



The Russian labor market in the context of the digitalization

El mercado laboral ruso en el contexto de la digitalización

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ABSTRACT

To ensure the competitiveness of the Russian economy in the international arena, it is necessary to increase labor productivity. However, its indicators lag significantly behind similar indicators in economically developed countries. The necessary conditions for the growth of labor productivity in the regions of the country are the technological re-equipment and modernization of production, the development and implementation of modern advanced information technologies in all areas, the presence of a highly professional workforce with the necessary competencies in the context of the digitalization of the economy.

Keywords: cluster analysis, employment of the population, labor productivity, regression model.

RESUMEN

Para garantizar la competitividad de la economía rusa en el ámbito internacional, es necesario aumentar la productividad laboral. Sin embargo, sus indicadores están muy por detrás de indicadores similares en países económicamente desarrollados. Las condiciones necesarias para el crecimiento de la productividad laboral en las regiones del país son el reequipamiento tecnológico y la modernización de la producción, el desarrollo e implementación de modernas tecnologías de la información avanzadas en todas las áreas, la presencia de una fuerza laboral altamente profesional y con las competencias necesarias. en el contexto de la digitalización de la economía.

Palabras claves: análisis de conglomerados, empleo de la población, productividad laboral, modelo de regresión.

1. INTRODUCTION

In the context of the development of the digital economy in Russia, there are significant changes in the labor market and employment of the population. This is evidenced by numerous foreign (Frank, Roehrig, Pring, 2017; Ioannides, 2012; Brynjolfsson, McAfee, 2014) and domestic studies (Zaitsev, 2016; Idrisov et al., 2018). The problem of regulating employment and the labor market in modern conditions is the most relevant in the regional context, since a number of important socio-economic factors have a significant impact on the formation of the labor force, and the number of employees forms the demand for labor.

The digital transformation of the Russian economy has potential benefits associated with a significant increase in labor productivity for many sectors of the national economy (Akaev, Sadovnichy, 2021). According to experts, the current decline in economic activity (and employment) is due to the general macroeconomic situation - low economic growth rates, which, among other things, hinder the growth of labor productivity (Uzyakova, 2020; Mukhina, Sindyashkina, 2020). This is especially relevant in light of the need to achieve the targets of the national project "Labor Productivity and Employment Support" (Dolzhenkova, Polevaya, Kamneva, 2019).

2. METHODOLOGY

The analysis of existing trends in the labor market in the country was carried out using analytical indicators of the time series of the number of employed, unemployed and the main indicators of the effectiveness of their activities. The regional structure of employment and unemployment is considered.

Based on the method of cluster analysis using the SPSS software package, the constituent entities of the Russian Federation were grouped according to the main socio-economic indicators, which demonstrates the existing regional differentiation in the labor market. The gross regional product per capita was considered as regressors;

- ✓ employment rate of the population aged 15 and over;
- ✓ the proportion of the unemployed for 12 months or more in the total number of unemployed;
- ✓ the proportion of unemployed over 22 years old with secondary vocational and higher education in the total workforce;
- ✓ number of enterprises; the volume of investments in fixed assets per employee; the cost of fixed assets per employee;
- ✓ retail trade turnover per employee;
- ✓ industrial production index;
- ✓ the size of the average monthly accrued wages of employees; the coefficient of vitality of the population;
- ✓ life expectancy at birth; the level of innovative activity of organizations; the proportion of organizations using the Internet in the total number of surveyed organizations;
- ✓ the share of organizations using information and communication technologies in the total number of surveyed organizations;
- ✓ the number of personal computers per 100 employees, units;
- ✓ the proportion of organizations using special software in the total number of surveyed organizations;
- ✓ the amount of costs for the introduction and use of digital technologies per employee;
- ✓ the proportion of organizations using electronic document management systems from the total number of surveyed organizations;

✓ consumer price index.

As a result of the study, the constituent entities of the Russian Federation were divided into 4 clusters (CL₁-CL₄). To identify the relationship between the indicators under consideration, the method of correlation and regression analysis was applied.

The information base was compiled by data from the Federal State Statistics Service (Federal State Statistics Service) and the Central Bank of Russia.

