

## FACTORS OF ATTRACTION AND HUMAN CAPITAL ACCUMULATION IN THE FRAMEWORK OF A MACRO-REGION

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### ABSTRACT

*One of the strategic priorities of spatial development is the formation and accumulation of human capital. It is the Foundation of the modern economy. The accumulation and successful functioning of human capital ensures the successful development of a macroregion. Therefore, creating comfortable conditions for the formation and accumulation of human capital is the most important task in developing a strategy for the spatial development of a macroregion. In terms of achieving a high quality of life, human capital is a key asset and ensures the competitiveness of the macroregion. The study identified the main factors of formation and accumulation of human capital. Among them: high fertility and sustained migration; improving the system of education, ensuring the formation of human capital corresponding to the needs of society and the economy; health and longevity; the quality and diversity of cultural life; social support for innovators; flexible labour market; efficient system of assistance to employment and social protection of the population. As a result of the research, an economic and mathematical model was constructed that takes into account interregional differences in the conditions for the formation and accumulation of human capital. Creating comfortable conditions for the accumulation of human capital in the future will help to retain highly qualified specialists and attract young specialists from other regions. This, in turn, will increase the region's investment attractiveness and strengthen its position in global interregional competition.*

**Keywords:** *region, human capital, modeling, cluster analysis*

### 1. INTRODUCTION

Under the prevailing conditions of intensive economic development, human capital is an important strategic resource for socio-economic development. N. Yarushin and A. Pavkevich note that the socio-economic development of the country and each of its regions is determined by many factors. However, in modern conditions, the determining factor is called human capital (Yarushin et al., 2013). The concept of human development has become widely recognized, which gives the first place to the expansion of human opportunities to realize their potential. In the modern world, investments in education and health care, ensuring freedom and opportunities for all-round creative development of a person become crucial. Regional aspects of the functioning of human capital require more in-depth study.

According to E. Chuchulina, the human capital of the region is a broad and multifaceted concept, so it is necessary to manage all the quantitative diversity of its qualitative characteristics. (Chuchalina, 2014) In order to manage human capital at the regional level, it is necessary to determine and evaluate the factors of formation and attraction of human capital. At the same time, it is necessary to have a tool that is able to comprehensively assess the available human capital with a focus on its effective use and that, if necessary, will quickly offer sources of replacement for the deficit of human capital. Foreign scientists have made a significant contribution to the study of human capital in relation to its accumulation and preservation factors (Becker, 1962; Minsler, 1958; Schultz, 1961; and others). Works (Anichin et al., 2018; Donichev et al., 2014; Yarushkin et al., 2013; Terekhin et al., 2014; Zabelina et al., 2013; Petrikona et al., 2016) are devoted to the study of regional development of human capital. However, despite the fact that the history of the theory of human capital is more than fifty years old, theorists and practitioners have not yet developed common approaches to the analysis of the conditions and factors of its attraction, accumulation and effective use. The development of human capital in the regions is determined by the influence of various factors-economic, social, demographic, etc. All of them are in close relationship (direct and reverse) with each other. The different influence of many groups of factors on the formation of human capital is, among other things, the reason for the differentiation of regions by levels of human capital development (Konopatskaya, 2011). O. Donichev notes that the differentiation in the socio-economic development of regions is so great that it is reflected in the indicators that characterize the level of development of human capital in them, which, of course, affects the processes of formation of the interregional economic space and innovative development of territories (Donichev et al., 2014). K. Vlasyuk and p. Stroevev, argue that the distribution of the population, and, as a result, human capital, on the territory of the Russian Federation on the one hand, is extremely heterogeneous, and on the other — subject to constant changes (Vlasyuk et al., 2017). Thus, the main task of the research is to identify factors that contribute to the attraction and accumulation of regional human capital, and on their basis to conduct a cluster analysis that allows you to identify homogeneous groups of regions and offer them targeted areas of development.

## **2. RESEARCH METHODS**

The study of the causes and factors of the formation and accumulation of human capital in the context of the macroregion consists of the following stages:

- 1) Identification of factors that influence the formation and accumulation of human capital in the region.
- 2) Selection of indicators that characterize the effect of each of these factors.
- 3) Determining the resulting indicators of the region, taking into account the accumulation of human capital at the regional level.
- 4) Bringing disparate indicators to a comparable form, through the procedure of standardization (normalization).
- 5) Integral assessment of the conditions for the accumulation of human capital in the region.
- 6) Clustering of regions of the Central Chernozem macroregion based on integral estimates.

