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Impact assessment of investments in education on the development of human capital and its influence on the economic growth

The study of the social role of higher education and its «contribution» to economic growth led to the conclusion that it is generated by expanding the amount of used labor and capital resources, as well as by improving their quality based on advances in technology and education. As a result, nowadays considerable attention has been paid to the study of human capital as the primary lever of economic growth. It is shown that the main indicator determining the potential of industries development and the region as a whole is a gross regional product (GRP), which characterizes the potential of the regional economy. The choice of factors for assessing and building of forecast models of GRP leads to the activation of regional and national policies and to the decline of the level of interregional imbalances. The relevance of the study of methods of estimating GRP and methods for its prediction is determined. The interrelation of the level of GRP from a number of statistical indicators characterizing the development of the region development, particularly education was revealed. The novelty of the research is the construction of the correlation-regression dependence of GRP on education costs, assessment of the significance and closeness of the connection of factors, identification of the applicability of the model for predicting GRP. Statistically significant regression equation is obtained that adequately describes the effect of costs on the level of GRP. The forecasting of the level of the GRP will allow planning the volumes and distributing the appropriate financial flows in order to increase the level of regional socio-economic development.

Keywords: human capital, economic growth, gross regional product, education costs, correlation and regression model.

As an investment in human capital we can consider the costs that improve the quality and characteristics of a person related to its performance. Since current expenses are incurred with the expectation that they will be offset by an increased flow of income in future periods. Investments in human capital are, first of all, investments in education and vocational training, which are specialized type of activity in the formation of knowledge, skills and abilities.

But the problem of human capital management in enterprises lies in the fact that traditionally their leading resource and element was considered technical capital - equipment, which in turn was determined by some technological structure, production communications, organizational aspects of production processes, engineering solutions, etc. This is often found in the investment policy of enterprises. Many Kazakhstani managers are still in the framework of the old paradigm of economic thinking. They do not consider the cost of human development as a way to increase the assets of the company. A too narrow understanding of human capital management is expressed by the fact that in many enterprises there is no «knowledge management». Meanwhile, the majority of researchers and specialists in this field believe that the process of knowledge management is an integral part of both the general strategy of the enterprise development and the increase of its capital. The concept of knowledge management appeared relatively recently. And by managing knowledge managers can manage the cost and profitability of human capital. In other words, knowledge management is aimed at maximizing the potential of the organization's personnel and identifying unused reserves.

The concept of human capital appeared in the publications of the second half of the twentieth century in the works of American economists Theodor Schultz [1] and Gary Becker [2]. For the creation of the foundations of the theory of human capital they were awarded the Nobel Prize in Economics: Theodore Schultz in 1979, Gary Becker in 1992. After that the gradual increase of human capital research was observed. An important idea was the statement about the growing role of knowledge in the process of formation of the modern labor force. In his work Becker noted that investments in education, training of specialists and in health care are correlated with investments of companies in new equipment. Investments in human capital were defined as the sum of monetary expenses for education and under-received income during the course of study. Becker showed the profitability of such investments both for an individual and for society as a whole.

Discussing a low-key attitude towards such investments on the part of the employer, who believed that while he paid for the public good to the detriment of his interests, Becker showed that the special training of the employee contributes to the growth of «catchable» profits.

There are many different definitions of human capital. The most common are determined as knowledge, abilities, health, skills that are formed by a person as a result of investments in themselves. They lead to an increase in employee skills, which contributes to an increase in the quality of work and thereby leads to an increase in human well-being.

It seems appropriate to divide the set of characteristics that form the structure of human capital into several components. For example, K.A. Ustinova [3] identifies common components of human capital, published in most scientific papers on this topic, and specific, found in the works of some authors (Table 1).

Table 1

Human capital components

Components found in most definitions of human capital	Components found in some definitions of human capital
abilities general and special knowledge and skills professional experience and work experience health status culture level motivation	family characteristics features of socialization creative skills the degree of inclusion in the corporate culture migration psychological, worldview characteristics possession of unique technologies spiritual component investments income investments in search and recruitment

Note. Used source [3].