3. RESULTS AND DISCUSSION

The number of employed in the Russian Federation in 2020 compared to 2010 increased by 667.7 thousand people. (by 0.95%), reaching according to the Federal State Statistics Service (Rosstat) 70601.4 thousand people. The employment rate, which characterizes the share of the employed in the total population of the country, took on different values during the period under consideration, amounting to 66.7% in 2020, according to Federal State Statistics Service (Fig. 1).

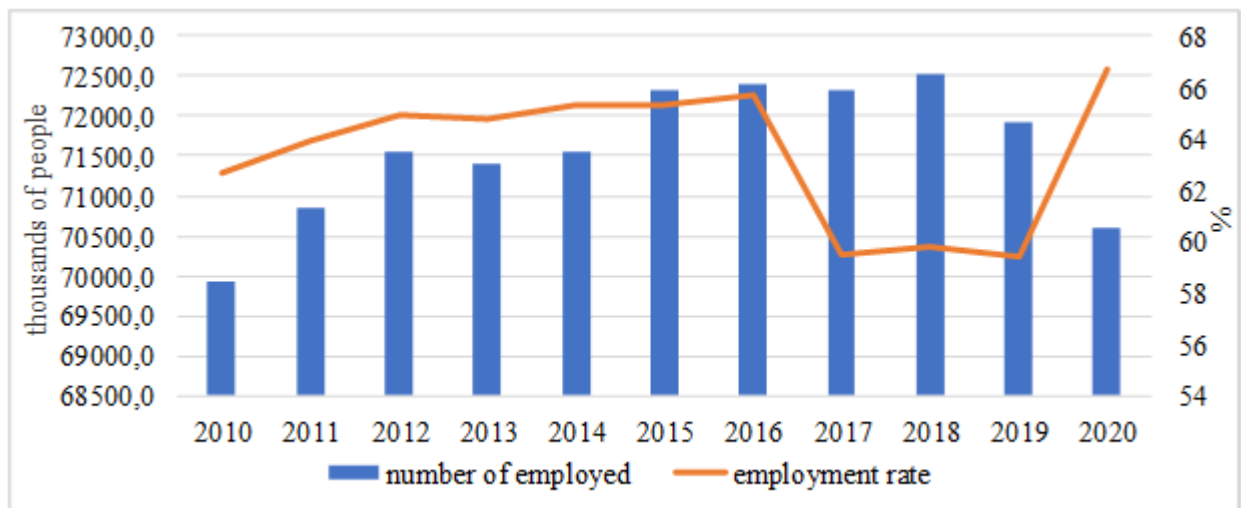


Figure 1. Dynamics of the number of employed and the level of employment in the Russian Federation in 2010-2020

It should be noted that due to the COVID-19 pandemic and the complication of the epidemiological situation in the country in 2020, the number of employed decreased by 1,331.7 thousand people. (by 1.85%).

In the federal districts of the country, there is a multidirectional dynamic of the number of employed. In the Central, Southern and North Caucasian Federal Districts, an increase in their number in 2020 compared to 2010 is noted. The level of employment of the population traditionally takes the lowest values in the North Caucasian Federal District, and the highest values are in the Central and Northwestern Federal Districts. In 2020, compared to 2010, there is a decrease in the employment rate of the population in all federal districts of the country (Table 1).

Table 1. Dynamics of the number of employed and the level of employment in the federal districts of the Russian Federation

Federal district	Employed, thousand people	Growth rate, %	Employment rate, %	Growth rate, %

	2010	2020		2010	2020	
Central	19716,3	20403,0	3,48	65,3	61,3	-6,13
Northwestern	7188,0	7064,9	-1,71	66,3	60,3	-9,05
Southern	6438,7	7662,9	19,01	59,7	56,2	-5,86
North Caucasian	3638,6	3889,1	6,88	53,2	51,1	-3,95
Privolzhsky	14664,5	13889,9	-5,28	62,7	57,4	-8,45
Ural	6005,1	5938,5	-1,11	63,4	59,7	-5,84
Siberian	8243,1	7795,8	-5,43	61,0	56,2	-7,87
Far Eastern	4039,4	3957,3	-2,03	62,3	60,2	-3,37

The most important indicator for assessing the efficiency of production and economic development of a country is social labor productivity, which is commonly understood as the volume of the Gross Domestic Product (GDP) per capita (per employee). In the regions of the country, there remains a significant differentiation in the volume of the gross domestic product (GRP) per capita. The leader in terms of this indicator is the Ural Federal District, in which the volume of GRP per capita is 4.6 times higher than the same indicator of the North Caucasian Federal District, which ranks last in this segment, and is 28.0% more than the Central federal district (Fig. 2).

