

Methodical Approaches to Determining the Labor Potential Quantity and Management

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Abstract—The article draw out theoretical and practical aspects of the formation and use of labor potential, compares different points of view on the definition of labor potential essence and gives an author’s definition of this concept. A method for calculating individual elements and labor potential as a whole based on calculating the total fund of working time is proposed. The result of using this method is shown on the example of the labor potential of pensioners in the Omsk region. The socio-economic consequences of changes in individual elements of the labor potential are analyzed, in particular in connection with the last increase of retirement age in Russia. The methods for managing employment and labor potential are systematized, the positive aspects and disadvantages of each method are determined.

Keywords—*labor potential, employment, elements of labor potential, total fund of working time, material and technical potential.*

I. INTRODUCTION

In modern conditions, the achievement of a high level of efficiency, innovative development of the economy is closely connected with improving the management of the country’s labor potential.

A significant factor affecting the dynamics of economic development in Russia in the coming years may be a significant decrease in the number of labor resources. Scientists-economists and practitioners are now coming to the unified conclusion that “the cessation of population growth in Russia, a decrease in the working-age population and its aging, an increase in the demographic burden on the able-bodied population will have an inhibitory effect on the economy development” [1]. This requires development of measures that can improve use of labor potential of the country and its individual regions. Meanwhile, while there is a significant discrepancy in determining the essence of labor potential, there are no scientifically based approaches to determining its value, which complicates the effective management of labor. Filling these gaps is the objective in this article.

II. LITERATURE REVIEW

The term labor potential was first used in 1970-1980, and often associated with it only with the working time fund of available labor resources. So, the scientific economists Sergeev G.P. and Chizhova L.S. gave such a definition of

labor potential. “Labor potential is the labor resources available to society. The number of the able-bodied population and its qualitative characteristics (gender, age, education, training, qualifications, etc.) determine the real value of labor potential” [2].

Another definition of labor potential close to the previous authors was given by Kostakov V, Popov A. In their opinion, “labor potential is labor resources considered in terms of the unity of their qualitative and quantitative sides” [3].

It is easy to see that in this definition the essence of labor potential is reduced to labor resources, although, as will be shown below, these concepts differ, and labor resources, even from the quantitative side and in essence, far from fully characterize labor potential. This approach can be called labor-resource.

Some time later, Professor Adamchuk V.V. gives the following definition of labor potential. “Labor potential is a resource category. It should include, in accordance with the definition of the concept of “potential”, sources, means, labor resources that can be used to solve a problem, achieve a specific goal, provide an opportunity for an individual, society, state in a certain area” [4].

The means of labor are included in the labor potential and the authors of the textbook “Economics and Labor Sociology”, Doctor of Economics, Professor R. G. Mumladze and G. N. Guzhina [5]. This approach can be called factorial.

A number of authors V.K. Vrublevsky, I.V. Korneychuk, and others characterize labor potential from the standpoint of possible results of labor activity (for example, output of GDP per unit of labor potential) [6-7]. According to Vrublevsky V.K. people not employed in social production are not taken into account when determining the value of labor potential. This approach can be called productive.

You can highlight the labor potential of an individual worker, team, region and society. In relation to the employee, in our opinion, such an interpretation of the labor potential should be given.

Labor potential is a combination of the psychophysiological, personal, qualification potential of an individual worker to solve production problems, able to improve in social activities and solve problems in the conditions of certainty and uncertainty of the external and

internal environment. If we touch on the quantitative side of labor potential, then we should take the labor time fund as an indicator of measuring the value of labor potential. Qualification characteristics, work experience, knowledge level, creative approach to labor activity will make up the qualitative side of labor potential. At the society level, we have formulated the following definition of labor potential. "Labor potential is the potential of the society (or its production, territorial unit) for the most efficient work in the country's national economy for the long-term perspective" [8].

III. RESEARCH METHODOLOGY

The methodology for calculating labor potential includes the following steps:

- Determination of the number of persons included in the calculation of labor potential.
- Choice of the unit of measurement of labor potential.
- Bringing the labor potential of different categories of workers to simple labor.
- Systematization of factors contributing to the increase and decrease in labor potential.
- Consideration of these factors in the prospective period.
- Calculation of labor potential.

The number of persons included in the labor potential is shown by us in further calculations.