So, in our opinion, the main reasons for changes in the number of human capital are natural and mechanical factors. Each group of factors includes indicators that can be used to characterize them.

*Table following on the next page*

*Table 1: Indicators for assessing factors of formation, accumulation and use of human capital*

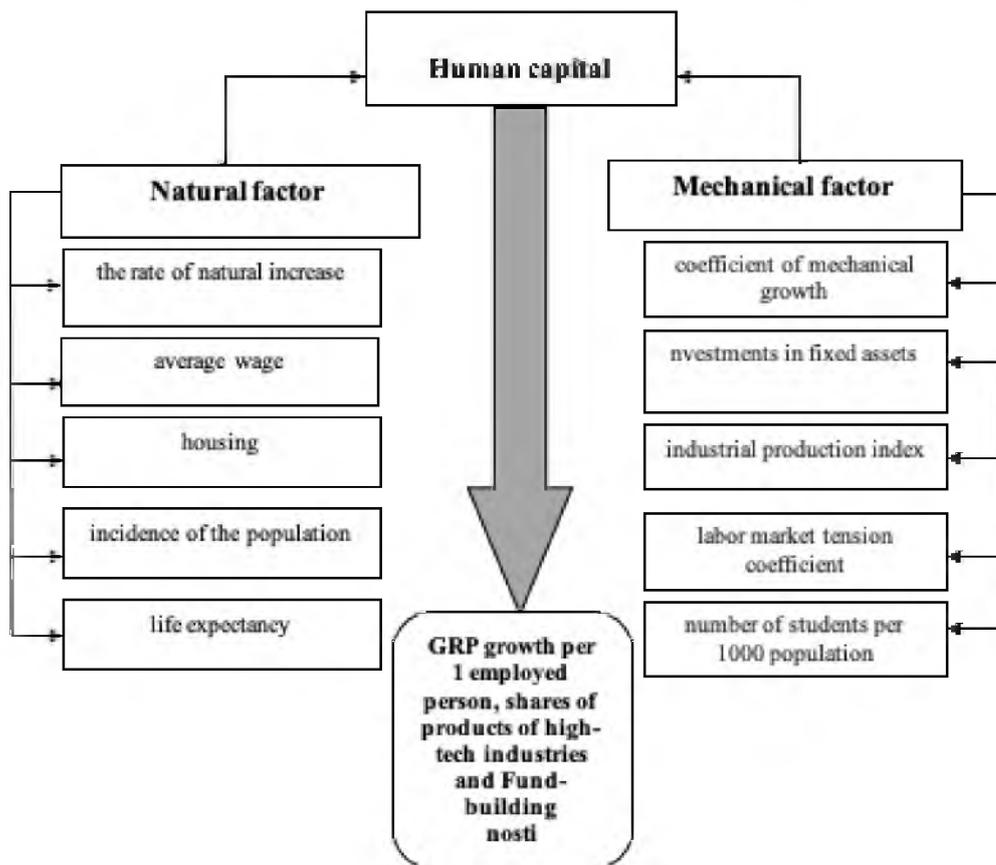
Group of factors		Indicators
Factors of formation and accumulation of human capital	Mechanical	coefficient of mechanical growth, 0/00
		investments in fixed assets, million rubles
		industrial production index, %
		labor market tension coefficient
		number of students per 1000 population
	Natural	the rate of natural increase, 0/00
		average salary, RUB
		housing security, m <sup>2</sup> per person,
		incidence of the population, per 1000 people
		life expectancy
Factors in the use of human capital		gross regional product per employed person, thousand rubles
		stock capacity, thousand rubles
		volume of innovative goods, works, and services, million rubles

The significance of each factor in the formation and accumulation of human capital in the region can be explained in a thesis:

- 1) Natural factors include the health of the population, quality and standard of living. Since the preservation of health and longevity are important priorities of the population and the health system, and the quality of life affects the shift of the center of gravity of human capital in the case of a low level and contributes to the accumulation of human capital in the case of a high level.
- 2) The effect of mechanical factors is explained by the education system, the state of the labor market and the production potential of the region. The education system ensures the formation of human capital that meets the needs of society and the economy. The flexibility of the labor market contributes to the mobility of labor resources, forms human capital, which provides an innovative vector for the development of the region's economy. Production potential determines the conditions for the development of the region and thus contributes to the accumulation of human capital in the region.
- 3) The Formation and accumulation of human capital in the region contributes to increasing the competitiveness of the territory and thereby increasing economic well-being. Due to the shift of the center of gravity to the person, it becomes important to evaluate the characteristics of factors of human capital accumulation in comparison with the results of its implementation in the region. The level of economic development of a subject is determined using the GRP per employee indicator, which allows you to assess labor productivity in the region and analyze the reasons for changes in this indicator for certain types of activities: changes in production volumes and the number of people employed in the economy. The efficiency of the use of production assets of the enterprise reflects the degree of provision of personnel with basic means of production, the increase of which contributes to the growth of labor productivity. It is important to note that the growth rate of capital-labor ratio must be provided as accumulated human capital, not increasing value of fixed assets. Improving the quality of human capital (scientific potential) of the region contributes to the growth of innovative activity of enterprises by increasing the share of high-tech production.

Schematically, our concept of human capital formation and accumulation is shown in figure 1.

Figure 1: Formation of human capital at the regional level



We will conduct a comprehensive analysis of the accumulation of human capital based on the calculation of integral indicators for groups of factors and resulting indicators. Since the selected components include indicators with different names, it is necessary to bring them to a comparable form using the normalization procedure. Indicators that reflect the potential for human capital formation are characterized by different directions, for example, the tension coefficient is reversed, and a minimum value of this indicator is necessary for a more favorable situation in the region. This aspect was taken into account when normalizing the data:

- for stimulators of human capital accumulation;
- or for destimulation of human capital accumulation;

where  $\alpha$  - actual value of the normalized indicator,  $\beta$  - the maximum and minimum values of the indicator in all of the analyzed regions.

Table 2: Example of normalized data of the intensity coefficient for the regions of the Central Chernozem macroregion, for 2018

Region / year	2010	2011	2012	2013	2014	2015	2016	2017	2018
Belgorod region	0,87	1	1	1	1	1	1	1	1
Voronezh region	1	0,65	0,64	1	0,89	0,81	1	0,62	0,87
Kursk region	0	0,13	0	0	0	0	0	0	0
Lipetsk region	0,022	0	0,04	0,23	0,24	0,19	0,21	0,35	0,32
Tambov region	0,24	0,17	0,11	0,33	0,5	0,5	0,48	0,49	0,32

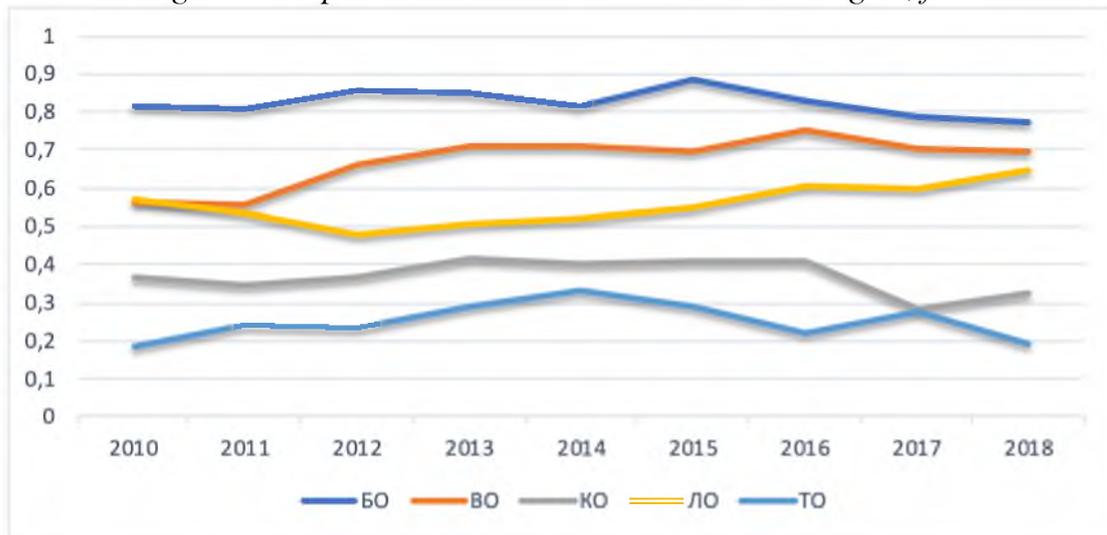
Other indicators were normalized in the same way. Further, for the purpose of a comprehensive assessment of the criteria, the aggregate value for each group of factors was determined using the formula. When determining an integral estimate for a group of factors, it is assumed that all indicators are equal. The calculated integral indicators are shown in table 3.