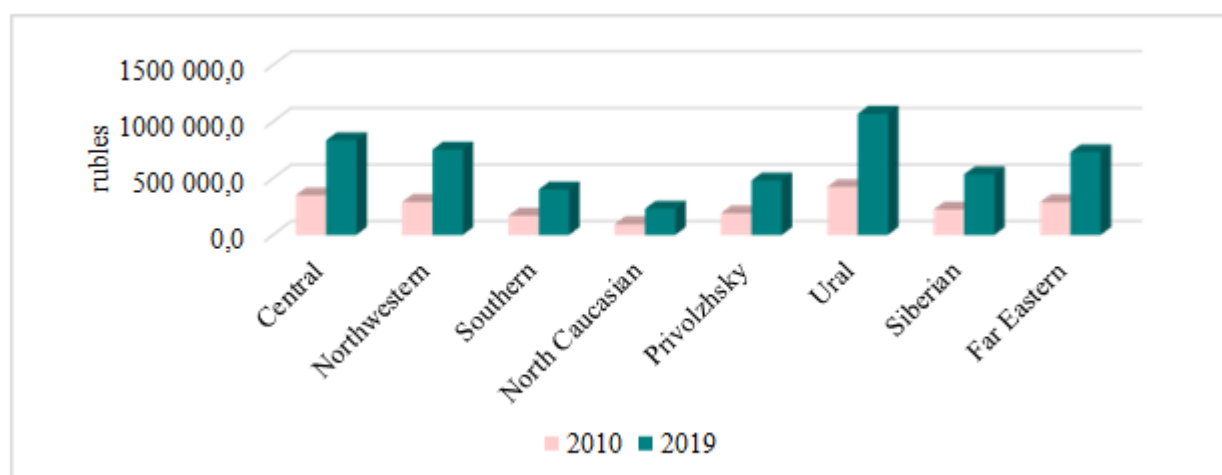


Figure 2. Gross regional product per capita in the federal districts of the Russian Federation in 2010 and 2019, rubles

An increase in labor productivity not only reduces production, but also increases the return on the labor resources used, which is especially important in conditions of a decrease in the number of employees. The changes taking place in the country in the context of the digitalization of the Russian economy necessitate the study of the main trends in the labor market in the constituent entities of the Russian Federation.

The division of the country's regions into groups according to the main socio-economic indicators makes it possible to identify common and regular features for groups of regions. For the grouping of the constituent entities of the Russian Federation, a system of indicators has been formed, which, in our opinion, objectively reflects the economic and social processes taking place in our country

x_1 – Gross regional product per capita, thousand rubles;

x_2 – employment rate of the population aged 15 and over, %;

- x_3 – the proportion of the unemployed for 12 months or more in the total number of unemployed, %;
- x_4 – the proportion of unemployed over 22 years old with secondary vocational and higher education in the total labor force, %;
- x_5 – number of enterprises, units;
- x_6 – the volume of investments in fixed assets per employee, thousand rubles;
- x_7 – the cost of fixed assets per employee, thousand rubles;
- x_8 – retail trade turnover per employee, thousand rubles;
- x_9 – industrial production index, %;
- x_{10} – the size of the average monthly accrued wages of employees, rubles;
- x_{11} – population vitality rate, %;
- x_{12} – life expectancy at birth, years;
- x_{13} – the level of innovative activity of organizations, %;
- x_{14} – the share of organizations using the Internet in the total number of surveyed organizations, %;
- x_{15} – the share of organizations using information and communication technologies in the total number of surveyed organizations, %;
- x_{16} – number of personal computers per 100 employees, units;
- x_{17} the proportion of organizations using special software in the total number of surveyed organizations, %;
- x_{18} – the volume of costs for the implementation and use of digital technologies per employee, thousand rubles;
- x_{19} – the proportion of organizations using electronic document management systems from the total number of surveyed organizations, %;
- x_{20} – consumer price index, %.