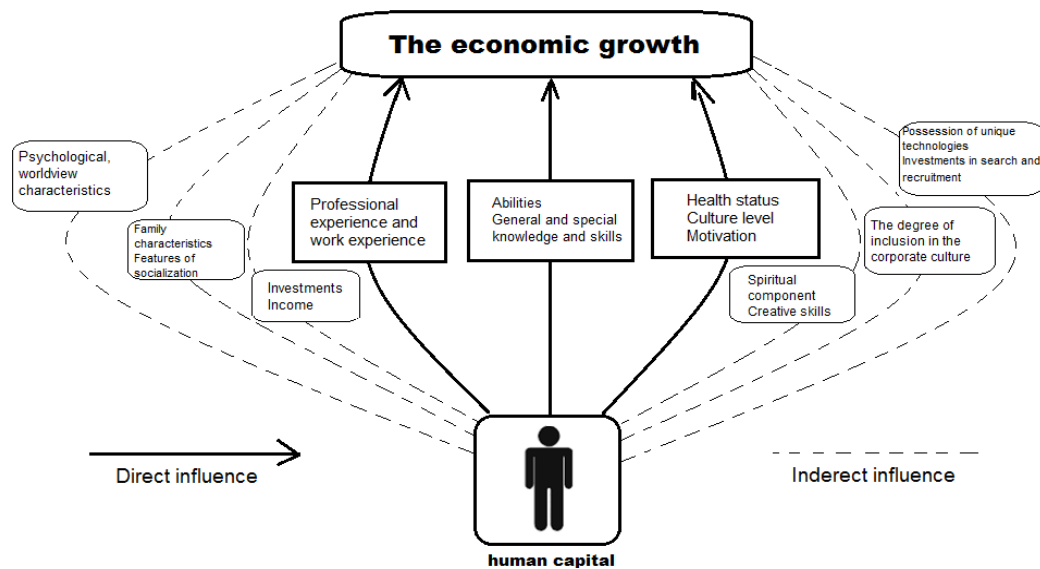


Figure 1. Direct and indirect influence of human capital on economic growth

On the basis of the above table, it is possible to make a drawing with direct and indirect influence of the qualitative characteristics of human capital on economic development (Fig. 1).

Education is one of the key components of human capital. Investments in education are the most important for raising the level and quality of human capital. Investment in education is a main, most widespread and deeply studied area of investment in human capital. According to UNESCO, 60 % of the difference in people's income comes from a different level of education, and 40 % from all other factors (health, natural abilities, social origin) [4].

Human capital is a basis of many phenomena stimulating economic growth. Typical estimates suggest that one percent increase in human capital results in an acceleration of per capita (GDP) growth rates of 1–3 %.

In theory, there are at least three mechanisms by which education can influence economic growth. First, education increases the amount of human capital imprisoned in the labor force. This increases productivity and provides a transition to a higher equilibrium level of output. Secondly, education can increase the innovation potential of the economy, knowledge of new technologies, products and processes will contribute to growth. Third, education can contribute to the dissemination and transfer of knowledge necessary for understanding and processing new information. Also for the successful implementation of new technologies developed by others, which again accelerates economic growth [5].

From the point of view of a person, the economic effect of higher education is estimated by comparing the increase in income derived from the increase in the level of education and the cost of education.

On the part of society, the effectiveness of the education system is reflected in reducing social tensions, unemployment, poverty, antisocial behavior, crime, in increasing social mobility, raising the cultural level of the population, and increasing the social responsibility of citizens.

From the standpoint of the economy, the effectiveness of the functioning of the higher education system is expressed in the growth of labor productivity, GDP and GRP, in increasing the competitiveness of the national or regional economy.

Education improves labor productivity, which provides an increase in employed income and growth of GRP/GDP. Studies conducted in the USA in the mid-1980s showed that an increase in one-year labor force training could lead to a 2 % of additional GDP growth [6].

In the realities of the Kazakh economy, stable economic growth is a pressing issue for all regions of Kazakhstan without exception. GRP is considered to be a key indicator assessing regional economic development. It is the growth of GRP that indicates the economic growth taking place in the region.

The dynamics of changes in the gross regional product of Akmola region in 2010–2017 is presented in Figure 2. It can be concluded that there is a steady increase in the gross regional product. In 2017, the region's GRP amounted to 1,518 million tenge in Akmola region and 5,617 million tenge in the city of Astana [7].

