Labor Market Modeling In The Regional Agro-Industrial Complex.

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ABSTRACT

The efficiency of the functioning of the regional agro-industrial complex is determined by the positive transformations of the social and labor sphere in rural areas, the improvement of the qualitative characteristics of the labor force, and the effective use of the labor potential in the region. A special role is played by the sustainability of the regional labor market, which is the main factor in the stability of socio-economic transformations in rural areas and an objective condition for the further development of agro-industrial production. The article substantiates a scientific approach to modeling and forecasting the rural labor market, taking into account the methodological provisions of V. A. Kotelnikov and the scientific developments of P. L. Chebyshev. This made it possible to apply for practical and theoretical substantiation of these scientists in relation to regional problems of employment and unemployment, including in relation to the agro-industrial complex and its social and labor sphere. As a result of the research, an approach to modeling the regional labor market has been proposed, the main provisions for its further development have been formulated, and trends in the distribution of labor for the future have been identified.

Keywords: modeling, forecasting, rural labor market, municipal areas, employment, unemployment, sustainable development of the region.

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INTRODUCTION

At present, the labor market in the Stavropol Territory is characterized by relative instability of its development. This was influenced by a certain decrease in the level and efficiency of using part of the material, financial and other elements of the resource potential of enterprises and organizations. If this trend continues in the near future, these factors may cause increased tension in the regional labor market, including a further exacerbation of the problems of rural employment and unemployment.

Under these conditions, the role and importance of operational monitoring of the main parameters of the labor market, among which such important components as labor demand, labor supply and distribution of labor resources, are growing. It is an adequate and timely assessment of trends in the development of labor processes and their forecast based on economic and mathematical modeling, which predetermines the efficiency of labor market management at the level of rural territories [2, 4, 8].

Currently, within the framework of methodological approaches to modeling and forecasting the social and labor sphere (including the labor market), the following methods are used: autoregression, correlation and regression models, direct and cascade extrapolation, as well as various expert assessment methods [1, 6, 7].

In addition, the models of V. Leontiev, R. Harrod, E. Domar, D. Robinson, Kaldor – Mirlis and other well-known scientists are considered and used for the scientific substantiation of the optimal balance between the ratio of supply and demand for labor. Each of these models has its advantages and disadvantages, characterized by specific features of the application.

Using the proposed methodology for modeling the labor market and the social and labor sphere in rural areas below will make it possible to more objectively assess the socio-economic situation, the direction and trends of changes in the basic parameters of the socio-economic system in the region.

MATERIALS AND METHODS

One of the most important conditions for ensuring sustainable development of rural areas is a balanced functioning of the regional labor market. It may be due to adequate modeling of work processes.

Studies show that time series representing stochasticity and uncertainty of processes in the labor market can be described by some continuous functions of time, since their values change quite smoothly, without sudden jumps and discontinuities. In other words, instead of continuous time dependencies, we have discrete values of functions, fixed at times Δt, $2\Delta t$, $3\Delta t$, … etc.

In the analyzed case, there is a situation where discrete signals are used in the transmission of messages, and the real signals are continuous. On the question of the possibility and uniqueness of the representation of continuous functions with the help of discretization, the theorem of V. A. Kotelnikov [3], which is one of the fundamental results of scientific research, unambiguously answers.

The theorem itself is formulated as follows: if the continuous signal U (t) has a limited spectrum and the highest frequency in the spectrum does not exceed f_b Hz, then the signal U (t) is completely determined by the sequence of its instantaneous values at discrete points in time, separated by no more than $1 / (2 f_b)$ seconds. Thus, f_b is the width of the signal spectrum.

Since in our case there are no restrictions on the number of measurement functions, it is possible to reliably satisfy the requirements of the Kotelnikov theorem, bearing in mind that in economic events time is measured not in seconds, but in years, and the cutoff frequency has a unit of measure (years)$^{-1}$.

The above theorem states that by the values of U (Δt), U ($2\Delta t$), U ($3\Delta t$), ... it is possible to determine the exact value of the function U (t) for any given time t between the moments of reference in accordance with model (1).

$$U(t) = 2f_b \cdot \Delta t \cdot \sum_{n=-\infty}^{\infty} u(n \cdot \Delta t) \frac{\sin \omega b(t - n \cdot \Delta t)}{\omega b(t - n \cdot \Delta t)}, \qquad (1)$$

where $0 < 2f_b\Delta t \leq 1$; $\omega_b = 2\pi f_b$; $u(n\Delta t)$; $n = \ldots -1, 0, 1, \ldots$ – samples of instantaneous values of the restored function U (t).

