OPTIMUM DISTRIBUTION OF THE REGIONAL LABOR POTENTIAL IN ITS ECONOMIC SECTORS

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The economic-mathematical model allowing to distribute optimally the labor potential of a region is offered. The developed model is a linear programming task. It allows to distribute optimally the labor potential of a region using statistical data on its labor potential and economic indicators. The model parameters are the total investment per employee in the industry and the profit it brings to the industry. They are calculated according to the statistics provided by state statistics department of the region. The economic-mathematical model was tested with statistical data of the labor potential distribution in different economic sectors of the Stavropol Territory.

Keywords: labor potential, the region, the mathematical model, the effects matrix.

In this paper we propose economic-mathematical model of labor potential optimal distribution of the region by economic sectors, which has been tested on statistical data for the Stavropol Territory. Research on the formation and use of labor potential of the region can use various methods: economic, social, mathematical, etc., that allow to evaluate the effects of the labor potential for economic development and to justify the ways of managing them [3, 4].

In the region there is allocated *n* sectors of the economy, which we denote conditional *№ 1*, *№ 2*, ..., *№ n*. The region's economy may be in the *m* states: *1st*, ..., *m-e*. We denote q_{ij} as income, which brings one employee to the *i*-th economic sector of the region, if the economy will be in the *j*-th state, $i = 1, ..., n$; $j = 1, ..., m$. Matrix $\{q_{ij}\}$ is called effects matrix (in accordance with the common terminology). In addition, we denote by x_i - the number of employees at the *i*-th sector, *p* - the minimum income per employee of the region. Then the value of income, that one employee of the *i*-th sector will bring to the region, if its economy is in the *j*-th state, is $\sum_{i=1}^{n} q_{ij} s_i$.

The model, that allows to distribute optimally the labor potential by economic sectors, obviously, would be:

$$p \to \max, \tag{1}$$

$$q_j^T X \geq p, \quad j = 1,2,...,m, \tag{2}$$

$$I^T X = 1, \tag{3}$$

$$X \geq \bar{0}, \tag{4}$$

$$q_j = (q_{1j},\ q_{2j},\ ...,\ q_{nj})^T,\ I = (1,\ 1,\ ...,\ 1)^T,$$

$$X = (x_1,\ x_2,\ ...,\ x_n)^T,\ \bar{0} = (0,\ 0,\ ...,\ 0)^T,$$

where T - transpose operation.

Dividing the variables x_i, i = 1, ..., n, by p and denoting $s_i = \frac{x_i}{p}$, we go from the tasks (1) - (4) to the following linear programming task (which is more convenient to use in applied research than (1) - (4)):

$$\sum_{i=1}^{n} s_i \to \min, \tag{5}$$

$$\sum_{i=1}^{n} q_{ij} s_i \geq 1,\ j = 1,2,...,m, \tag{6}$$

$$s_i \geq 0, i = 1,...,m. \tag{7}$$

Note that the results of these research overlap with the results of the research set out in [1, 2].

We use the model (5) - (7) for the optimal distribution of labor potential of the Stavropol region on its economic sectors. According to [5] in the region there are the following economic sector (see Table 1.).

Table 1

Employed population distribution in the manufacturing process of the Stavropol region by economic activity in 2009

Number	Economic sectors	Th. of people
	Total employment in the economy	799,2
	including:	
1	Mining	4,1
2	Manufacturing	148,3
3	Production and distribution of electricity, gas and water	36,9
4	Building	87,3
5	Wholesale and retail trade; repair of motor vehicles, motorcycles, household goods	218,1
6	Hotels and restaurants	25,7
7	Transport and communication	93,6

8	Financial sector	13,4
9	Realty, renting and other services with real estate	54,8
10	Unemployed	117,0

Table 2 shows the costs of the Stavropol Territory employers for the labor resources in 2009 in the various economic sectors.

Table 2

Costs of the Stavropol Territory employers for the labor resources in 2009 (thousand rubles per employee per year)

Number	Economic sectors	Costs (thousand rubles)
	Total in considered sectors	2037,6
	including:	
1	Mining	246,5
2	Manufacturing	201,1
3	Production and distribution of electricity, gas and water	198, 5
4	Building	185,9
5	Wholesale and retail trade, repair of motor vehicles, motorcycles, household goods	162,3
6	Hotels and restaurants	103,8
7	Transport and communication	273,9
8	Financial sector	401,9
9	Realty, renting and other services with real estate	228,7
10	Unemployed	2,9

According to the data in Tables 1, 2 and the fact, that the cost per employee is 20% of the income that he brings to the sector in which he works, it is easy to calculate the value of p = 890142,9 rubles.

Effects matrix $\{q_{ij}\}$ is calculated depending on the economy state: "bad", "satisfactory", "good" (i = 1, ..., 10; j = 1, 2, 3)

$$\{q_{ij}\} = \begin{pmatrix} q_{11}\ q_{12}\ q_{13} \\ q_{21}\ q_{22}\ q_{23} \\ q_{31}\ q_{32}\ q_{33} \\ q_{41}\ q_{42}\ q_{43} \\ q_{51}\ q_{52}\ q_{53} \\ q_{61}\ q_{62}\ q_{63} \\ q_{71}\ q_{72}\ q_{73} \\ q_{81}\ q_{82}\ q_{83} \\ q_{91}\ q_{92}\ q_{93} \\ q_{101}\ q_{102}\ q_{103} \end{pmatrix} = \begin{pmatrix} 739505 & 1396842 & 4683530 \\ 603511 & 1139966 & 3822238 \\ 595487 & 1124808 & 3771416 \\ 557769 & 1053565 & 3532541 \\ 486803 & 919516 & 3083084 \\ 311461 & 588316 & 1972588 \\ 821858 & 1552399 & 5205103 \\ 1205834 & 2277687 & 7636951 \\ 686236 & 1296223 & 4346159 \\ -2900 & -2900 & -2900 \end{pmatrix}. \quad (8)$$

We find the solution of the task (5) - (7) with m = 3, n = 10, and the found matrix (8). We have: s_1 = 0,03; s_2 = 0,03; s_3 = 0,02; s_4 = 0,02; s_5 = 0,02; s_6=0,01; s_7 = 0,03; s_8 = 0,05 ; s_9 = 0,03; s_{10} = -0,00004. Since p = 890142,9 rubles., Then x_1 = 27295, x_2 = 22276, x_3 = 21979, x_4 = 20587, x_5 = 17968, x_6 = 11496, x_7 = 30335, x_8 = 44507, x_9 = 25329, x_{10} = 0 .

As a result, with a minimum income of 890,142.9 rubles per employee of the Stavropol Territory, it is necessary to plan the labor resources by economic sectors in accordance with the above values of x_i, i = 1, ..., 10 (note that such planning Unemployment in the region disappears, x_{10} = 0).

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