According to experts, an increase in labor productivity is associated with investment and innovation activities and can be considered as one of the results of such activities. At the same time, the growth of labor efficiency is impossible without significant investments in the modernization of production, the introduction of innovative technologies and the latest technology. Therefore, the inclusion of indicators of the volume of investments in fixed assets and the cost of fixed assets per employee, in our opinion, is justified.

The division of the constituent entities of the Russian Federation into groups that have similar features and patterns in terms of the main socio-economic indicators is based on the application of the k-means method

using the Euclidean metric. This method is based on the determination of the centers of the clusters and further grouping of all objects under study within the threshold value specified from the center.

The cluster analysis was carried out on the basis of data from the Federal State Statistics Service (Federal State Statistics Service) using the SPSS software package. According to data for 2019, the study was carried out in 82 constituent entities of the Russian Federation, because The following Nenets, Khanty-Mansi and Yamalo-Nenets autonomous districts, which are included in the larger administrative-territorial regions - Arkhangelsk and Tyumen regions, respectively, were excluded from the country's regions.

As a result of the study, the constituent entities of the Russian Federation were divided into 4 clusters. The first cluster (C_{11}) included 2 constituent entities of the Russian Federation - the Moscow region and the city of St. Petersburg. The second (most numerous) cluster (C_{12}) consisted of 65 regions of the country. The third cluster (C_{13}) includes 14 economically developed regions of the country, and the fourth cluster (C_{14}) consists of only one region - Moscow (Table 2).

Table 2. Grouping of constituent entities of the Russian Federation by main indicators in 2019

Cluster (CL)	Federal district	Subjects of the Russian Federation
CL ₁	Central	Region: Moscow
	Northwestern	City: Saint Petersburg
CL ₂	Central	Regions: Belgorod, Bryansk, Vladimir, Voronezh, Ivanovsk, Kaluga, Kostroma, Kursk, Lipetsk, Oryol, Ryazan, Smolensk, Tambov, Tverskaya, Tula, Yaroslavl
	Northwestern	Republics: Karelia, Komi
		Regions: Arkhangelsk, Vologda, Kaliningrad, Leningrad, Murmansk, Novgorod, Pskov
	Southern	Republics: Adygea, Kalmykia, Crimea
		Regions: Astrakhan, Volgograd
		City: Sevastopol
	North Caucasian	Republics: Dagestan, Ingushetia, Kabardino-Balkarian, Karachay-Cherkess, North Ossetia - Alania, Chechen
	Privolzhsky	Region: Stavropol
		Republics: Mari El, Mordovia, Udmurt, Chuvash
	Ural	Regions: Kirov, Orenburg, Penza, Saratov, Ulyanovsk
		Region: Kurgan
	Siberian	Republics: Altai, Tuva, Khakassia
		Territory: Altai
		Regions: Kemerovo, Omsk, Tomsk
Far Eastern	Republics: Buryatia, Sakha (Yakutia)	
	Regions: Transbaikal, Kamchatka, Khabarovsk	
	Regions: Amur, Magadan, Sakhalin	
	Autonomous District: Chukotka	
	Autonomous Region: Jewish	
CL ₃	Southern	Region: Krasnodar
		Region: Rostov
	Privolzhsky	Republics: Bashkortostan, Tatarstan
		Territory: Perm
	Ural	Areas: Nizhny Novgorod, Samara
Siberian	Regions: Sverdlovsk, Tyumen, Chelyabinsk	
		Region: Krasnoyarsk

		Areas: Irkutsk, Novosibirsk
	Far Eastern	Region: Primorsky
CL ₄	Central	Moscow city

Economic growth is critically dependent on an increase in labor productivity.