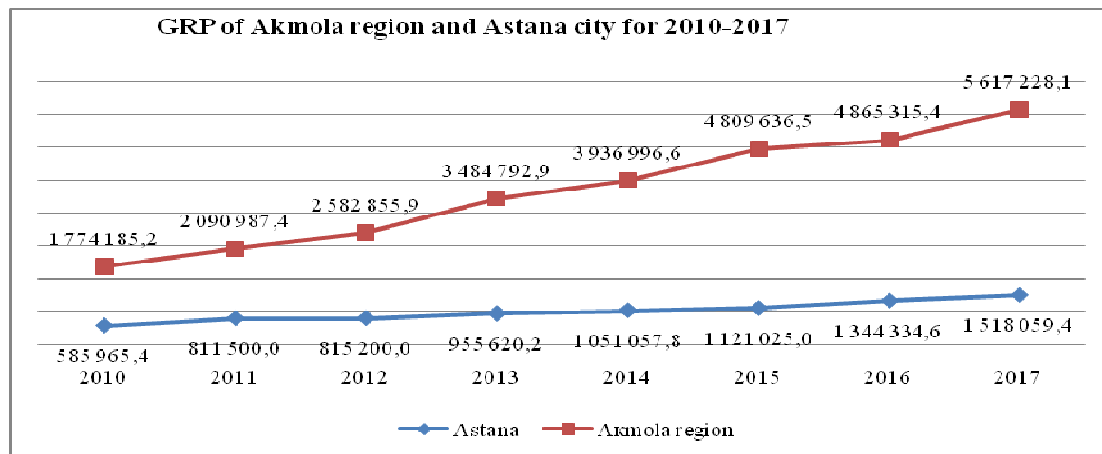


Figure 2. Dynamics of the gross regional product of the Akmola region and the city of Astana for 2010–2017

It can be concluded that there is a positive trend in the total volume of the regional product in Akmola region. It can also be noted that despite the different levels of funding between the region and the city, the level of GRP in the two sites varies directly parallel to each other.

Structural analysis of added gross value indicates that the most developed key sectors of the regional economy are: agriculture (16 %), manufacturing (15 %), trade (13 %) and real estate (12 %). The share of education in the context of branches of the region was 4.13 % or 46.48 billion tenge.

The cost of education in the republic in 2017 amounted to 1813 million tenge, where the share of expenses in Akmola region was 3.9 %, which is 3 times less than the cost in Astana. The large share of investment in education in the capital is occupied by higher professional education — KZT 71299 thousand per capita. This is due to the high cost of educational services in the city of Astana (Table 2).

Dynamics of expenses for education in Akmola region and Astana city for 2009–2017

Indicators	2009	2010	2011	2012	2013	2014	2015	2016	2017
Expenses for education of the Republic of Kazakhstan, thousand tenge	644 431 881	756 639 098	948 451 387	1 103 875 304	1 156 367 964	1 279 558 981	1 352 067 285	1 657 249 678	1 813 414 703
Education costs in Akmola region, thousand tenge	27 821 115	33 922 353	41 952 722	45 865 045	50 958 340	55 999 889	51 802 748	66 844 916	69 978 352
Education costs in Astana city, thousand tenge	34 710 303	43 522 369	56 470 562	100 074 071	89 812 815	113 049 418	123 710 346	162 481 313	199 017 229
Costs of secondary professional education per capita in Akmola region, thousand tenge	4843	6225	7037	9235	9502	18577	10617	12542	13586
Costs of secondary professional education per capita in Astana, thousand tenge	5 950	7 432	7 874	9 221	9 097	9 003	9 065	10 488	11 134
Costs of higher professional education per capita in Akmola region, thousand tenge	4725	5365	6653	8336	7985	11421	6088	6609	7036
Costs higher professional education per capita in Astana, thousand tenge	21229	22250	26790	50476	52866	56233	57270	66980	71299
The share of education costs in Akmola region, %	4,3	4,5	4,4	4,2	4,4	4,4	3,8	4,0	3,9
The proportion of the cost of education in Astana city, %	5,4	5,8	6,0	9,1	7,8	8,8	9,1	9,8	11,0

In Akmola region the cost of secondary and higher education per capita is slightly different from each other, while in the capital, the cost of higher education is dozens of times higher than the average. The dynamics of education costs in Akmola region and Astana city for 2008–2017 is shown in Figure 3.