The series (1) has an infinite number of terms. Guided by the substantive formulation of the problem, which is of an economic nature, one can exclude from consideration in the given model the left half-plane and limit $0 \leq n < \infty$.

Exact equality in model (1) is achieved only when all terms are taken into account. If we restrict ourselves to a finite number of terms on the right-hand side, then their sum will give only an approximate value of the function U (t).

At the same time, real continuous dependences have spectra with a rather rapidly approaching zero amplitude with increasing frequency. Bearing in mind the accuracy of predictive calculations that is sufficient for an economic-mathematical modeling, the question of the limited spectra can be ignored. Choosing a discretization step Δt sufficiently small, a negligibly small value of the recovery error of a continuous signal from its samples at discrete instants of time can be provided. The working formula of Kotelnikov theorem, given the fairly stable dynamics of cyclical functions in the labor market, can be used for short- and medium-term forecasting.

Another method of modeling (method of approximation of extrapolated data), which allows to distribute the error most evenly over the entire interval, is the use of a linear combination of basis functions.

The latter can be orthogonal elements, for example, the P. L. Chebyshev polynomials [5], defined by models (2) and (3).

$$T_n(x) = 0,5((x + \sqrt{x^2 - 1})^n - (x + \sqrt{x^2 - 1})^n) = \cos(n \cdot \arccos x) \qquad (2)$$

$$T_{n+1}(x) = 2x \cdot T_n(x) - T_{n-1}(x), \quad n = 1,2,\ldots, \quad (3)$$

where n – degree of polynomial; x – independent variable, $1 \leq x \leq 1$.

Since the approximation segment considered in our problems |a, b| differs from the standard one, then to bring it to the last one, you can use the change of variable by the formula (4).

$$T = (a + b)/2 + (b - a)/2x, \quad -1 \leq x \leq 1 \qquad (4)$$

For the existing data set {t_i, y_i}, i = 0 … m, the discrepancy at this point is determined as (5).

$$r_i = \sum_{i=1}^{n} C_j \cdot T_j(x_i) - y_i \qquad (5)$$

Next, a system of linear algebraic equations is formed to determine the coefficients of the decomposition C_J by the formula (6).

$$\sum_{j=1}^{n} (\sum_{i=1}^{m} T_j(x_i) \cdot T_k(x_i)) C_j = \sum_{i=1}^{m} y_i \cdot T(x_i), \quad k = 1\ldots n \qquad (6)$$

The approximation techniques considered in this study, as shown by the experience of calculations, should be considered equally effective in relation to the tasks to be done in forecasting the main parameters of the regional socio-economic system, including the cyclical factor of labor processes. Their use makes it

possible to more effectively manage the conjuncture processes in the labor market and promptly regulate business and production activities in the regional agro-industrial complex.

RESULTS AND DISCUSSION

The problem of providing employment for the able-bodied population always occupies a dominant position in the socio-economic policy of municipalities in the region. In this regard, the issues of scientific substantiation of modeling and predictive calculations for the further development and effective use of labor are of particular importance.

As the conducted studies have shown, in the near future the growth of labor supply will continue, which means that the possibilities for its quick employment will decrease, and the disparity between supply and demand for labor will increase.

This method of modeling socio-economic processes made it possible to calculate the forecast of the main parameters of the labor market in the region for the near future (Table 1).

Table 1: Forecast of the distribution of labor in the rural labor market in the region, thousands peoples

Indicators	2018	2019	2020
Will be looking for work	94,3	95,1	97,4
including: independently	72,4	72,7	74,2
through the employment service	21,9	22,4	23,2
Find a job:	38,2	39,5	40,2
by myself	27,7	26,8	25,1
through the employment service	10,5	12,7	15,1
Number of unemployed	8,9	8,7	8,7
Employed in public works	1,5	1,5	1,4

Thus, one of the most important structural components of the rural labor market is the distribution of labor in specific areas of its application. It should be borne in mind that, both now and in the future, the staff will be employed mainly independently (including self-employment) and approximately 23-24% of their number will seek employment assistance from the district employment services.

The forecast of the number of these categories of workers in the future should be carried out, first of all, in accordance with the current trends in the areas of their actual employment and justification for the creation of new jobs in enterprises and farms with various forms of property, taking into account the need for replacement personnel for various reasons.