The national project "Increasing labor productivity and supporting employment" is a continuation of the priority project of the same name, which has been implemented since 2017, aimed at stimulating enterprises to increase labor productivity, removing unnecessary administrative and regulatory barriers and developing export potential.

Studies of the relationship between labor productivity, employment and the spatial effects affecting them are quite common in the EU countries, but they are rare in domestic works.

In large regions of the country, there is a concentration of employed people who, in search of a better job, seek to find a job in such regions. According to analysts, the localization of employment is closely related to average labor productivity.

To identify the relationship between the indicators under consideration, the method of correlation-regression analysis was used. The volume of the gross regional product (GRP) per capita (x_1) was chosen as an effective factor. Based on the calculated paired correlation coefficients between the indicators under consideration, it is possible to formulate a conclusion about the presence of a strong dependence of the effective indicator on the following factor indicators: the volume of investments in fixed assets per employee (x_6), the cost of fixed assets per employee (x_7) and the size average monthly accrued wages of employees (x_{10}), as well as moderate direct and weak direct dependence on the level of employment of the population aged 15 years and older (x_2) and on the volume of costs for the introduction and use of digital technologies per employee (x_{18}). The rest of the factors do not have a significant effect on the volume of GRP per capita, since the corresponding pair correlation coefficients do not exceed 0.35 (Table 3).

Table 3. Matrix of paired correlation coefficients of dependence

		Correlations					
		x_1	x_2	x_6	x_7	x_{10}	x_{18}
Pearson correlation	x_1	1,000	0,708	0,847	0,900	0,882	0,453
	x_2	0,708	1,000	0,553	0,549	0,761	0,371
	x_6	0,847	0,553	1,000	0,786	0,747	0,261
	x_7	0,882	0,549	0,786	1,000	0,720	0,428
	x_{10}	0,883	0,761	0,747	0,720	1,000	0,528
	x_{18}	0,453	0,371	0,261	0,428	0,528	1,000

Multiple correlation coefficient (R) characterizing the degree of influence on the effective indicator of the employment level of the population aged 15 years and over (x_2), the volume of investments in fixed assets per one employed (x_6), the cost of fixed assets per one employed (x_7), the size of the average monthly accrued wages of employees (x_{10}) and the volume of costs for the introduction and use of digital technologies per employee (x_{18}), indicates the presence of a strong direct relationship between the indicators under consideration ($R = 0.960$). The calculated coefficient of determination shows that the change in the volume of GRP per capita by 92.2% is due to the change in factors x_2 , x_6 , x_7 , x_{10} and x_{18} , and by 7.8% is due to the influence of other factors ($R^2 = 0.922$).

In the clusters, there are significant differences in the average values of the main indicators that affect the volume of GRP per capita (for the region of the fourth cluster, actual values were taken into account). The city of Moscow, which is part of the fourth cluster, has the highest values of such indicators as the employment rate of the population aged 15 years and older (x_2), the volume of investment in fixed assets per employee (x_6), the cost of fixed assets per one employed (x_7), the size of the average monthly accrued wages of employees (x_{10}) and the volume of costs for the introduction and use of digital technologies per employee (x_{18}). In the regions of the first cluster, which included the Moscow Region and St. Petersburg), there are high values of the employment rate of the population aged 15 years and older (x_2), the cost of fixed assets per employee (x_7), the size of the average monthly wages employees (x_{10}) and the volume of costs for the introduction and use of digital technologies per employee (x_{18}). The minimum values of the main indicators. Influencing the effective trait is observed in the regions of the second cluster (Table 4).

