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The Index Approach to Assess the Human Capital of Russia

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Abstact

The article is devoted to the problem of methodology for the assessment of human capital. The authors critically and comprehensively considering various existing approaches to the assessment of human capital at the macro level, including unhallowed in the domestic literature, and spend their systematization. On the basis of critical analysis is presented of the author's approach to building human capital index, which is being tested on Russian data. The author's empirical study is conducted on the basis of a broad interpretation of the notion of "human capital", the proposed indicators not previously used in the literature, in particular it is proposed to use not only traditional indicators characterizing the level of education and health, but also components that characterize the cultural level, the values of the population, the quality of the education. Built indicator of human capital can be useful for the development of public policies aimed at reducing regional imbalances in the accumulation of human capital, and more efficient use of labor resources.

Keywords: human capital, education level, health of the population, the index approach to the evaluation of human capital, the method of principal components, the rating approach, the regions of Russia

1. Introduction

Most developed countries now goes to the post-industrial economy, the knowledge economy and innovation, a key driver of which is human capital. Human capital becomes the most important productive and social factor in the development of modern society. This, in turn, due to the lack of generally accepted methods of valuation of human capital raises the question about the methods of its assessment.(Kryukova et al., 2014, 2015)

In empirical work human capital, as a rule, understood in the narrow sense and includes indicators of the level of education of the population.

In this study, human capital is interpreted in a broad sense and includes the addition of a component of education and health as components that reflect the culture and values of the population.

The relevance of the study is justified, first, the relatively weak development of the threat assessment of human capital in the domestic literature, and secondly, the neglect of research other component of human capital in addition to level of education and health.

Used in modern empirical macroeconomic literature, the indicators of human capital can be divided into two categories: natural and cost. The first mainly represented by various indicators of the level of education and health, the latter represent the estimated value of the human capital stock of a country (region) in the current (national) currency. A special case is the index approach to the evaluation of human capital, because, strictly speaking, the index may include components that characterize the return on investment in human capital, in the current currency along with natural indicators of human capital.

1.1 Natural Indicators

In empirical studies on the impact of human capital on economic growth, technical progress and indicators of the standard of living of the population, most often to measure human capital, we use natural indicators, analysis of the application of which in the empirical literature allows you to split them into the following groups:

1) "Quantitative" indicators of education";

2) Indicators of "quality" of the labor force;

3) The health indicators of the population.

1.1.1 "Quantitative" Indicators of Education

The most simple indicators that were used in the first empirical research on this issue, were indicators of the coverage of primary, secondary and higher education (Barro, 1991; Mankiw et al., 1992). This group of indicators is simply the proportion of the population of the relevant age group for which completed one or another stage of the educational system. Coverage of the population in all levels of education, as a rule, is growing steadily and has in particular a statistically significant positive impact on economic growth.

Despite the wide use of indicators in this group (primarily due to the availability of data for them for a long period of time and in most countries of the world), they almost immediately began to be criticised in the following areas. First, the standards of the educational system in each country, as well as vary the duration of the learning stages. Secondly, the indicators do not take into account the quality of education: as rightly pointed out Hanusek and Kimko, few will agree that one year of secondary education in the U.S. is identical to one year of education of the appropriate level in Egypt (Hanushek & Kimko, 2000). Third, the coverage of that particular level of education is an indicator of flow rather than stock and therefore does not allow to estimate the human capital stock available for production activities.

Quickly enough the enrolment has been replaced by two other types of indicators: proportion of the population for which one or the other level of education is higher and the average number of years of schooling of the population aged 15 (25)—64 years. Since the first group of indicators is included as a component of the second group, the more it should focus on the latter.

Indicator average number of years of schooling of the population aged 15 (25)-64 years was proposed by Barro and Lee (Barro & Lee, 1993, 2010). It represents the sum of the number of years of schooling at each step (for each country), weighted by population shares, for which one or the other level is the highest.

The proportion of people for whom this or that stage is the most high, is calculated by the following formulas:

$$\begin{aligned} h_{0,t} &\equiv H_{0,t} / L_t = h_{0,t-5}\left[1-\left(L15_t / L_t\right)\right]+\left(L15_t / L_t\right)*(1-PRI_{t-5}) \\ h_{1,t} &\equiv H_{1,t} / L_t = h_{1,t-5}\left[1-\left(L15_t / L_t\right)\right]+\left(L15_t / L_t\right)*(PRI_{t-5}-SEC_t) \\ h_{2,t} &\equiv H_{2,t} / L_t = h_{2,t-5}\left[1-\left(L15_t / L_t\right)\right]+\left(L15_t / L_t\right)*SEC_t-(L20_t / L_t)*HIGH_t \\ h_{3,t} &\equiv H_{3,t} / L_t = h_{3,t-5}\left[1-\left(L15_t / L_t\right)\right]+\left(L20_t / L_t\right)*HIGH_t \end{aligned} \quad (1)\text{-}(4)$$

Lt—population aged 15-64, hjt, the proportion of people for whom j is the highest level of education (where j varies from 0 to 3 agricultural Variables PRI, SEC, HIGH enrolment in primary, secondary and higher education respectively. L15—population aged 15-19 years, L20—aged 20-24 years.