*Table 3: Integrated assessment of human capital accumulation in the Central Chernozem macro-region for 2018*

Region / Integral indicator for a group of factors	Integral indicator 1	Integral indicator 2	Integral indicator 3
Belgorod region	1	0,5411053	0,77238202
Voronezh region	0,5846623	0,81778034	0,68458998
Kursk region	0,34268667	0,37891425	0,25834202
Lipetsk region	0,73509004	0,35019533	0,8573918
Tambov region	0,14772727	0,32609983	0,10708523

The dynamics of the combined integral indicator for the study period is clearly shown in figure 2.

*Figure 2: Dynamics of changes in the integral indicator of factors for attracting and accumulating human capital in the Central Chernozem macro-region, for 2010-2018*



As can be seen in the figure, regions develop heterogeneously, with a high degree of differentiation in terms of human capital assessment criteria. Therefore, for a qualitative analysis of the conditions for the formation and accumulation of human capital, it is necessary to combine regions into groups based on common factors. Next, the study involves conducting a cluster analysis. Since the virtual clustering process allows you to develop typical (basic) strategies addressed to relatively homogeneous subjects of the Russian Federation (Petrikina et al., 2016). We use the data from table 3 to implement the procedure for cluster analysis of the regions of the Central Chernozem macroregion by factors of attracting and accumulating human capital. Clusterization was performed in the SPSS Statistics program using the k-means method. Based on the cluster analysis, 3 groups of regions with similar indicators of attracting and accumulating human capital were identified. The selection of such a number of groups was confirmed by the criteria of significance. As can be seen from table 4, the inter-group variance in all cases exceeded the intra-group variance, and the table value of the Fischer f-distribution is less than the calculated values.

*Table 4: Criteria for the significance of clustering regions of the Central Chernozem macroregion by factors of attracting and accumulating human capital in 2018*

Integral indicator	The between-group variance	Intra-group variance	F-Fisher criterion
II 1	0,194	0,027	7,172
II 2	0,074	0,01	7,591
II 3	0,214	0,008	28,384

The results of clustering of the regions of the Central Chernozem macroregion are presented in table 5.

*Table 5: Central values of normalized indicators of attracting and accumulating human capital by clusters of the Central Chernozem macroregion for 2018*

Integral indicator	Clusters			The average for the Central black earth macro-region
	Voronezh region	Belgorod and Lipetsk regions	Kursk and Tambov regions	
II 1	0,68	0,81	0,18	0,536
II 2	0,82	0,45	0,35	0,484
II3	0,58	0,87	0,25	0,562

To determine the strengths and weaknesses of a particular cluster, it is necessary to compare the values of integral indicators calculated for the cluster and indicators calculated on average for the Central Chernozem macroregion. The cluster's strengths will be those indicators that exceed the calculated average for the macroregion, and vice versa. Thus, it is easy to see that the regions of the first cluster have favorable conditions due to the action of natural and mechanical factors, while mechanical factors and the socio – economic level of development of the region affect the attraction of human capital to a greater extent. The regions of the second cluster form human capital through the action of mechanical factors and by ensuring a high standard of living for the population. The regions of the third cluster have a weak potential for the accumulation of human capital. The distribution of strengths and weaknesses for each cluster is shown in table 6.