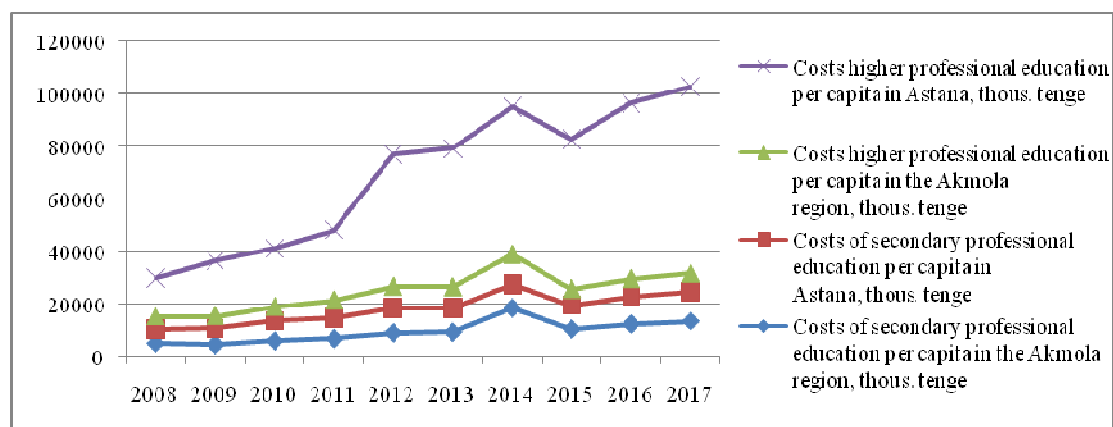


Figure 3. Dynamics of expenses for education in Akmola region and Astana city for 2008–2017

Forecasting of the GRP provides an opportunity to plan financial flows into the economy of the region, both state budget and local budget. The methods of mathematical modeling and, in particular, the correlation-regression analysis allow to take into account the mutual influence of various factors of the socio-economic development of the region. In this study, based on the statistics committee data, the dependency of GRP of Akmola region on the cost of education was established. Mathematical modeling allows you to confirm or refute this relationship and further predict the level of GRP, as well as plan the use of financial flows generated by the GRP to the budget of Akmola region.

In order to study the impact of the volume of expenditures on education on the GRP per capita of the employed population of the Akmola region, a matrix of pair correlation coefficients was built (Table 3).

Table 3

Assessment of the influence of factors on the GRP of Akmola region

INDICATORS	The cost of secondary professional education per capita	The cost of higher professional education per capita
Domestic regional product per capita	0,6	0,6

Analyzing the results of calculations, it can be argued that the amount of expenditure on education has a less significant effect on the gross regional product, as evidenced by the coefficient of pair correlation between the defined indicators, equal to 0.6. Nevertheless, the correlation coefficients are positive values, which indicate the presence of a positive correlation connection between the gross regional product and the volume of expenses for secondary and higher professional education. The relationship that exists between random variables of a different nature, for example, between the value of GRP and the value of costs, is not necessarily the result of a direct dependence of one quantity on another (the so-called functional relationship). In some cases, both values depend on a whole set of different factors common to both values, as a result of which regularities are related to each other. When the relationship between random variables is detected using statistics, we cannot claim that we have discovered the reason for the changes in the parameters we only saw two interrelated effects.

By the number of factors acting on a variable relationships are classified into simple (one-factor) and multifactorial, when a variable is affected by two signs or more. One-factor relationships are usually called paired. For example, the relationship between GRP and the cost of higher professional education (HPE) or secondary professional education (SPE). In the case of a multi-factor relationship, it is assumed that a variable is influenced by many factors. For example, the link between GRP and total education costs in general.

When constructing one-factor multiplicative model, it was established that the correlation is equal to 0.8, the calculation of the coefficient of determination, which is $R^2 = 0.6$. This coefficient shows how much the variance of GRP is due to the influence of factors included in the equation. Accordingly, 60 % of changes in GRP are determined by changes in explanatory variables, i.e. costs of secondary and higher vocational education. It should be noted that these factors enter the equation with a plus sign, which indicates a directly proportional relationship. For example, an increase in education funding will lead to an increase in GRP. To determine the quantitative growth, the values of partial elasticity coefficients were estimated, which show how much percent varies on average, depending on the growth by 1000 tenge of one of the x - factors. In this study, an increase in education costs by 1000 tenge leads to an increase in GRP by 1 % and, conversely, in the case of a decrease.