The variable δ_t is the mortality rate for the population 15 years and more:

$$\delta_t = \left(L15_t + L_{t-5} - L_t\right) / L_{t-5} \quad (5)$$

It should be noted that in this formulation there are two implicit assumptions:

1) The mortality rate does not depend on the level of education;

2) Perfect substitutability between workers with different education levels (by giving equal weights to each year of education, regardless of its level and the actual level of education).

This figure up to the present time is one of the key used in empirical work. He characterizes the stock of human capital, however, in many studies the effects of human capital, measured by the average number of years of schooling is statistically insignificant. In addition, it also does not solve the lack of a quantitative assessment of the level of human capital.

1.1.2 Indicators of "Quality" of the Labor Force

The indicators of the "quality" of the labor force was a response to the General lack all used to this performance, namely that they are not allowed to evaluate the quality of accumulated human capital (Hanushek & Kimko, 2000).

The quality of the labour force is measured on the basis of international tests of students and pupils of different ages. The main tests are tests PISA (OECD), TIMMS (Trends in International Mathematics and Science Study), PIRLS (The Progress in International Reading Literacy Study).

Among the main problems in the development of indicators of "quality" of the labor force can be distinguished:

1) Insufficient data in the case of using a panel approach;

2) The problem of data aggregation.

Regular cross-country examination of the level of knowledge of pupils and students began to be published in open sources recently: normally, the interval between surveys is 3-5 years. The problem of aggregation of test results may occur and due to the lack of data, as a reasonable way is to combine the results of different tests that have different average and maximum number of points, even if we neglect several distinguishing the methodology of the tests. However, the problem of aggregation still occurs and due to the fact that usually builds indicator that includes test scores in different subjects (e.g., mathematical and natural-science disciplines).

The original indicator "quality" of the labor force suggested that Lynn and Vanhanen, which they called "average national IQ" (Lynn &Vanhanen, 2006). The authors estimate the average IQ score for 185 countries and show a statistically significant positive correlation between average IQ and GDP growth rate per capita (correlation coefficient 0.82). The proposed indicator makes it possible to measure the quality of the workforce, however, the proposed methodology has caused extensive criticism in the following areas:

1) Calculations IQ are based on national studies, which are available only for 81 countries, for other countries the value of IQ, as a rule, is calculated as the average value of the neighboring countries or countries that are close, according to the authors, the level of development (e.g., raises questions as to the correctness of the calculation of IQ for Kyrgyzstan as a cross between Iran and Turkey);

2) For a number of countries as a proxy for IQ workforce has used the results of IQ tests among persons younger than working age (e.g., Egypt 6-12 years, 13-16 years in Colombia, 5-17 years in Ecuador). Despite criticism, this indicator is used in a number of empirical studies devoted to the investigation of the effect of human capital on economic growth. In particular, Jones and Schneider showed that the increase in average IQ by 1 point leads to the growth of GDP per capita 0.11% (Jones & Schneider, 2006).

1.1.3 The Health Indicators of the Population

Population health as a component of human capital is seen much less frequently than education. Basic considerations allow us to conclude that health should have an impact on economic growth and the living standards of the population. In particular, individuals with higher life expectancy should, first, to save more, which will lead to the accumulation of a larger stock of capital, and secondly, to invest more in education. Finally, more healthy individuals, other things equal, more productive and creative.

As the main indicators used as a measure of the level of health of the population, used life expectancy (at birth, at the age of 20 and 40 years) and mortality rates (in the relevant age groups).

The empirical results are rather contradictory. So, Acemoglu and Johnson received negative impact of increased life expectancy on the growth rate of income (Acemoglu & Johnson, 2007). At the same time, Lorentzen et al. found a negative effect of mortality on economic growth and, consequently, the positive impact of increased life expectancy (Lorentzen et al., 2008).

1.2 Value Indicators

Cost indicators of human capital is the value of human capital of a country (region) in the current (national) currency. Typically, these indicators are estimated using a discounted total income received by individuals:

$$V_{t1} = \sum_{t=t1}^{T} \frac{(B-C)}{(1+i)^t} \tag{6}$$

In the literature there are two main ways of calculating the value of human capital—the cost of its formation and the revenue that it will bring.