The choice of the unit of measurement of labor potential is important. A number of authors propose measuring labor potential in person-years, i.e. in fact, labor potential approaches the concept of labor resources. "Working time is the living being of labor," noted K. Marx, "indifferent to its form, content, individuality, it is a living quantitative being of labor and at the same time an immanent measure of this being" [9].

In our opinion, labor potential should be measured in man-hours. But here it immediately attracts attention that the labor potential of an employee or a group of persons with higher education differs significantly from the labor potential of people engaged in simple labor. Therefore, in our study, labor potential is measured in man-hours of simple labor. The transfer of complex labor to simple was carried out at a ratio equal to the ratio of the number of years (for education, plus the length of practical work) required to occupy this position to the same number of years of simple labor. On this basis, the potential labor time fund (PLTF) of workers of different categories was calculated. A potential working time fund is a calendar fund (365 days) minus planned breaks for vacation, study, government duties, etc. Further, factors that influence the value of PLTF in the current and prospective period are taken into account: changes in the length of the working day, the boundaries of the retirement age, etc.

One of the factors in the growth of labor potential is an increase in the potential fund of working time. However, there are a number of factors that show the difficulty in solving the problems of maximizing the total fund of working time, given the prolonged efficiency of all social production. According to statistics, currently 48-50% of women out of the total number of employees are employed in social production.

The list of professions in which a woman can work is expanding. At the same time, for the reproduction of the population, it is necessary to create favorable working and leisure conditions for women.

Thus, we can conclude that when determining labor potential, in addition to economic criteria, social criteria must also be taken into account, including the normal intensity of labor.

IV. RESULTS

In general terms, the value of labor potential (LP) in a person - hours of simple labor can be determined as follows:

$$LP = \sum_{i=1}^n N_i * F_{pot} * \bar{K}_{qual}, \quad (1)$$

where $\sum_{i=1}^n N_i$ is the optimal number of people who can be employed in social production (in average annual terms) by group. F_{pot} – potential fund of time of one employee per year by groups. \bar{K}_{qual} – coefficient taking into account the average level of qualifications of persons included in the calculation of labor potential.

When calculating the labor potential, the socially normal intensity of labor is assumed, i.e. the coefficient of labor intensity, taken equal to "1.0", and therefore, this coefficient is not used in this calculation formula.

The number of persons who can participate in social production (N_{sp}) is determined by the formula:

$$N_{sp} = N_{act} + (N_1 + N_2 + N_3 + N_4 + N_5 + N_6 + N_7 + N_8), \quad (2)$$

where N_{act} is the number of actually employed in social production; N_1 – number of unemployed; N_2, N_3, N_4 – number of high school students, students of educational institutions of primary, secondary and higher education who can participate in social production; N_5 – number of persons of retirement age who do not yet participate, but can participate in social production; N_6 – number of people of working age employed in the household who, under certain conditions (part-time work, part-time week, work at home, etc.), can participate in social production; N_7 – possible increase in the number of employees (in average annual terms) by combination, etc.

The potential working time fund by groups (F_p) is determined by subtracting non-reserve non-attendance absenteeism from the calendar fund and multiplying the obtained value by the length of the working day. So for the company, the calculation will be according to the formula:

$$F_p = DF_c - NN \text{ or } \Phi_{\pi} = N * D_a * T_{shift}, \quad (3), (4)$$

where F_c is the calendar fund of time, NN – non-reserve non-attendance, N – number of employees, D_a – number of attendance days (work days) in the period, T_{shift} – duration of the shift.

We propose a methodological approach to calculating the labor potential of the region and its use, taking into account both quantitative and qualitative characteristics of the potential, we consider the following conditional example:

Baseline: In the region of 900,000 people. employed; 100,000 people registered unemployed; 100,000 pensioners under 67 years of age; 120,000 high school and college

students and 100,000 household workers who could work part-time.