The number of self-employed workers should be predicted on the basis of a careful analysis of the lists of released personnel submitted by enterprises of the agro-industrial complex and the number of workers released and applied to the district employment services. In this case, you should be guided by the following:

- the number of released workers who are self-employed will not exceed 55–60% in the future; among the personnel changing jobs due to their turnover, about 70–75% of their number will be employed independently;
- the share of self-employed graduates of schools and graduates of educational institutions will be about 45%, and among graduates of various educational institutions who have not received distribution - almost 69%. Since retired servicemen rarely turn to district employment services, the share of their self-employment will reach 88%;
- from among the cadres who arrived in rural areas as migrants, as well as those not employed in production, at least three-quarters of them will be employed independently; self-employment of women leaving child care leave will not exceed 8–9%.

Modeling the distribution of labor in the rural labor market makes it possible to point out the following key points.

First, in the future, the total number of people who will seek employment both independently and by applying for help to employment service agencies will increase (an average of 3–6% over the forecast period). Secondly, the share of self-employed will tend to decrease and, accordingly, the role of the employment service will increase. Thirdly, the number of registered unemployed will slightly decrease, and the growth rate of their numbers will constantly slow down.

In order to mitigate unemployment and create conditions for increasing the employment of labor in the countryside, it is necessary: on the one hand, to increase the demand for labor resources by creating and maintaining jobs in the agro-industrial complex of the Stavropol Territory.

On the other hand, in order to regulate the excessive growth of labor supply, it is necessary to: reduce jobs at the expense of retirees; retraining of dismissed workers at the expense of the financial resources of the enterprises themselves, and not only budget funds; to establish migration quotas for entry into labor-intensive areas of the region; apply a marketing approach in monitoring and researching the rural labor market.

Studies show that all types of unemployment (and especially long-lasting for more than 1 year) have a negative impact on the social and economic development of rural areas and the region as a whole.

First, the most qualified rural cadres are exposed to unemployment, which account for more than half (51.7%), and in some areas - moreover: Aleksandrovsky - 59.3%, Petrovsky, Izobilnensky - 61-65%, in Stepnovsky - 73.8%.

Secondly, among the unemployed - the proportion of female labor resources is high (on average, 73.4%). In a third of the districts of the region their share is 75-80%; in Sovetsky, Izobilnensky, Shpakovsky districts - 81–85%.

Third, over the past 10 years, the proportion of young people in the total number of unemployed has practically not changed significantly and remains relatively high - more than 32%. This has a significant negative impact on the change in the social structure of labor resources in rural areas, which, in turn, does not always correspond to the interests of agro-industrial production.

Demographic damage from unemployment, as studies show, is confirmed by the fact that it negatively affects the birth rate of the rural population (the pair correlation coefficient: –0.486), the average life expectancy (–0.448) leads to an increase in the death rate (+0.506) and the divorce rate (+0.402).

In order to improve the efficiency of using labor in the labor market, we offer the implementation of the following measures in the short term:

- accelerate the formation of a sustainable employment system in the field of agro-tourism, recreational and environmental activities;
- to pay special attention to the priority development of branches of the agro-industrial complex, construction and trade in rural areas, which will increase employment in the countryside;
- to form a sustainable system of small and individual entrepreneurship at the level of regional and municipal labor markets;
- introduce municipal electronic databases on the problems of sustainable development of enterprises, as well as the balance of supply and demand on the labor market.

CONCLUSION

1. The effective functioning of the labor market is a consequence of the optimal coordination of the interests of employees and employers for its services, which ultimately contributes to the positive development and improvement of the human capital of any particular region. Under these conditions, particular importance is attached to modeling the basic parameters of the labor market, among which such important components as labor demand, labor supply and distribution

of its resources are distinguished. It is an adequate and timely assessment of the patterns and tendencies of the development of labor processes in the future that predetermines the efficiency of managing the conjuncture processes in the labor market.

2. In the process of modeling and forecasting, the following regularities are established. The main demand in the regional labor market will be: qualified managers, accountants, auditors and psychologists, specialists in social protection of the population, technologists, doctors. Among the working professions are drivers, equipment wizards, builders. In general, demand for 69% will be determined by the need for blue-collar occupations. The structure of labor supply in the context of municipal territories will be characterized by the following components: those laid off due to staff turnover - 7.4–8.2%, released from enterprises and organizations, as well as graduates of educational institutions - 9.1–10.4%, migrants - 3.6–4.8%, unemployed - 3.6–7.2%.

3. The justified methodology for modeling and forecasting the main characteristics of the labor market will allow, at the regional level, to more efficiently manage the employment process, the vocational training of unemployed persons and the performance of paid public works, and plan the necessary funds for unemployment benefits in a timely manner. In turn, this will lead to a positive process of rural development.

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