According to the multiplicative single-factor model, we obtain the following equation:

$$y = 44,62x^{1,186},$$

where y — GRP; x — the cost of professional education (Fig. 4).

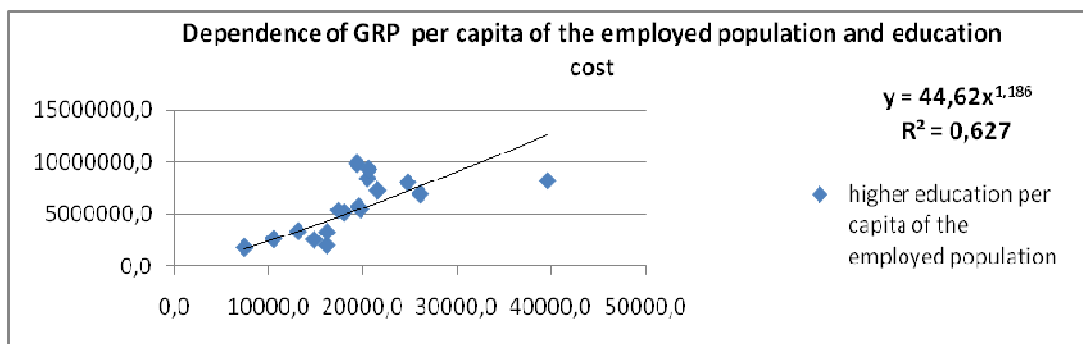


Figure 4. The dependence of the GRP per capita of the employed population and the cost of education using a single-factor multiplicative model

The equation of the multifactor multiplicative model is:

$$y = 71,38 * x_1^{0,54} * x_2^{0,6}$$

where y — GRP; x1 — the cost of secondary professional education; x2 — the cost of higher professional education (Fig. 5).

In order to assess the quality of the constructed regression, the following characteristics were analyzed:

- the coefficient of determination (R2) is 0.7, the value compared to the single-factor model is close enough to 1, therefore, the quality of the constructed regression can be considered quite high;
- Fisher coefficient, equal to 16.37, exceeds the table value, which suggests that the regression equation constructed is statistically significant and this equation can be used to analyze and predict the gross regional product and the relationship of statistical indicators;
- T-statistics for investment is 3.3, therefore, the cost of education is a statistically significant factor.

Regression statistics								
Multiple R	0,84							
R-square	0,70							
Normalized R-square	0,657778744							
Standard error	0,323449484							
Observations	17							
Dispersive analysis								
Regression	df	SS	MS	F	Significance - F			
	2	3,426644355	1,713322178	16,3766894	0,00021588			
Remainder	14	1,464673959	0,104619568					
Total	16	4,891318314						
	Coefficients	Standard error	t - statistics	P - Value	Bottom 95%	Top 95%	Bottom 95%	Top 95%
ln b0	4,27	1,96	2,18	0,05	0,07	8,46	0,07	8,46
ln x1	0,54	0,21	2,63	0,02	0,10	0,98	0,10	0,98
ln x2	0,69	0,21	3,30	0,01	0,24	1,14	0,24	1,14
b0	71,38							

Figure 5. Regression analysis data

Overall, an increase in the cost of higher professional education by 1000 tenge leads to an increase in the GRP by 0.5 % and an increase in the financing of secondary vocational education by 1000 tenge increases the level of the regional GRP by 0.6 %. In the case of a decrease, the GRP refuses to the appropriate level the use of the above models can be used to predict the volume of the gross regional product of the region. In our case, an increase in funding in education by 10 % will lead to an increase in GRP by more than 1 billion tenge.

As a result of the construction of various models for determining the relationship between the volume of GRP and education costs, different results were obtained. As a result, it can be argued that the multiplicative multifactorial model is more preferable than the single-factor one. All this allows us to conclude that the constructed regression equation, estimating the quantitative relationship of the gross regional product, the

amount of education costs and the number of people employed in Akmola region, is of high quality and is statistically significant, which allows it to be used to predict the gross regional product.

