Supplementary Notebook (RTEP - Brazilian academic journal, ISSN 2316-1493)

METHODOLOGICAL APPROACH FOR FORMATION OF HUMAN CAPITAL IN INNOVATIVE CONDITIONS

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Abstract: The article provides an assessment and empirical analysis of the impact of human capital on the incomes of the population of the European and Asian regions of the Russian Federation. It shows a significant influence of the human capital of workers with higher education on incomes and wages in each of the selected groups of regions and, almost complete absence of influence on the income of the population of the human capital of workers without higher education. Moreover, the positive impact on the payroll of this category of workers remains in the European part for all years of the period under review but is absent for income in 2011-2013.

Keywords: human capital, human resources, agriculture, income of the population, education.

INTRODUCTION

One of the most important problems of the modern economy is to achieve economic growth, the most important task of which is to improve the standard of living of the population living in Russia. It should be noted that the period of long-term economic reforms had an extremely negative impact on all aspects of the state's socio-economic policy. Significant differentiation of incomes of the population, low quality of social infrastructure, insufficient financing of agriculture - all this leads to the fact that often young, qualified and promising young people prefer to choose an urban area as their permanent place of residence.

Further increases in agricultural production must be carried out with all productive resources such as land, labor and capital. Currently, wages are formed under the influence of institutional and geographical factors: quality of life, educational level of the population, individual abilities of workers (22; 19; 11). In turn, the relationship between these factors in a planned and market economy is fundamentally different.

LITERATURE REVIEW

The concept of human capital is inextricably linked with such a definition as "human capital". Turning to history, one can trace the long evolution of this concept, which originates from the emergence of such a definition as "labor force". The most famous foreign economists' researchers in this area are G. Becker and T. Schultz (3). Their research is related to the development of the theory of human capital, which dates to the middle of the 20th century (23). Domestic research in this area is inextricably linked with such famous names as (4, 26, 5, 1; 3; 7; 10, 20; 8). The listed scientists became famous due to the development and improvement of methods for measuring human capital at the micro level.

METHODOLOGY

The subject of the research is the economic relations arising between the population and the leading stakeholders in agriculture. The methodological basis is the works of domestic and foreign economists, materials of all-Russian and international conferences, monographs, statistical material presented by state statistics bodies. The research was carried out using statistical, monographic, graphic methods, as well as using the method of deduction and induction.

RESULTS

For several decades, domestic and foreign literature has been discussing the impact of human capital on labor productivity and incomes of the population of different countries and regions; empirical assessments of the impact of education on income differentiation and growth rates in different countries are often given. It has already become generally accepted to consider human capital as the main driver of economic growth, because it increases the efficiency of investments in fixed assets, the total productivity of production factors, promotes scientific and technological progress and the diffusion of knowledge and technologies (9; 12; 15; 25; 6; 24).

The value of the human capital and research index (a component of the Global Innovation Index) of Russia is growing, its position in the ranking of the countries of the world is constantly improving. Now our country is among the top thirty. In terms of higher education, the trend in Russia has been positive since 2015. Meanwhile, the level of human capital accumulation in Russian regions with a large share of agriculture in the sectoral structure is lower than in territories where there are many high-tech industries. Many scientists consider the level of education as the main characteristic of human capital, which determines the economic and innovative development of regions (13; 17, 18). The authors of the article carried out an analysis of the provision of the agricultural industry with specialists, which confirms the fact that the industry is experiencing serious personnel problems, which greatly affect the final financial results.

