: 13.10.2016).

It should be noted that the data presented are based on representative population surveys. Data for European countries reflect them for 2007 and 2011, while for Russia - for 2014. The presented comparative characteristics of the educational potential of the country, characterized by the share of the population in life-long education in Russia and European countries, shows that Russia is still ranked penultimate. This is due to the fact that the process of continuing education in the paradigm of "education through life" in Russia is only being formed. An important role in this belongs to enterprises, which must develop new approaches to the formation of human capital.

Search for indicators of the effectiveness of the use of human capital in the national economy

For the purpose of this study, it is proposed to search for indicators of the effectiveness of the use of human capital on the basis of state statistics. To reflect the dynamics of social-economic processes of human capital development in Russia, as well as a comprehensive study, it is necessary to identify from the total number of indicators of social-economic development those that have the most impact on the development of human capital. Display indicators for the subsequent quantitative determination of the degree of their influence (see table1).

Table 1
Indicators of the state of human capital in the national economy

Indicator 1	The number of manpower (thousand people).
Indicator 2	The number of employed in the economy (thousand people).
Indicator 3	The number of jobs in the economy (thousand jobs).
Indicator 4	The number of actual hours worked on jobs and labor (million person-hours).
Indicator 5	The average monthly salary of employees of organizations in the economy (RUB.).
Indicator 6	Growth rate of labor productivity in the economy, in comparable prices, as a percentage of the previous year (%)
Indicator 7	The growth rate of the average monthly real wages of employees, in comparable prices, as a percentage of the previous year (%).
Indicator 8	Cash expenditures of the population (billion rubles).
Indicator 9	Profit of organizations, in actual operating prices (billion rubles).
Indicator 10	Public expenditure on education (billion rubles).
Indicator 11	Public expenditure on healthcare (billion rubles).

Analyzing the dynamics of the constituent indicators, we determine which of the above closely affect the development of human potential. Currently, for a cross-country assessment of the status of human development gets spread index of human development, which is calculated as the arithmetic mean of three indices: life expectancy, GDP per capita and level of education. However, this indicator does not take into account labor productivity and wages required in the analysis of the state of human capital as indicators of its impact.

The current trends in the development of human capital are evidenced by the dynamics of its value, the level of education, the level of development of the health care system, changes at different levels in the education system (see table.2).

Table 2
Distribution data of the studied indicators

№ of indicator	2000	2005	2010	2011	2012	2013	2014
Indicator 1	72 770	73 581	75 478	75 779	75 676	75 529	75 428
Indicator 2	65 070	68 339	69 934	70 857	71 545	71 391	71 539
Indicator 3	73 700	73 780	74 164	75 181	75 290	75 131	74 829
Indicator 4	145 808	147 703	148 977	149 742	150 288	149 499	149224
Indicator 5	2 223	8 555	20 952	23 369	26 629	29 792	32 495
Indicator 6	100,10	105,50	103,20	103,80	103,00	101,90	100,80
Indicator 7	100,80	192,50	150,30	102,80	108,40	104,80	101,20
Indicator 8	3 984	113 819	32 498	35 649	39 904	44 650	47 912
Indicator 9	1590366	3225916	6330589	7139536	7824538	6853753	4346793
Indicator 10	376,4	628,6	1 450,9	1 517,6	2 047,0	2 333,8	2 474,3
Indicator 11	169,90	463,80	796,80	1 885,6	1 358,4	1 250,9	1 316,2

In the course of further statistical research, it is important to determine the tightness of the relationship between the indicators by calculating the correlation coefficient by analogy with the study "Indicators of the effectiveness of the formation of personnel reserve capital" (see table. 3).

Table 3
Calculation of coefficients of Pearson's pair correlation (rxy)

	Indicator 1	Indicator 2	Indicator 3	Indicator 4	Indicator 5	Indicator 6	Indicator 7	Indicator 8	Indicator 9	Indicator 10	Indicator 11
Indicator 1		0,94	0,86	0,96	0,92	0,13	-0,31	0,93	0,91	0,85	0, 88
Indicator 2	0,94		0,86	0,97	0,95	0,20	-0,21	0,95	0,83	0,90	0,85
Indicator 3	0,86	0,86		0,88	0,86	-0,02	-0,58	0,85	0,84	0,84	0,92
Indicator 4	0,96	0,97	0,88		0,89	0,28	-0,20	0,89	0,93	0,82	0,87
Indicator 5	0,92	0,95	0,86	0,89		-0,08	-0,41	0,99	0,75	0,98	0,81
Indicator 6	0,13	0,20	-0,02	0,28	-0,08		0,756	-0,06	0,30	-0,20	0,13
Indicator 7	-0,31	-0,21	-0,58	-0,20	-0,41	0,75		-0,40	-0,23	-0,47	0,47
Indicator 8	0,93	0,95	0,85	0,89	0,99	-0,06	-0,40		0,76	0,98	0,81
Indicator 9	0,91	0,83	0,84	0,93	0,75	0,30	-0,23	0,76		0,68	0,80
Indicator 10	0,85	0,90	0,84	0,82	0,98	-0,20	-0,47	0,98	0,68		0,74

Indicator 11	0,88	0,85	0,92	0,87	0,81	0,13	0,471	0,81	0,80	0,74

The presence of low negative values obtained suggests that there is no connection. The value of the correlation coefficient, close to one, gives an answer about the dependence. However, for objective reflection we use the polynomial method. To do this, the study calculated polynomials of 1,2 and 3 degrees, with a high coefficient of determination to a greater extent has a polynomial dependence of 2 degrees (see table. 4).