The approach of calculating the cost assumes that human capital is estimated on the basis of the investment required for its formation. Kendrick in the framework of this approach consider the following cost components on the formation of human capital: the cost of children up to 14 years, educational investments (including fee for the use of museums, libraries and so on., the cost of training in the armed forces, etc.), transport costs (mobility Fund) and health care costs, lost earnings (Kendrick, 1976). Estimated Kendrick, for the period 1929-1960, the stock of human capital of the USA in constant prices almost tripled. However, this approach is not currently used due to its numerous disadvantages, in particular the lack of a strong connection between the investment and the

return on them, disputed the inclusion of all costs for children up to 14 years as investment in human capital, not taking into account the possibility of long-term investments in human capital, the choice of the depreciation rate.

The second approach is based on the fundamental in this research work Jorgenson and Fraumeni (Jorgenson & Fraumeni, 1989, 1992). They divided the life cycle of an individual in five periods:

1) 0-4 years, when the individual is not enrolled and not working;

2) 5-13 years, the individual can learn, but may not work;

3) 14-34 years, when the individual can learn, and work;

4) 35-74 years, the individual can only work;

5) 75 years or more, when the individual is again not studying and not working.

This separation into groups allows to equate to zero the current earnings of the first two groups, and the fifth group is zero earnings for both current and future. The recursive calculation procedure: first, calculate the discounted value of the income of individuals at the age of 74 years, because for this group of future and current earnings are the same, then for the age of 73 years, taking into account the results of the previous stage of the calculations, etc. A General formula for groups who cannot learn, has the form

$$i_{s,a,e} = yi_{s,a,e} + sr_{s,a-1} * i_{s,a-1,e} * (1+g)/(1+r) \tag{7}$$

A—age, s—sex, e—education, r—the discount rate, g—the expected growth rate of real wages, $yi_{s,a,e}$—current salary, $sr_{s,a+1}$—the probability of survival to age a+1, $i_{s,a+1,e}$—given the amount of income of an individual of the same gender and educational level, age a+1.

For groups in which the individual is given a choice between work and study, the calculation formula is more complicated:

$$i_{s,a,e} = yi_{s,a,e} + \left[(senr_{s,a,e} * sr_{s,a+1} * i_{s,a+1,e+1} + (1-senr_{s,a,e}) * sr_{s,a+1} * i_{s,a+1,e}\right] * (1+g)/(1+r) \tag{8}$$

Where $senr_{s,a,e}$—enrolment at a higher education e+1 individuals of sex s, age a, and education level e.

This approach is very popular and currently in the OECD project calculations were performed for 14 countries, and in 2012 he published the work of Kapelyushnikov, in which these calculations are performed for Russia (2010 using data from the population census). In particular, his calculations showed that the total cost of human capital Russia exceeds 600 trillion. RUB that in 13 times the country's GDP and more than 5 times the cost of physical capital. It should be noted that in terms of the value of human capital of Russia in PPP it is comparable to the cost of capital to other countries included in the sample of OECD.

The advantage of this approach is that it is valued at current market prices, is estimated at no cost on human capital and expected income. However, many authors point to a number of shortcomings (e.g., Le et al., 2003; Folloni & Vittadini, 2010): The implicit assumption that the wage is an adequate indicator of the quality of human capital and level of education; lack of accounting cycles (when wages may differ significantly from that specified in the model); the return on education in this approach is mixed with the return on other components of human capital; controversial issues are the choice of discount rate and growth rate of wages.

1.3 The Index Approach

Indexes are also quite popular indicator of human capital. Among them the most famous is the ИРЧП (HDI), which is calculated in the framework of the development Programme of the United Nations (UNDP) (United Nations Development Programme: Human Development Reports, 2014) and is used in a special series of reports to the UN human development. It takes into account health, education and quality of life of individuals and is formed as the arithmetic mean of the three partial indices: life expectancy, quality of life, and the achieved level of education:

$$ИРЧП = \frac{I_e + I_{ввп} + I_{обр}}{3} \tag{9}$$

Generally speaking, the use of HDI as an indicator of human capital is not quite correct, because this indicator includes the indicator of welfare. Some authors exclude in their empirical research component of the standard of living of the population and includes the indicator of the health of the population and level of education of the population is equal to (1/2) weights (Khan & Rehman, 2012).

The main disadvantages of the index approach are:

1) Expert attributed the weight;

2) Use mainly formal indicators of human capital (in particular, enrolment and literacy rates);

3) Difficulties in the interpretation of the results.

According to the results of analysis, we can conclude that there is no single, universally accepted measure that would characterize the stock of human capital and the pace of its growth. The currently used indicators are characterized by certain disadvantages.

When conducting econometric studies this problem is usually solved by including multiple indicators of human capital in the model. If the aim of the study is to compare the countries (regions) on the level of human capital required to build some of the aggregated indicator, which entails the necessity of using an index approach.

2. Methodology

2.1 Justification of Research Method

With the development of the methodology of the index of human capital one of the main problems that needs to be solved is to find the weights.