Table 1– Composition and structure of the provision of the agricultural sector of the Novosibirsk region with specialists, people

Categories of workers	Have professional training / education						Do not have specialized education		Need	% provision
	higher education		secondary education		Total with specialized education					
	quantity	%	quantity	%	quantity	%	quantity	%		
Specialists, total (except the main ones)	913	32,9	1158	41,7	2071	74,7	703	25,3	257	91,5
Agronomists of all specialties (including deputy chief specialists)	79	69,9	24	21,2	103	91,2	10	8,8	12	90,4
Animal technicians of all specialties, incl. breeders, pedigree technicians, pedigree breeders (including deputy chief specialists)	71	48,0	49	33,1	120	81,1	28	18,9	20	88,1
Veterinarians,	85	25,0	165	48,5	250	73,5	90	26,5	51	87,0
Herd reproduction specialists (including insemination technicians)	8	3,7	84	38,7	92	42,4	125	57,6	39	84,8
Engineers and technicians of all specialties	104	38,5	100	37,0	204	75,6	66	24,4	15	94,7

(mechanics, technologists, etc., except for builders, hydraulic engineers, power engineers, electricians)										
Power engineers and electricians	67	27,0	111	44,8	178	71,8	70	28,2	18	93,2
Reclamation engineers and hydraulic technicians	0	0,0	1	100,0	1	100,0	0	0,0	3	25,0
Economists of all specialties, incl. deputy chief specialists	69	71,6	2	26,9	66	98,5	1	1,5	2	97,1
Accountants of all specialties, incl. deputy chief specialists	997	37,7	65	48,6	804	86,3	128	13,7	65	93,5
Environmental specialists (ecologists)	8	100,0	3	0,0	5	100,0	0	0,0	3	62,5
Other workers in specialist positions	462	21,9	29	35,3	248	57,3	185	42,7	29	93,7

The analysis showed that the average level of provision of the agricultural sector with specialists stopped at 91.5%. This indicator, over the past few decades, had an unstable dynamic, and in 2015 it was - 68%. On the face of it, there are positive changes in the improvement of the personnel situation, but if you look at the age composition of employees, there is a professional aging of employees, which has an extremely negative effect on the ability to master digital technologies and platforms (Table 2) (12)

Table 2 - Age structure of workers in the agricultural sector of the Novosibirsk region

Categories of workers	Total employees	Up to 30 years		Over 55		Total (up to 30, + over 55)	
		quantity	%	quantity	%	quantity	%
Specialists, total	**2774**	**308**	**11**	**246**	**9**	**554**	**20**
Agronomists of all specialties (including deputy chief specialists)	113	18	16	10	9	28	25
Animal technicians of all specialties, incl. breeders, pedigree technicians, pedigree breeders (including deputy chief specialists)	148	29	20	12	8	41	28
Veterinarians, veterinarians,	340	58	17	14	4	72	21

veterinarians, veterinarians							
Herd reproduction specialists (including insemination technicians)	217	11	5	10	5	21	10
Engineers and technicians of all specialties (mechanics, technologists, etc., except for builders, hydraulic engineers, power engineers, electricians)	270	39	14	20	7	59	22
Power engineers and electricians	248	19	8	13	5	32	13
Reclamation engineers and hydraulic technicians	1	0	0	1	100	1	100
Economists of all specialties, incl. deputy chief specialists	67	11	16	2	3	13	19

As for the provision of the agricultural sector with the main specialists, the situation here is somewhat worse. According to official statistics provided by the Ministry of Agriculture of the Novosibirsk Region, the average provision of agricultural enterprises with chief specialists is 81.4%.

Table 3 - Composition and structure of the provision of the agricultural sector of the Novosibirsk region with chief specialists, people

Categories of workers	Have professional education						Do not have specialized education		Need	% provision
	высшее		среднее		Всего, имеющих профильное образование					
	quantity	%	quantity	%	quantity	%	quantity	%		
Chief specialists – total	**684**	**62,4**	**349**	**31,8**	**1033**	**94,3**	**63**	**5,7**	**251**	**81,4**
Chief agronomists	109	80,7	25	18,5	134	99,3	1	0,7	44	75,4
Main zootechnicians, incl. ch. Breeders	86	67,2	32	25,0	118	92,2	10	7,8	35	78,5
Chief Veterinarians	89	65,9	41	30,4	130	96,3	5	3,7	44	75,4
Chief engineers of all specialties (mechanics, technologists, heating engineers, etc., except for construction and hydraulic engineering, power engineers and electricians)	88	46,3	79	41,6	167	87,9	23	12,1	38	83,3
Chief power	39	39,8	42	42,9	81	82,7	17	17,	22	81,7

engineers and electricians								3		
Chief economists (heads of planning, economic departments)	78	77,2	23	22,8	101	100,0	0	0,0	44	69,7
Chief accountants (heads of accounting and financial departments, financial directors)	166	60,4	102	37,1	268	97,5	7	2,5	21	92,9
Other positions of chief specialists	29	85,3	5	14,7	34	100,0	0	0,0	3	91,9