Table. 4

Calculation of coefficients (R^2) of determination for polynomial dependence of degree 2

	Indicator 1	**Indicator 2**	**Indicator 3**	**Indicator 4**	**Indicator 5**	**Indicator 8**	**Indicator 9**	**Indicator 10**	**Indicator 11**
Indicator 1		0,90	0,82	0, 92	0, 97	0,78	0,92	0,99	0,93
Indicator 2	0,90		0,86	0,96	0,96	0,52	0,70	0,93	0,99
Indicator 3	0,82	0,86		0,81	0,96	0,02	0,71	0,76	0,88
Indicator 4	0,92	0,96	0,81		0,94	0,46	0,91	0,93	0,94
Indicator 5	0,97	0,96	0,96	0,94		0,66	0,85	0,99	0,94
Indicator 8	0,78	0,51	0,02	0,46	0,66		0,29	0,008	0,088
Indicator 9	0,92	0,70	0,71	0,91	0,85	0,29		0,90	0,74
Indicator 10	0,99	0,93	0,76	0,93	0,99	0,008	0,90		0,88
Indicator 11	0,93	0,99	0,88	0,94	0,94	0,08	0,74	0,88	

According to the table, it is necessary to select those indicators, the values of which will meet the conditions set by us and exceed the lower limit of 0.9 at a determination coefficient in the range of 0.9 ÷ 1. The values of the determination coefficient will allow to make combined models taking into account the degree of the polynomial trend line. Studying the indicators of human capital development, important for the economy, we came to the conclusion that with a high correlation dependence in a pair of coefficients, it is possible to express one indicator through another.

In the formula of the Dublin-Trays in the calculation model Y indicator 5. Using the resulting polynomial representation of the indicator relations, we obtain:

$$Y = -1{,}67\ t^3 + 0{,}74\ t^2 - 109699\ t + 5437026706,$$

where t – indicator 4, the amount of time actually worked during the year in the workplace and work million people.

The high value of the determination coefficient $R^2 = 0.9937$ has a quadratic regression indicators 1-the number of labor and 10 - the cost of the state to form a polynomial quadratic bond:

$$y = -0{,}0013\ x^2 + 5{,}0391\ x + 71016.$$

Therefore, to include the indicator 10 in the model, we obtain:

$$Ex = E / (-0{,}0013\ G^2 + 5{,}0391G + 71016)$$

where E - indicator 2, number of employed in the economy, thousand people.

G-indicator 10, public expenditure on education, billion rubles.

Since trend dependences are the basis, we can most likely talk about the model of forecasting the development of human capital, which will take the form of:

$$V = E\ (-1{,}67\ t^3 + 0{,}74\ t^2 - 109699\ t + 5437026706) / (-0{,}0013\ G^2 + 5{,}0391G + 71016),$$

where t – the amount of time actually worked during the year in the workplace and work million people.;

E-number of employed in the economy, thousand people;

G-public expenditure on education, RUB bn

It is obvious that this indicator is measured on the basis of the introduced indicators per person-h./RUB., i.e. reflects the labor efficiency of each ruble invested by the state in education. It should be noted that this model does not take into account the discount rate and the number of years, as it allows to determine the effectiveness of the use of human capital for the period. Thus, substituting these indicators, it is possible to determine the projected values of this indicator, for example, to predict how to change the labor productivity of the human capital from each ruble invested in education. It is obvious that this model can be used for the purpose of strategic impact on the national economy for the effective management of the human capital.

4. The findings of the study

1. Analysis of the convergence of knowledge in the theory of human capital measurement showed that for many scientists the attempt to measure human capital is paradoxical and impossible. However, we argue that it is impossible to control what cannot be measured.

2. The essence of the social-economic environment of the human capital formation is revealed. It is proved that to determine the effective formation of the human capital it is necessary to determine the possibilities of indicative regulatory impact on society.

3. Its author's definition of social and economic environment of the human capital formation is given. The estimation of conditions of social and economic environment of formation of human capital is resulted. The educational potential of the country is estimated from the position of world trends.

4. It is proved that despite a large number of foreign and domestic approaches to the measurement of human capital as a criterion of its management, the issues of its measurement are incomplete, the indicators are contradictory, and therefore requires further elaboration in order to create a universal and integrated model.

5. The presented indicators of the efficiency of the use of human capital are necessary for effective management and strategic forecasting. The need to measure human capital is undeniable, as human capital is the only economic component capable of producing value that is difficult to estimate.

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