*Table following on the next page*

*Table 6: Strengths and weaknesses of clusters of regions of the Central Chernozem macroregion by the level of human capital accumulation*

Cluster	Regions	Strengths	Weaknesses
Cluster 1 – "Regions with an above-average level of human capital accumulation»	Voronezh region	High life expectancy; low level of tension in the labor market, high migration growth, high scientific potential, growth of the industrial production index, high indicators of investment in fixed assets, a developed health and education system	Low efficiency of use of fixed assets; reduced labor productivity, low innovative activity of enterprises.
Cluster 2 - "Regions with an average level of human capital accumulation»	Belgorod, Lipetsk region	High life expectancy, high level of housing security, high average salary, efficient use of fixed assets	Reduction in the number of enterprises, low level of mechanical population growth, low number of students in educational institutions, tension in the labor market, high incidence of diseases
Cluster 3 - "Regions with a low level of human capital accumulation»	Kursk, Tambov region		Low level of socio economic development, low level of housing security, high mortality rate, negative migration growth, low life expectancy, poorly developed health care system, low employment rate, low number of students in educational institutions

Systematization of the "strengths" and "weaknesses" of these clusters allows us to move on to setting strategic goals for the development of human capital. Note the fact that the first cluster includes only one area of the macroregion – Voronezh. in this regard, it is necessary to develop proposals that would contribute to the development of the region's strengths and improve indicators that characterize the region's weaknesses:

- 1) increased supply in the labor market due to the influx of migrants;
- 2) provision of personnel with basic means of production;
- 3) improving the efficiency of using scientific potential;
- 4) increasing the scale of regional production;
- 5) increasing the innovative activity of enterprises by increasing the share of high-tech production.

Given the composition of the "strengths" and "weaknesses" of cluster 2, the goals of the strategy for the formation and accumulation of human capital should be:

- 1) maintaining a high life expectancy through the development of social policy in the region;
- 2) improving the quality of the education and health system;
- 3) creation of additional jobs in the labor market;
- 4) development of scientific potential;
- 5) assistance in the development of enterprises, including high-tech ones;
- 6) formation of favorable living conditions for migrants in the region.

The regions of the third cluster - Kursk and Tambov regions are characterized by unfavorable conditions for the formation and accumulation of human capital, as evidenced by the low indicators of the selected groups of factors compared to the average in the Central Chernozem macro – region. In this regard we should focus on such tasks as:

- 1) increasing the level of socio-economic development;
- 2) increasing the birth rate;
- 3) reducing mortality;
- 4) ensuring sustainable growth in life expectancy;
- 5) improving the quality and level of the education system;
- 6) active development of the healthcare system;
- 7) increasing the level of employment;
- 8) creation and development of high-performance enterprises;
- 9) improving the level and quality of life;
- 10) development of productive capacity.

### 3. CONCLUSION

In general, it can be noted that the "problem zone" of formation and accumulation for most regions remains high mortality in comparison with the birth rate, high morbidity in the regions against the background of a poorly developed health system. In addition, the decrease in the number of enterprises causes tension in the labor market and reduces the scale of regional production. In most of the regions under review, there is a decrease in the number of students and the number of staff engaged in research and development, as well as the level of provision of staff with fixed assets. The presence of "problem zones" negatively affects the resulting indicators of regional development: it reduces labor productivity, the efficiency of using fixed assets and the share of high-tech products. Thus, we will focus on the most significant points that characterize the updated needs for the formation of human capital in the regions of the macroregion under study:

- 1) It is necessary to implement institutional restructuring of the system of higher and secondary special education, including such tasks as: integration of software resources of the educational institutions (through various forms) with the enterprises of real sector of economy; introduction of the dual education system (training in educational institutions and in the workplace).
- 2) Creating new "points" of economic growth that involve the unoccupied population in the economy and pool resources to ensure a high level of diversity of organizational forms in which these "points" are formed and developed.
- 3) In addition, we believe that it is necessary to modernize the health system, developing result-oriented medical institutions and ensuring the availability of high-tech medical care to residents of the region, as well as to ensure the safety of the population's living conditions, including their work. The implementation of this direction will contribute to improving the health of the population and the accumulation of human capital in the region.

So, based on a comprehensive assessment of the size of the human capital of the regions of the Central Chernozem macroregion, based on the analysis of factors, summary indicators were formed that allow us to assess the current state of territories, combine them into clusters, and identify problem areas that hinder the socio-economic development of subjects in terms of the formation and use of human capital. The developed method is universal and allows not only to assess the current level of human capital, grouping them, but also to manage the selected factors for its formation and accumulation.

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