An analysis of the age composition of chief specialists also shows that in the industry 14% are workers of retirement age, and 5% are workers under the age of 30. In total, the group of young specialists and chief specialists makes up 19% of the total number.

Table 4 - Age structure of the main specialists in the agricultural sector of the Novosibirsk region

Categories of workers	Total employees	Up to 30 years		Over 55		Total (up to 30, + over 55)	
		quantity	%	quantity	%	quantity	%
Chief specialists - total	**1096**	**58**	**5**	**153**	**14**	**211**	**19**
Chief agronomists	135	9	7	18	13	27	20
Main zootechnicians, incl. ch. breeders	128	9	7	14	11	23	18
Chief Veterinarians	135	8	6	11	8	19	14
Chief engineers of all specialties (mechanics, technologists, heating engineers, etc., except for construction and hydraulic engineering, power engineers and electricians)	190	10	5	26	14	36	19
Chief power engineers and electricians	98	3	3	9	9	12	12
Chief economists (heads of planning, economic departments)	101	8	8	15	15	23	23
Chief accountants (heads of accounting and financial departments, financial directors)	275	8	3	50	18	58	21
Other positions of chief specialists	34	3	9	10	29	13	38

Research shows that about 9% of workers are over 55 years old. This does not in the best way affect the production process of the industry. Since age-related absenteeism leads to a decrease in concentration, a slowdown in managerial decision-

making, as well as to a longer mastery of digital technologies. This paper examines the influence of the accumulated in the regions of the volumes of fixed and two types of human capital on the total income and wages of the population of the Russian regions. The difference from the previous works of the authors was the allocation of two categories of human capital: "fund for higher education" and "fund for the education of workers without higher education", measured by the number of years of study of the corresponding categories of workers. The authors use the extended Cobb-Douglas macroeconomic production function, which includes human capital as a factor of production:

$$Y_i = AK_i^{\alpha} H_{1i}^{\gamma} H_{2i}^{\delta}, \quad (1)$$

where A - coefficient characterizing the overall factor productivity;

Y_i - income (average monthly) of the entire population of the i-th region (or the wage fund of the population employed in the economy of the region);

K_i – fixed assets of the economy in the i-th region;

H_{1i} – human capital "fund of higher education" of workers in the i-th region (the total number of years of education of workers with higher education in the region);

H_{2i} – human capital "education fund for workers without higher education" for workers in the i-th region (the total number of years of education for workers without higher education in the region).

A similar approach was used by the authors of this work. Statistical information from the yearbooks "Regions of Russia: Socio-Economic Indicators" for the corresponding years (2011-2017) is used as the initial data. The methodology and approaches to dividing regions into European and Asian are described in more detail in the article “Comparative analysis of the return on human capital in European and Asian regions of Russia” (21) made according to the following formula:

$$H_{1i} = (4d_{1i} + 9d_{2i} + 11d_{3i} + 12d_{4i} + 13d_{5i} + 16d_{6i} + 19d_{7i})N_{1i}. \quad (2)$$

