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Technique to Study the Employment Potential of the Region: Economic-Mathematical Aspect

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Abstract: Statement of an economic problem and its qualitative analysis demands the formulation of essence of a problem. For studying of labor potential it is necessary to allocate its major characteristics and properties of modelled object, to investigate its structure and interrelation of its elements. Creation of mathematical model is a stage of formalization of an economic problem of labor potential. At a stage of the mathematical analysis of model the general properties, properties of its decisions and their existence come to light. For preparation of initial information various mathematical methods are used. Carrying out calculations for model includes development of algorithms of the solution of a task, preparation of programs on the computer and computing procedures. At the last analysis stage of the received results and their applications, first of all, the major issue of correctness and completeness of results of modeling and their applicability both in practical activities and for model improvement is resolved. The various mathematical models used for studying of labor potential are presented in this article. Stages of process of creation of mathematical model of social and economic object as a whole and labor potential in particular are described. Mathematical methods and ways of their application for research of labor potential are considered.

Key words: Labor potential · Mathematical models · Computing procedures

INTRODUCTION

The process of constructing a mathematical model of social and economic facilities in general can be divided into six stages: formulation of the economic problem, the qualitative analysis, the construction of a mathematical model, the mathematical model analysis, preparation of the initial information, carrying out model calculations, analysis of the results and their application [1].

In the case where the developed model has a complete, reliable and accurate information, you can use statistical methods: factor, component analysis, cluster analysis, a method of time series analysis, correlation and regression analysis, etc.

Feature of the method of statistical modeling is that, by taking into account the random factors in the simulation, the results obtained with a single simulation of the process are considered as realizations of a random process. Since each of these implementations alone can not serve as an objective characteristic of the system being studied, the unknown quantities in the study of the statistical modeling method is usually determined by averaging the data of a large number of realizations. If this number of realizations N is large enough, the law of large numbers, the estimates become statistically stable (the order of the variance estimates is equal to 1 / N) and with sufficient accuracy for practical purposes can be taken as approximate values used values.

The method of statistical modeling allows detailed modeling of behavior by the environment in which the system operates and the process of the operation of the system to estimate the degree of adaptability of the system to perform its tasks under different conditions of work. The practical implementation of this method and largely determined by the capabilities to overcome a number of difficulties: the need to develop and debug the behavioral environment and the process of functioning of the system sufficiently rich to correct representation of the real process, the need of a large number of implementations of the model, so that the results acquired

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resistance statistical modeling and analysis can provide meaningful conclusions about the quality of the system on the whole set of combinations of external influences on the system, the need to bring the system to evaluate the performance of computers with high performance.

It should be borne in mind that statistical simulation method has a disadvantage due to the difficulty of establishing functional relationships between the numerical values of the parameters of the environment and the efficiency of the system. The results of evaluation of the effectiveness of the system using this method are private and characterize the performance of the system only in the situations for which the simulation was carried out.

In combination with statistical methods can be used simulation method. Simulation modeling is a tool for the design and study of complex economic processes and systems, in which large number of variables, time-consuming mathematical analysis of relationships, a high level of uncertainty of simulated situations.

Simulation modeling to combine mathematical methods with practical and theoretical experience of practitioners, which provides two types of actions performed by a computer work to create or modify the simulation model and operation of the simulation model and interpretation of results.

For models based on incomplete information, are developed in the last decade by means of data mining (data mining), such as the methods of reasoning by analogy, Bayesian methods, the method for finding logical patterns in the data set, neural networks, genetic algorithms, the search for associations and sequences, building a tree-making, etc. [2].

To model the uncertainty in the data, you can use the theory of fuzzy sets, allowing to formalize fuzzy or qualitative information in order to use it to quantify the construction of mathematical models.

The complex nature of the problem of modeling dependencies targets of socio-economic status of the region to support decision making in the management of key parameters, in particular the employment potential, requires a unified modeling techniques applicable studies of factor indicators and regional studies [3, 4].

The stages presented method [5]. In the first phase of the study stated goal, which is to achieve and to collect and process statistics. To study the working potential of the goal may be to build a set of tasks for the entire set of targets, or for individual indicators, which are analyzed. At the same stage the information base for the factor indicators. At the second stage, the analysis data base to determine the completeness and accuracy of information and is defined modeling tools: choose methods, adequate levels of certain information and software tools to implement these methods. In the third stage problem is solved at the qualitative and meaningful level. At the stage of qualitative analysis examines the structure of the data, recognize and deal with these contradictions and ambiguities in their descriptions, are overlapping symptoms, with the removal of one of them, building new features. In the fourth stage, the construction of multi-factor models of influence factor indicators allocated to the target sign. The fifth stage is devoted to the analysis and interpretation of the model target, the formation of the forecast for decision-making in the study area.

To assess the computational efficiency of the proposed mathematical models now there are a number of methods to optimize the dynamic properties of its own socio-economic systems. We present some comparative characteristics of the computational efficiency of the developed methods to optimize its own dynamic properties of economic systems to ensure static stability and an acceptable level of damping business cycles [6].

Simultaneous coordination and gradient method implemented the process of minimizing a functional and a method based on singular value decomposition of the matrix equations forecast allows direct control of the roots. In all cases, the main reason for the need to build an iterative process to optimize a complex nonlinear dependence of the roots of the characteristic equation of the system of variable parameters. The first method of the above requires a larger number of iterations and calculate the eigenvalues of the system. Therefore, the first method is always inferior to the last two, which have different performance characteristics in various design situations.

Gradient optimization method requires a large number of iterations due to a very small step size after the first 3-4 - iterations. The complicated process of optimization due to large gully minimized function quality. Method based on singular value decomposition provides a greater degree of stability increment by one iteration cycle optimization.