Human capital can be increased in the process of education, training, gaining work experience. The time and money required for education and training can be considered as an investment in human capital. Such investments will be economically feasible only if they bring return, will pay off, that is, if the education or training received will provide a high level of income. Labor resources can be transformed into capital, but for this it is necessary to create conditions that provide an opportunity to realize the human potential in the results of the organization activities. In other words, if a person is engaged in social production, and labor resources bring real income and create wealth, then they can be called capital. The efficiency of business development and the state's economy largely depends on various factors, for example, the amount of funds that are spent on the development of human capital, as well as the timeliness of the direction of these funds. This type of investment brings significant in terms of volume, a long-term and integral economic-social effect by its nature, therefore it is the most beneficial from the point of view of a person, an enterprise and the whole society.

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Білімді жоғарылатуға бағытталған қаржыландырудың адам капиталының өсуіне және экономикалық дамуына тигізетін ықпалын бағалау

Жоғары білімнің әлеуметтік ролін және оның экономикалық өсімге «қосқан үлесін» зерттеу еңбек және капитал ресурстарының көлемін ұлғайту, сондай-ақ технология мен білім берудегі жетістіктерге негізделген сапасын жақсарту арқылы жасалады. Осыған байланысты соңғы кездерде адами капитал экономикалық өсудің өзегі ретінде қарастырылып, оның аясында зерттеулер көлемі ұлғаюда. Өңірдің және аймақтардың даму әлеуетін анықтайтын негізгі көрсеткіш жалпы өңірлік өнім (ЖӨӨ) болып табылады. ЖӨӨ болжамды модельдерін бағалау және қалыптастыру үшін факторларды таңдау аймақтық және ұлттық саясатты белсендіруге және аймақаралық теңсіздіктің деңгейін төмендетуге әкеледі. ЖӨӨ бағалау әдістемесі және оны болжау әдістерін зерттеудің өзектілігі анықталды. Білім беруді сипаттайтын бірқатар статистикалық көрсеткіштер мен ЖӨӨ деңгейі арасындағы өзара байланыс анықталды. Зерттеудің жаңалығы ЖӨӨ-нің білім беру шығындарына корреляциялық-регрессиялық тәуелділігін құру, факторлардың маңыздылығы мен байланысын бағалау, ЖӨӨ болжау моделінің қолданымдылығын анықтау болып табылады. Шығындардың ЖӨӨ деңгейіне әсерін сипаттайтын статистикалық маңызды регрессиялық тендеу алынды. ЖӨӨ деңгейін болжау аймақтың әлеуметтік-экономикалық даму деңгейін арттыру үшін қаржы көлемдерін жоспарлауға мүмкіндік береді.

Кілт сөздер: адам капиталы, экономикалық даму, жалпы аймақтық өнім, білім беру шығындары, корреляция және регрессиялық модель.

А.А. Булашева, Т.А. Кусяинов

Оценка влияния инвестиций в образование на развитие человеческого капитала и его воздействие на экономический рост

Изучение социальной роли высшего образования и его «вклада» в экономический рост позволило сделать вывод о том, что последний порождается расширением объема использованных трудовых и капитальных ресурсов, а также улучшением их качества на базе прогресса в области технологий и образования. В связи с этим в последнее время значительное внимание стало уделяться изучению человеческого капитала как первостепенного рычага экономического роста. Основным показателем, определяющим потенциал развития отраслей и региона в целом, является валовой региональный продукт (ВРП), характеризующий потенциал экономики региона. Выбор факторов для оценки и построения прогнозных моделей ВРП приводит к активизации региональной и национальной политики и снижению уровня межрегиональных диспропорций. Определена актуальность исследования методов оценки ВРП и способов его прогнозирования. Выявлена взаимосвязь уровня ВРП от ряда статистических показателей, характеризующих развитие региона, в частности, образования. Новизной исследования является построение корреляционно-регрессионной зависимости ВРП от затрат на образование, оценка значимости и тесноты связи факторов, выявление применимости модели для прогнозирования ВРП. Получено статистически значимое уравнение регрессии, адекватно описывающее влияние затрат на уровень ВРП. Проводимое прогнозирование уровня ВРП позволит спланировать объемы и распределить соответствующие финансовые потоки для повышения уровня регионального социально-экономического развития.

Ключевые слова: человеческий капитал, экономическое развитие, валовой региональный продукт, затраты на образование, корреляционно-регрессионная модель.

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