The calculation of the "education fund for workers without higher education" in the regions of Russia is made according to the following formula:

$$H_{1i} = (4d_{1i} + 9d_{2i} + 11d_{3i} + 12d_{4i} + 13d_{5i})N_{2i}, \quad (3)$$

where:

d_{1i} – the share of those employed with primary education in the total employed population in the i-th region (term of study is 4 years);

d_{2i} – the share of those employed with incomplete secondary education in the total employed population in the i-th region (duration of study is 9 years);

d_{3i} – the share of employed with complete secondary education in the total employed population in the i-th region (term of study 11 years);

d_{4i} – the share of those employed with primary vocational education in the total employed population in the i-th region (term of study 12 years);

d_{5i} – the share of employed persons with secondary vocational education in the total employed population in the i-th region (study period 13 years);

d_{6i} – the share of employed persons with higher professional education in the total number of employed population in the i-th region (study period 16 years);

d_{7i} – the share of those employed with postgraduate education in the total employed population in the i-th region (the term of study is 19 years);

N_{1i} – the number of people with higher education employed in the economy of the i-th region;

N_{2i} – the size of the population without higher education employed in the economy of the i-th region;

The durations of the terms of study were adopted by the authors on the basis of the previously existing or accepted today terms of study at a particular level of education, they are approximate and cannot significantly affect the accuracy of the calculations. The number of the employed population and its distribution by educational level, as well as the level of the average monthly nominal wage, are taken from the yearbooks "Regions of Russia: socio-economic indicators" for 2011-2017. Calculations are carried out using the regression equation (4).

$$\ln Y_i = \ln A + \alpha \ln K_i + \gamma \ln H_{1i} + \delta \ln H_{2i} + \varepsilon_i \qquad (4)$$

The results of calculations for this regression equation for the period from 2011 to 2017. are presented in table 2.

Table 5 - The relationship between the incomes of the population of the regions of the Russian Federation with fixed assets (PF) and human capital of two categories (FVO and FSHO) in European and Asian regions of the Russian Federation in 2011-2017

Indicators	Period for							
	European regions of the Russian Federation				Asian regions of the Russian Federation			
	2011	2013	2015	2017	2011	2013	2015	2017
Constant	7,273*** (0,422)	7,269*** (0,419)	7,426*** (0,404)	7,457*** (0,332)	7,728*** (0,343)	7,699*** (0,382)	7,809*** (0,459)	8,354*** (0,417)
α	0,241*** (0,082)	0,250*** (0,075)	0,205*** (0,068)	0,128** (0,058)	0,268*** (0,053)	0,290*** (0,055)	0,304*** (0,061)	0,216*** (0,052)
γ	0,693*** (0,110)	0,622*** (0,120)	0,489*** (0,121)	0,488*** (0,090)	0,492*** (0,155)	0,388** (0,172)	0,511** (0,198)	0,655*** (0,194)
δ	0,108 (0,139)	0,177 (0,142)	0,372*** (0,138)	0,475*** (0,117)	0,202 (0,155)	0,283 (0,177)	0,144 (0,203)	0,082 (0,180)
Determination coefficient	0,956	0,958	0,963	0,973	0,986	0,984	0,983	0,985
Fisher's criterion	358,3	382,9	438,3	606,33	489,7	444,2	401,54	450,5
Significance	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000
Number of regions	54	54	54	54	25	25	25	25

*** - 1% significance; ** - 5% significance; * - 10% significance.

All regression equations are statistically significant, the coefficients of determination are higher than 0.95, and Fisher's test is also quite high. The elasticity coefficients for fixed assets are relatively low (at the level of 0.12-0.3) and tend to decrease over time. They are noticeably higher (about one and a half times) in the Asian regions of Russia, that is, in the regions included in the Ural Federal District, the Siberian Federal District and the Far Eastern Federal District (0.21-0.30 in Asian regions versus 0.12-0.24 in European regions). The coefficient of income elasticity of the population for the higher education fund is quite high in both groups of regions and decreased from 0.69 in 2011 to 0.49 in 2017 for European regions and increased from 0.49 in 2011. to 0.65 in 2017 for the Asian group of regions (see Table 1). The coefficient of income elasticity of the population for the school education fund was statistically insignificant in the period 2011-2013. in the European part of the Russian Federation and is statistically insignificant for all years of the period under consideration (see Table 1). It can be concluded that workers without higher education are not in demand in the labor market and cannot have a significant impact on the income of the population in most regions of Russia.