The advantage of direct control is the ability to implement controls, such election (modal), which is discussed below. This changes the attenuation of only one form of economic fluctuations at constant rest. The difference of this method from the classical modal

control is to implement it by adjusting the values of variable parameters of range of their changes for a given limited set of control signals.

There are various mathematical models used to study the working potential [6, 7].

By [7] points out that "a change of characteristic parameters of the labor potential is reflected, of course, the dynamics of the result of its use." The author offers economic-mathematical relationship between the volume of production and the major factor E, determine the magnitude of this production, with the characteristics of the main types of resources in the form pro-production function:

$$Y = A \times K^{\alpha} \times L^{\beta} \times M^{\gamma} \times R^{\mu} \times e^{rt} \quad (1)$$

where Y - GRP (gross regional product) and A - coefficient scale, K - capital assets; L - number of people employed in manufacturing and M - current assets (materials); R-the cost of education, including the retraining of workers; e - base of the natural logarithm; α - elasticity parameter GRP on fixed assets; β - elasticity parameter GRP employment; γ - parameter elastic GRP Revolving Fund; μ - GRP elasticity parameter for the costs of education; r - rate of autonomous technical progress (growth GRP growth through science and technology); t - time.

Method for determination of estimates presented in [7], consists of sequential computing the returns of productive resources. According to the production function (1) decomposes the change GRP components for the factors of production. Considering the contribution to the growth of GRP by NTP, as an integral part of the labor potential, the author gets the absolute efficiency of the labor potential of the formula:

$$\overline{\overline{\Delta Y}} = Y(\frac{\beta}{L}\Delta L + \frac{\mu}{R}\Delta R + \frac{r}{t}\Delta t) = A \times K^{\alpha} \times L^{\beta} \times M^{\gamma} \times R^{\mu} \times e^{rt}(\frac{\beta}{L}\Delta L + \frac{\mu}{R}\Delta R + \frac{r}{t}\Delta t)$$

In the calculation of the integrated assessment of economic growth by [7] takes into account that at one time the growth rate of production factors and the degree of influence on the final result are different and different direction. Let $\alpha = (\pi, \rho, m, n)$ - vector defining the direction of change in the net of the four factors of production, which are interpreted as follows: π - the growth rate of fixed assets at the beginning of the period of analysis; ρ - the growth rate of the number of employees at the beginning of the period; m - growth (decrease) of material at the beginning of the period; n - the growth rate of spending on education at the beginning of the analysis period.

Integrated indicator of the effectiveness of the labor potential is expressed by the following formula, which takes into account the contribution of the NTP in the region's economic growth:

$$\tilde{\Delta Y} = \frac{\partial Y}{\partial L} \times \frac{\rho}{|\alpha|} \times \Delta L + \frac{\partial Y}{\partial R} \times \frac{n}{|\alpha|} \times \Delta R = \frac{A}{|\alpha|} K^{\alpha} L^{\beta} M^{\delta} R^{\nu} (\rho\beta L^{-1}\Delta L + \mu\nu R^{-1}\Delta R) e^{rt}$$

Thus, for a more objective assessment of the contribution of labor to economic growth potential should use the integral contribution of employment and level of education of workers [9].

By [10] proposes to construct an integrated assessment of the labor potential of using multi-criteria optimization (or the theory of group selection.) Based on the assumption that given a set I = {1,... n} of attributes (parameters or experts), characterizing the employment potential of the subsystem is given partial criterion xi (or preference relation Pi) for each trait. Specified criteria allow to assess the selected features and compare them to different groups. The choice of indicators depends on the objectives of a specific research and information management capabilities.

To construct a generalized evaluation of the quality of the labor potential elements necessary to build a consolidated P preference for private preferences (PII = 1) or to construct a function of preference. To solve this problem, a system of indicators of the labor potential of the data subsystem and then allocated to each indicator criteria that compare to the selected parameters of different groups. The result is the construction of the integral criterion for the overall assessment of the labor potential.

The authors [11] suggest that the potential of society depends on the quality characteristics of the total labor force, defining the level of ability to work, to calculate the value of the labor potential in relation to the organization of the following formulas:

$$F_p = F_K - T_{NP}$$
$$F_p = V \bullet D \bullet T_{CM}$$

where F_P - total potential working time fund company, an hour.; F_K - calendar fund of working time, h. T_{NP} - total rezervoobrazuyuschie absence and breaks an hour. V - number of employees, people. D - the number of work days in the period; T_{CM} - hours of work, shift hours.

In general, the value of the labor potential of the company (the region), according to the findings of these authors, can be defined as

$$F_P = \sum_{i=1}^{m} V_i T_p$$

where F_P - potential working time fund company; V_i - population i-th group, able to participate in social production; m - the number of groups, T_P - the statutory amount of work in groups during the calendar period (year, quarter, month) [12].

As the authors of [11]: "... as the working potential includes all citizens are able to participate in social production, due to their physical features, existing knowledge and professional skills and qualification with normal intensity of labor, in the calculation should include all groups employees based on their characteristics. Since the structure of these groups is heterogeneous on possible participation in social production, to determine the correct size of the labor potential of the society need for each group of individuals lead to the base value. "

The value of the labor potential is defined as follows [11]:

$$Po = \frac{F_o}{t}$$

where F_o - a full calendar year, an hour. t - the estimated time of a worker's time.

CONCLUSIONS

Therefore, in view of the levels of certain information to construct a mathematical model of social and economic system of each of the studied parameters requires special modeling tools consisting of a set of mathematical and software [13]. This integrated approach should take into account the different characteristics of the aggregate labor potential: demographic, organizational-economic, sociological, psychological, etc. The mathematical model will measure the qualitative relationship between the factors that influence the formation, implementation and development of the labor potential of the region.

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