Table 4. Average values of the main indicators affecting the volume of the gross regional product per capita in clusters

Cluster	x_2	x_6	x_7	x_{10}	x_{18}
CL ₁	64,6	259,9	6394,2	60713,5	34,0
CL ₂	56,3	242,2	3766,1	39343,8	8,5
CL ₃	58,6	289,1	4919,8	42012,7	13,9
CL ₄	66,1	458,5	9823,3	94294,0	209,0

According to the data for 2019, the following regression model was obtained for all constituent entities of the Russian Federation:

$$\bar{y}_x = -650,238 + 7,460x_2 + 0,403x_6 + 0,068x_7 + 0,010x_{10} - 0,114x_{18}$$

(1,809) (3,192) (7,171) (5,330) (-0,153)

Under the values of the regression coefficients, in parentheses, the corresponding calculated values of the t-criterion are indicated, with the help of which the significance of the factors under study is assessed. The parameters of the obtained regression equation indicate its statistical adequacy and significance, since the hypothesis of the statistical significance of the equation is not rejected with a probability of 95.0% ($F_p = 176.400$). The variation in the volume of the Gross Regional Product per capita by 92.2% is explained by the indicators included in this model ($R^2 = 0.922$). Based on the obtained parameters of the multiple regression equation for the indicators for 2019, it can be concluded that with an increase in the employment level by 1.0%, the volume of GRP per capita will increase by 7.460 thousand rubles, with an increase in the volume of investments in fixed assets in per person employed and the cost of fixed assets per person employed per thousand rubles, it is expected that the gross regional product per capita will grow by 0.403 thousand rubles, respectively. and 0.068 thousand rubles. An increase in the average monthly accrued wages by 1 ruble will contribute to an increase in the performance indicator by 0.010 thousand rubles, and a decrease in the volume of costs for the introduction and use of digital technologies per employee per 1,000 rubles. will lead to a decrease in GRP per capita by 0.114 thousand rubles

5. CONCLUSION

As can be seen from the results of the study, in the conditions of digitalization of the Russian economy, such indicators as the proportion of organizations using the Internet in the total number of surveyed organizations (x_{14}); the proportion of organizations using information and communication technologies in the total number of surveyed organizations (x_{15}); the number of personal computers per 100 employees (x_{16}) and the proportion of organizations using special software in the total number of surveyed organizations (x_{17}) and the proportion of organizations using electronic document management systems

from the total number of surveyed organizations (x_{19}) do not affect the volume of GRP per employee, i.e. do not contribute to productivity growth.

Some experts fear that the introduction of information and communication technologies, automation equipment, industrial robots may lead to the spread of structural (technological) unemployment. But in the event that this situation arises, special importance, in our opinion, is acquiring the possibility of professional retraining of laid-off workers.

With the widespread penetration of digital technologies into all spheres of the economy and management, additional requirements are increasingly imposed on employees: along with high professional competence, there is also a good knowledge of digital technologies.

The main factors influencing the growth of labor productivity include the level and dynamics of technological development, the level and dynamics of wages, changes in the structure of the economy.

Medium-skilled jobs with average wages will be cut intensively; and employment will increasingly be concentrated in the most highly skilled and highly paid, as well as in the least skilled and lowest paid segments of the labor force.

The introduction of digital technologies will undoubtedly lead to a reduction in the number of employees in certain specialties. According to experts, the number of translators, journalists, financial analysts, screenwriters, tutors, bank employees, accountants, brokers, vehicle drivers and many other professions will significantly decrease in the next five to ten years.

However, it is expected that digital technologies will create many new jobs in such new professions as big data analytics, training and management of artificial intelligence (AI), development of intelligent computing technologies and software, training and management of intelligent robots.

According to most experts, the process of job polarization caused by information technology will accelerate with the beginning of widespread adoption of digital technologies. Thus, digital technologies will increase both unemployment and income inequality.

The upcoming automation using digital technologies will replace a maximum of 25-50% of routine and boring human work.

In most regions of Russia (except for the largest and fastest-growing agglomerations), automation processes are delayed, as there is cheap labor, there are restrictions on layoffs, technological backwardness, etc. This leads to an increase in the productivity gap between Russia and developed countries.

According to experts, in 2020, the emergency mass transfer of workers to remote employment revealed a number of problems and limitations in this area, related both to insufficient skills in the digital environment, and with cramped housing conditions and insufficient provision of families with computer equipment, which significantly hindered the organization of "offices at home".

Changes in the structure of employment also impose corresponding requirements for training, depending on the specialties and type of activity. Thus, the forecast shows that the main growth in the demand for personnel falls on specialists and skilled workers, while the demand of the industries under consideration for managers, service personnel and unskilled workers is relatively low.

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