In many studies, the problem is solved simply and weight are exogenous. Exogenous weight is most often established in the form of a simple arithmetic mean of the weights or arbitration weights—when a researcher sets of different weights for the index component, which reflect his subjective assessment of the importance of a measurement of a multidimensional index to obtain a comprehensive assessment of the investigated phenomena.

An example of the simultaneous use of both equal and arbitration weights is already mentioned above, the HDI, each component (sub-index) is included in the final index with a weight of 1/3. At the same time, the index achieved level of education consists of index literacy and index of total enrolment. The first index prescribed weight 2/3, the second 1/3, thus, is secured a relatively large degree of importance of literacy in comparison with the coverage of the population to assess the achieved level of education.

Despite numerous obvious disadvantages of this method is popular due to ease interpretation of the results and laying the premise that the researcher is equally important that all components of the index. A more advanced variation of the exogenous job weights are expert weight. This method consists in sampling experts and a survey among them, on the basis of which the calculated final weight. Deficiencies in broadly the same as in the case of arbitration weights. Among other things, raises the problem of the representativeness of the sample of experts.

The main methods of endogenization weights are the principal component method and the DEA—approach.

The method of principal components is one of the main methods of reducing the dimensionality and allows of n correlated variables to obtain m uncorrelated components, each of which is a linear combination of the original n variables:

$$\begin{aligned} PC_1 &= a_{11}X_1 + a_{12}X_2 + \cdots + a_{1n}X_n \\ &\vdots \\ PC_m &= a_{m1}X_1 + a_{m2}X_2 + \cdots + a_{mn}X_n \end{aligned} \tag{10}$$

In the PCA weights extracted from the first principal component or more of the first component, explaining a large percentage of the variance.

The method is applied in case of high dependence between the variables. The main problem is the possibility of obtaining negative weighting coefficients, which can be solved by imposing restrictions on the weights.

In recent years, to build indexes widely used method of analysis of the operating environment (DEA—Data Envelopment Analysis). In addressing the problem of choosing weights for the index component DEA approach involves the choice of weights as the most “profitable” for each object sample for all variables. Solved an optimization problem of maximizing the objective function (index) of each sample object at the limit of the index values for all other objects (not to exceed one):

$$\max h_{j_0} = \sum_{i=1}^{k} w_i X_{ij_0}$$
$$\sum_{i=1}^{k} w_i X_{ij} \le 1, w_i \ge \varepsilon, i = \overline{1...k} \quad (11)$$

where h_{j0}—optimal value of the objective function for an object j0, w_i are weighting coefficients, k— the number of indicators included in the index.

The main problems of this method are the following:

1) For each object is formed by an individual set of weights, which makes it impossible to make a comparative analysis between objects, which in turn, raises the problem of choosing a method to bring the individual weights to common;

2) Under this method, the maximum weight will be obtained for the component on which the object has the best results, but this does not mean that this component makes the largest contribution to the evaluation of human capital.

On the basis of the conducted analysis identified the close relationship of the individual component of human capital as a method of constructing the index of the selected principal component method. The index in this case will be the first principal component, representing a linear combination of all variables included in the final sample.

The study can be divided into the following stages:

1) The creation of the database;

2) The index of all the selected indicators in the scale from 0 to 1. General view of the private index takes the form: $I_i = \frac{X_i - X_{i\min}}{X_{i\max} - X_{i\min}}$ or $I_i = \frac{X_i - X_{i\max}}{X_{i\min} - X_{i\max}}$, where X_i is the value of the variable i, X_{imax} и X_{imin}—maximum and minimum, respectively, the values of this variable in the sample. If it is assumed that the variable should enter with a positive sign in the total index, the index of the indicator is held by the first formula, otherwise the second. Thus, the value 1 is assumed for the region having the maximum value on the "positive" variables (e.g., maximum coverage of the population with higher education), and has minimal value for the "negative" variables (e.g., minimal morbidity and infant mortality).

3) Applying to the received set of variables principal components method, the index is the first principal component explains the maximum variance. Introduces a restriction on the nonnegativity of the weights. The implementation takes place in the package Statistica 7.0.

4) The calculation of the final rating of the Russian regions in terms of human capital on the basis of the obtained in the second stage of weighting coefficients.

2.2 Data

We should also specify the process of forming the database, since the choice of the component indicators of human capital is one of the key points of the study.

Table 1. Variables-potential components of the human capital index

Education	The population, which was higher (incomplete higher education); the population for which the maximum level of education is primary and secondary vocational education, b) elementary General education) which is not received even a primary education.; the number of winners and prize-winners of WSOS grades 10-11; the number of students of educational institutions of higher professional education
Health	Life expectancy at birth for the population as a whole, life expectancy at birth of men, expectancy life at birth women ; total fertility rate; total mortality; infant mortality; mortality from suicide; the death rate from accidental alcohol poisoning; morbidity; the number of sports facilities and gyms
Science	The number of personnel employed in R&D (total, researchers, technicians)
Institutions	Interregional migration growth; net migration of persons with higher education; the increase in migration of those with only primary education or not even with him; property crimes (robbery, theft, burglary); crimes economy; the election turnout
Culture	The number of visits to museums

Discription: Source: Compiled by authors.