Similar results are provided by the analysis of regression equations when used as the resulting indicator of the "wage fund" of the population of the regions (Table 3). In this case, the elasticity coefficients of the wage fund with respect to fixed assets turned out to be significantly higher; they turned out to be approximately the same for both groups of regions and turned out to be at the level from 0.36 to 0.51. Moreover, for the case of European regions, they show a downward trend, while in the Asian part of the Russian Federation, such a clear trend is not observed. The coefficient of elasticity of the wage fund with respect to the higher education fund tends to grow in both groups of regions. They are especially high in the Asian group of regions, they increased from 0.72 in 2011 to 0.96 in 2017. The coefficients of elasticity of the wage fund for the education fund of workers without higher education have a positive and statistically significant effect on wages in the European part regions. Although this influence is much less strong than that of fixed assets and higher education funds.

But it does not have any effect in the Asian regions, and in 2017 it even has a negative and statistically significant effect on the payroll in these regions (Table 3). This phenomenon can be attributed to significant volumes of shadow employment of relatively low-skilled workers. The employment of migrants, as well as seasonal workers, is often unofficial, unregistered, and, as a rule, is accompanied by the payment of wages and other incomes according to "gray" or even "black" schemes, which leads to distortions of statistical data. It is possible that shadow employment is more widespread in the regions of the Asian part of Russia than in the European part. It can be concluded that the human capital of workers with higher education has a decisive influence on the differentiation of incomes of the population of the regions of Russia. Therefore, it can be assumed that it is the development of the higher education system in the provincial regions of the Russian Federation and the increase in government spending on all types of education that will help equalize the income levels of the “rich” and “poor” regions. It is also possible that it is advisable to develop the system of secondary and primary vocational education in Russia, which may contribute to the growth of the positive influence of workers with a relatively low level of education on the incomes of the population as a whole.

Table 6 - Relationship between the wage fund of the population of the regions of the Russian Federation with fixed assets (OF) and human capital of two categories (FVO and FSHO) in the European and Asian regions of the Russian Federation in 2011-2018.

Indicators	Period for							
	European regions of the Russian Federation				Asian regions of the Russian Federation			
	2011	2013	2015	2017	2011	2013	2015	2017
Constant	4,885*** (0,281)	5,457*** (0,221)	5,560*** (0,261)	5,631*** (0,261)	9,449*** (0,418)	6,882*** (0,478)	7,084*** (0,612)	7,388*** (0,514)
α	0,509*** (0,055)	0,450*** (0,040)	0,415*** (0,044)	0,362*** (0,046)	0,459*** (0,064)	0,458*** (0,069)	0,456*** (0,081)	0,403*** (0,064)
γ	0,347*** (0,073)	0,420*** (0,063)	0,420*** (0,078)	0,484*** (0,071)	0,727*** (0,189)	0,575** (0,215)	0,743*** (0,264)	0,946*** (0,239)
δ	0,202** (0,093)	0,178** (0,075)	0,226** (0,089)	0,242** (0,092)	-0,296 (0,189)	-0,127 (0,222)	-0,301 (0,271)	-0,427* (0,222)
Determination coefficient	0,982	0,989	0,985	0,985	0,978	0,974	0,966	0,976
Fisher's criterion	892,0	1461,8	1132,1	1070,5	306,2	261,3	200,0	286,2
Significance	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000
Number of regions	54	54	54	54	25	25	25	25

*** - 1% значимость: ** - 5% значимость; * - 10% значимость

It can also be assumed that it is necessary to pay more attention to the protection of labor rights of relatively low-skilled workers, their official employment. This will help to increase payments of contributions to social funds and income tax on their "whitewashed" wages.

CONCLUSION

Thus, summing up, as a summary, it would be good to to focus on the fact that the agricultural industry is a strategic industry. The result of production activity largely depends on the qualifications and motivation of workers. And therefore, when developing programs to support low-skilled workers, it is worth paying special attention to increasing the income of workers, which ultimately will have a beneficial effect not only on the material well-being of the workers themselves and their families, but will also lead to an increase in macroeconomic indicators.

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