The sample includes the regions of Russia except Autonomous okrugs part of a larger Federation subjects (Nenets ed.env., Khanty-Mansiysk ed. OCD.—Yugra, Yamalo-Nenets ed. env.) and the Chechen Republic, thus, in the initial sample consists of 79 subjects.

A statistical study based on the data of Rosstat, the information portal of the all-Russian Olympiad (VSOS), the Central election Commission of the Russian Federation in 2011, due to the fact, on a number of selected indicators of regional data for 2012 at the time of the study were absent.

Selected for the study the indicators presented in Table 1.

Taken together, they describe the education, health, culture and motivation.

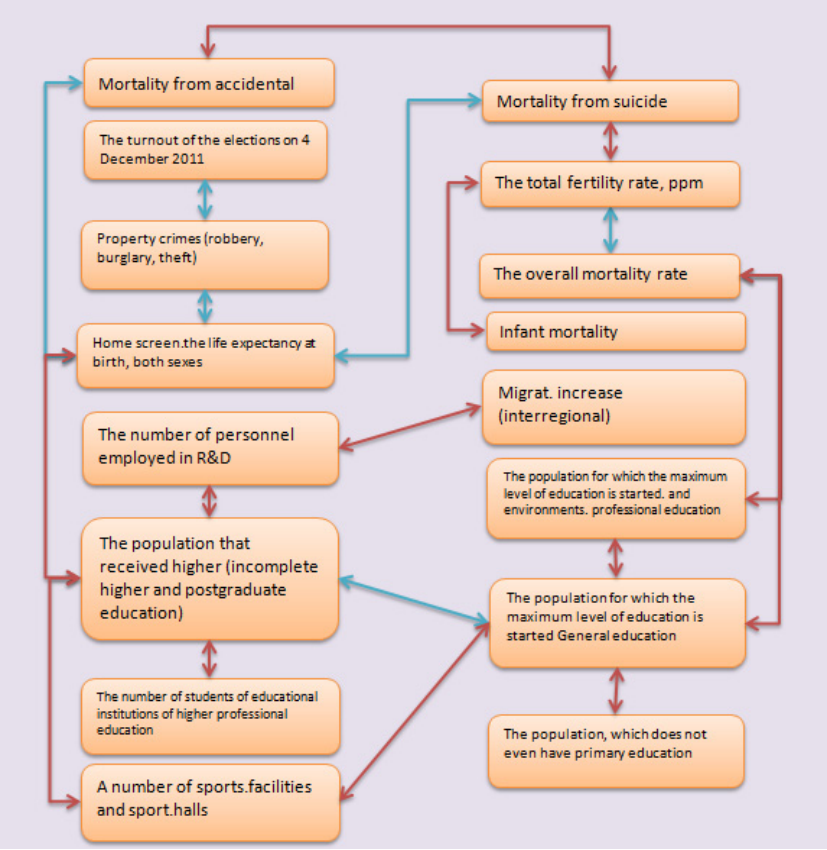

Figure 1. The results of correlation analysis

You must separately specify the choice of some of the variables as a potential component of the human capital index:

1) The enrolment rates varying by level of education, the values of which are derived from the results of the CENSUS of 2010. In the course of the survey population aged 15 years and over were asked to indicate the highest level of educational attainment. Given the formulation of the question to build the indicator "population coverage" of this or that level of education possible only for General and higher professional education, so for the indicator are encouraged to take a "critical" level of education—that is, the maximum level of education attained by the individual at the time of the survey.

2) To account for the influence of science on the process of human capital accumulation are invited to take the indicator "number of personnel employed in R&D, because this category of people employed directly produces new knowledge. It should be noted that according to the methodology of Rosstat of personnel engaged in research and development, there are four categories: researchers, technicians, support staff and other personnel. Researchers generally have higher education and are directly involved in the development of new knowledge, products, methods. Equipment carry out various functions under the guidance and supervision of researchers, as a rule, associated with the operation of equipment, conducting experiments and so on. The analysis was carried out separately for three categories—the total number of separate researchers, separately technique.

3) As an indicator characterizing the quality of the labour force" formed the indicator "number of winners and prize-winners of all-Russian Olympiad among 10-11 classes on 100 thousand students". This indicator is used for the first time in the empirical literature devoted to the evaluation of human capital. It seems that it more adequately reflects the quality of education than the results of the Unified state exam (EGE).

4) The level of development of institutions reflected a range of indicators. Population mobility is characterized by the migration growth. Input indicators of migration growth in higher education and in primary education allow us to characterize the "quality" of an incoming workforce. The level of development rights and freedoms and, accordingly, civic awareness, values, individuals are assumed to reflect the turnout at elections on 4 December 2011.

5) The indicator reflecting the commitment of the population to a healthy lifestyle, is the number of sports facilities and sports halls for 1000 people.

6) Cultural values of the population as an important component of human capital is reflected by the indicator "the number of visits to museums per 1000 people".

Red positive value of correlation coefficient (>0.5).

Blue negative value of the correlation coefficient (-0.5<).

To simplify the scheme of her exceptional following three closely correlated indicators: life expectancy at birth (both sexes, men, women); the number of staff engaged in R&D, total, per 10 000 employed population (total, researchers, technicians); net migration per 1000 us. (persons with higher professional education; persons with only primary education or no even in primary school) and interregional migration growth for 1000 people. Also excluded variables if the correlation coefficient is less than 0.5 modulo.

Thus, to construct the indicator was originally selected 26 indicators.

Selected for study figures are preliminary hypotheses about the direction of influence of each component on the final index measuring human capital. For some variables uniquely determine the direction of influence at the preliminary stage of analysis was not possible due multidirectional influence of this variable for human capital. For these variables were considered both possible directions of influence when indexing the selected indicators

Correlation analysis showed a strong dependence between the variables (Figure 1). Strong dependence is one of the main factors in the choice of the method of principal components as a tool to build the human capital index.

As the main statistical base used official site of the state statistical service and data licensing consulting statistical structures(Statistics Information portal WAS, 2014; Statistical data of the Central election Commission of the Russian Federation,2014; Statistical data of the Federal service of state statistics, 2014) .

3. Results

The final indicator of human capital includes 7 indicators of the level of development of education, scientific potential, health, mobility (i.e., institutional component) and cultural level. A set of weights derived from the first principal component, are presented in Table 2.

Table 2. Components of the final index and their weights

Index component	Designation	Weight
Life expectancy at birth, both sexes, years	Life_Exp	0.13
The number of staff engaged in R&D, total, per 100 000 employed population	R_D	0.18
Coverage of the population with higher and incomplete higher education	H_Edu	0.18
The number of winners and prize-winners of 10-11 grades of VSOS per 100,000 people.	Olymp	0.13
The number of students of educational institutions of higher professional education for 10 000 people.	Uni	0.14
Net migration per 1000 people, persons with higher education	Migr	0.11
The number of visits to museums per 1000 people	Mus	0.13

Discription: Source: Compiled by authors.

Most important are the number of staff engaged in R&D, and the coverage of the population with higher and incomplete higher education. Notable is the high weight of the first measure, not previously encountered in the literature devoted to the evaluation of human capital. The result is that this component of the index reflects the scientific potential of the region.

The expected high weight received and the indicator "quality" of the labor force—the number of winners among 10-11 classes of SOS. Thus, these results confirm the priority influence of educational level on the stock of

human capital.

Index component, reflecting the cultural level and partial values of the population—the number of visits to museums were included in the final index with the same weight, and life expectancy at birth. This confirms the importance of this component of human capital. It is obvious that individuals with higher human capital stock, differ in their spiritual needs from individuals with less human capital stock, and accordingly are different and the activities that partially reflected by the selected indicator.

In the final index also includes the increase in migration of people with higher education. In addition to the obvious increase in the stock of human capital due to the influx of highly skilled workforce, a positive significant impact of migration growth as an index component of human capital is manifested due to the likely higher mobility.

Major, currently in the index indicator of human capital in Russia is the HDI, which is calculated in the framework of the UNDP in Russia. It should be noted that in the Russian technique in comparison with the standard methodology of the UNDP introduced a number of adjustments. First, the adjustment GRP of all the regions on neraspredeleno part of the country's GDP, as well as at the inter-regional price differences. Secondly, the conversion into US dollars at purchasing power parity for the current year. Thirdly, the calculation of the level of literacy maximum is taken as 99.5% of the population. Fourth, the enrolment is calculated as the ratio of the number of students of educational institutions at all levels to population aged 6-23 years

The final rating of the Russian regions in human capital are presented in Table 3.

The top ten are Federal cities and regions—the largest centers of scientific research (e.g., the Kaluga region) and "University" centers (Novosibirsk and Tomsk region). A significant difference from the HDI is the lack of "top ten" leading "export" regions, which are placed in the HDI mainly due to its leading position in the GRP. The rating closes the so-called "regions-the outsiders". Notable is the fact that the regions of the North Caucasus Federal district, which in most ratings are generally, relatively low position in the index of human capital are comparatively high. This is due to the fact that the component health data regions are among the leaders.

Table 3. The rating of the Russian regions on human capital

Region	Index value	Place in rating	Region	Index value	Place in rating
Saint-Petersburg	0.857	1	Karachay-Cherkess Republic.	0.266	41
Moscow	0.851	2	Krasnoyarsk region	0.266	42
Moscow region	0.507	3	Rep. Adygea	0.264	43
Tomsk region	0.452	4	Perm Krai	0.263	44
Kaluga region	0.405	5	Primorsky Krai	0.261	45
Nizhny Novgorod region	0.397	6	Novgorod oblast	0.259	46
Novosibirsk region	0.393	7	Tambov region	0.255	47
Stavropol Krai	0.384	8	Lipetsk region	0.253	48
Rep. Tatarstan	0.374	9	Rep. Of Sakha (Yakutia)	0.251	49
Voronezh region	0.371	10	Rep. Dagestan	0.247	50
Kaliningrad region	0.353	11	Rep. Karelia	0.247	51
Yaroslavl region	0.351	12	Bryansk region	0.245	52
Belgorod region	0.337	13	Pskov region	0.245	53
Samara region	0.336	14	Kamchatskiy Krai	0.243	54
Chelyabinsk region	0.323	15	The Magadan region	0.243	55
Rep. Ingushetia	0.315	16	Kabardino-Balkar Republic.	0.242	56

Rostov region	0.313	17	The Murmansk region	0.239	57
Kirov oblast	0.309	18	Tver region	0.239	58
Sverdlovsk oblast	0.305	19	Rep. Kalmykia	0.236	59
Tyumen region	0.304	20	Irkutsk region	0.235	60
Rep. North Ossetia-Alania	0.298	21	Rep. Bashkortostan	0.234	61
Ulyanovsk region	0.298	22	Rep. Buryatia	0.233	62
The Chuvash Republic.	0.298	23	Ivanovo region	0.231	63
Khabarovsk Krai	0.297	24	Astrakhan region	0.231	64
Orel region	0.296	25	Arkhangelsk region	0.220	65
Ryazan region	0.295	26	Rep. Komi	0.216	66
Rep. Mordovia	0.295	27	The Orenburg region	0.208	67
Kursk region	0.291	28	Kurgan region	0.205	68
Volgograd region	0.290	29	Altai Krai	0.203	69
Vologda region	0.290	30	Rep. Khakassia	0.195	70
Omsk	0.290	31	Kostroma region	0.193	71
Leningrad region	0.287	32	Kemerovo region	0.192	72
Krasnodar region	0.282	33	Sakhalin oblast	0.178	73
Smolensk region	0.280	34	Rep. Altai	0.168	74
Vladimir region	0.280	35	The Amur region	0.154	75
The Udmurt Republic.	0.278	36	Zabaikalsky Krai	0.140	76
Penza region	0.278	37	Chukchi ed. district	0.128	77
Saratov region	0.278	38	Jewish author. region	0.125	78
Tula region	0.274	39	Rep. Tyva	0.098	79
Rep. Mari El	0.267	40			

Discription: Source: Compiled by authors.

4. Discussion

It is interesting to compare the indicator with the presently used for the estimation of human capital. As mentioned above, the main index, which characterizes the level of human potential is the HDI.

Analysis of the relation between obtained by the authors of the index and the HDI by region of Russia was based on the Spearman correlation coefficient and Kendell. The obtained values of the coefficients indicates a positive, statistically significant, the relatively weak relationships (Table 4). This is primarily due to the fact that the HDI takes into account gross regional product per capita, which does not allow him to consider the full extent of the indicator of human capital. Thus, communication is present, however, suggested by the authors of the indicator better reflects the level of human capital of the region than is used frequently for these purposes, the HDI for several reasons, the main ones are the following. First, the design of the indicator consists of a component directly characterizing human capital (HDI includes GRP). Secondly, the design of the indicator contains a larger number of components, characterizing different aspects of human capital, which undoubtedly makes it more full and rich analysis of the level of human capital in regions and their.

Table 4. Spearman correlation developed index and HDI

Correlation coefficients	Indices	HDI	IMGC*
Spearman	HDI	1.00	
	IMGC	0.45	1.00
Candell	HDI	1.00	
	IMGC	0.33	1.00

Discription: IMGC*—index derived from principal component method (Statistics Information portal WAS). Source: Derived by the authors.

The analysis of the positions of the regions in the final rating and component-specific evidence of extreme heterogeneity of regional development by separate parts of the human capital index (Table 5, 6). In General, two regions, occupying the top position in the final ranking of the top of almost all components included in the final index. However, St. Petersburg ahead of leading the rest of the components of the index Moscow only due to the fact that the latter occupies a relatively low position on migration of highly skilled workers. However, the table shows that these workers are just "settle" in the Moscow region, which is likely, especially with the relatively lower cost of housing and rents in the Moscow region in comparison with Moscow.

Most of the regions top ten takes a very "moderate" designated health and cultural component. On other indicators of the development of more balanced. Thus, they are on the first positions primarily due to high enrolment high quality of education (the"quality" of the labor force) and high scientific potential. In particular, in the final top 10 included such major scientific and educational centers, as Novosibirsk, Tomsk, Kaluga and Moscow regions.

The bottom position is occupied by a typical region outsider. Most indicators (education, health R&D) they occupy a stable "low" position. However, individual components of these regions occupy a middle (or high) position. In particular, in approximately half of the regions "average" figures on migration gains and visiting museums.

Analysis of regions that are not included in the top and bottom 10 positions, the individual components of the index allows to concludeing that in some regions the position in the final ranking higher than expected, due to high positions on one or two components of the index. First of all, it refers to the regions of the North Caucasian Federal district. In particular a high position in the ranking is occupied by the Republic of North Ossetia-Alania and Ingushetia, which is due to the fact that in these regions the highest life expectancy at birth (Ingushetia is in the first place, of North Ossetia-Alania—sixth place among Russian regions) and they have a very good position on the coverage of the population with higher education.

An important conclusion is the fact that there is a high level of differentiation of the regions on the final index. In particular stands out sharply St. Petersburg and Moscow, followed by a big jump in the value of the index. The average index value of 0.285, with half of the regions has an index value below 0.267.

Table 5. Final rating (the first 10 places) Russian regions on human capital and individual components of the index

Region	Index value	final rating	Life_Exp	R_D	H_Edu	Olymp	Uni	Migr	Mus
Saint-Petersburg	0.857	1	4	2	2	4	2	2	1
Moscow	0.851	2	2	1	1	1	1	21	4
Moscow region	0.507	3	17	3	3	27	76	1	42
Tomsk region	0.452	4	29	6	5	20	3	16	56
The Kaluga region	0.405	5	32	5	23	7	59	19	22

Nizhny Novgorod region	0.397	6	49	4	17	29	21	15	40
The Novosibirsk region	0.393	7	27	7	12	30	9	12	66
Stavropol Krai	0.384	8	9	40	27	2	23	40	59
Rep. Tatarstan	0.374	9	10	20	14	17	8	17	19
Voronezh region	0.371	10	16	8	24	24	7	14	62

Discription: Source: Compiled by authors.

Table 6. Final rating (last 10 seats) Russian regions on human capital and individual components of the index

Region	Index value	final rating	Life_Exp	R_D	H_Edu	Olymp	Uni	Migr	Mus
Rep. Khakassia	0.195	70	60	75	66	55	71	37	25
Kostroma region	0.193	71	50	79	71	64	68	57	13
Kemerovo region	0.192	72	68	71	60	42	66	56	29
Sakhalin oblast	0.178	73	74	44	48	77	74	41	27
Rep. Altai	0.168	74	75	60	58	74	75	8	78
The Amur region	0.154	75	76	59	61	66	60	69	44
Zabaikalsky Krai	0.14	76	73	74	76	65	54	72	64
Chukchi ed. district	0.128	77	78	78	35	79	79	7	11
Jewish author. region	0.125	78	77	36	78	78	33	76	63
Rep. Tyva	0.098	79	79	35	77	75	77	42	69

Discription: Source: Compiled by authors.

The high level of differentiation of regions by level of human capital is clearly very prominent cities of Federal importance and high level of heterogeneity of regions on the individual components of human capital show significant regional disparities. Human capital in the modern world is one of the key resources for socio-economic development, which requires targeted public policies to encourage the accumulation of human capital in regions and reduce observed disparities.

5. Conclusion

In the course of the study were able to improve the methodology for the assessment of human capital due to the fact that the basis is laid broad interpretation of this concept. Human capital in this setting includes not only the traditional level of education and health, but also components that characterize the cultural level, the values of the population, indirectly, the state institutions in the country. (Kryukova, 2005; Kryukova et al., 2005)

To measure human capital proposed indicators not previously used in the literature. First of all, it appeared important indicator of the "quality" of the labor force, which is proposed to be assessed on the basis of the quality received by individual education, namely the number of winners among 10-11 classes of SOS. In

addition turned out to be significant as first proposed indicator characterizing the scientific potential of the regions (i.e., those who "produce" direct knowledge)—the number of staff employed in R&D.

The authors have obtained the indicator is an index describing the level of human capital and allowing to map the regions of Russia on the level of human capital.

In the construction of the index the problem of choosing weights were decided on the basis of multivariate statistical analysis that allowed us to obtain endogenous weights.

Testing results on Russian data revealed a high heterogeneity of human capital in Russia in General and its individual components of the index for different regions. The study showed that the priority level of education, quality of education and scientific potential. However, turned out to be significant public health and the culture and values of the population.

Built indicator of human capital can be useful for the development of public policies aimed at reducing regional imbalances in the accumulation of human capital, and more efficient use of labor resources.

Further research directions include primarily the calculation of the obtained indicator on countries of the world and the comparison of obtained results with the Russian; improving the methodology of index calculation, in particular the consideration of new indicators—primarily institutional.

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