Calculation of the individual components of the labor potential:

1. Of the 900,000 employed, 450,000 are skilled workers for whom the required time to acquire qualifications is $9 + 3 + 3$ (9 years of incomplete secondary education, 3 years of vocational education in college or 3 years of practical experience). The annual fund of the employee's working time is on average 1,760 people, the labor potential of this group in man-hours of simple labor:

$$LP_1 = (9 + 3 + 3) * 1760 * 450000 = 11880000 \quad (5)$$

thousand hours

2. In fact, these workers performed work requiring less qualification (practical experience of 2 years) and with a fund of working time due to unplanned losses due to illness, absenteeism and administrative leave of 1,700 hours. The reported amount of time worked by this group of workers (F_1), taking into account qualifications, will be:

$$F_1 = (9 + 3 + 2) * 1700 * 450000 = 10710000 \quad (6)$$

thousand hours

3. The total number of employees is 150,000. specialists with higher education, but performing simple tasks that do not require such education (working in kiosks selling periodicals, sellers, secretaries, car mechanics, etc.). But in the labor potential, the total number of years of training of such workers is taken into account (11 years of general education and 5 years of higher education):

$$F_2 = (9 + 3) * 1700 * 150000 = 3060000 \text{hours} \quad (7)$$

Conditionally, by example, that the employees of this group are engaged in only secondary specialized education, then:

$$F_2 = (9 + 3) * 1700 * 150000 = 3060000 \text{hours} \quad (8)$$

4. Among the employed 200,000 people. unskilled workers who have undergone short-term training in the workplace (2-3 months):

$$LP_3 = 9 * 1760 * 200000 = 3168000 \quad (9)$$

thousand hours

where, 9 years - study for the acquisition of incomplete secondary education.

Actually worked hours of simple labor:

$$F_3 = 9 * 1700 * 200000 = 3060000 \text{hours} \quad (10)$$

5. Among the employed 150,000 specialists in positions requiring, in addition to higher education, an average of 4 years of practical experience. For this group:

$$LP_4 = (11 + 5 + 4) * 1760 * 150000 = 5280000 \quad (11)$$

thousand hours

In fact, half of the specialists performed work below their qualifications, requiring practical experience of only 1 year, or secondary specialized education and experience of 5 years:

$$F_4 = (11 + 5 + 4) * 1700 * 75000 + (11 + 5 + 1) * 1700 * 75000 = 4717000 \text{thousand hours} \quad (12)$$

6. Among those employed in the management of 40,000 people. with secondary specialized education and in positions requiring 2 years of practical experience for qualification.

$$LP_5 = (9 + 3 + 2) * 1760 * 40000 = 985600 \quad (13)$$

thousand hours

Among this group of employees, 50% also performed work below their qualifications, which did not require practical experience of 2 years:

$$F_5 = (9 + 3 + 2) * 1700 * 20000 + (9 + 3) * 1700 * 20000 = 476000 \text{thousand hours} \quad (14)$$

7. Among the employed 10,000 masters holding positions requiring practical experience of at least 5 years:

$$LP_6 = (11 + 4 + 3 + 5) * 1760 * 10000 = 404800 \quad (15)$$

thousand hours

where, 4 and 3 are the years of study, respectively, in undergraduate and graduate programs.

We assume that some of the masters also performed work below their qualifications, therefore, in fact, we restrict ourselves to the necessary length of service - 3 years:

$$F_6 = (11 + 4 + 3 + 3) * 1700 * 10000 = 357000 \quad (16)$$

thousand hours

8. Of the 100,000 pensioners, 25% could work in managerial and other jobs in their specialty on a part-time basis, and 25% in simple jobs (watchmen, pensioners, sellers, etc.):

$$LP_7 = (11 + 5) * 880 * 25000 + 9 * 880 * 25000 = 550000 \text{thousand hours} \quad (17)$$

In fact, only one half of the pensioners worked in either group:

$$F_7 = (11 + 5) * 880 * 12500 + 9 * 880 * 12500 = 275000 \text{thousand hours} \quad (18)$$

9. In the region there are 120,000 high school students and students who could work under conditions of part-time work. We will accept the fund of their working time 300 hours a year. Then the potential of this group:

$$LP_8 = 9 * 300 * 120000 = 324000 \text{thousand hours} \quad (19)$$

In fact, only 40,000 students with a time fund of 250 hours were employed:

$$F_8 = 9 * 250 * 40000 = 90000 \text{thousand hours} \quad (20)$$

10. Among 100,000 unemployed, 60,000 have working professions that require, in addition to studying, 3 years of practical experience and 40,000 specialists applying for positions requiring at least 2 years of experience:

$$LP_9 = (9 + 3 + 4) * 1760 * 60000 + (11 + 5 + 2) * 1760 * 40000 = 2956800 \text{thousand hours} \quad (21)$$

In this group, 50% of the unemployed worked in the reporting year for an average of 6 months, with a time fund of 850 hours:

$$F_9 = (9+3+4) * 850 * 60000 + (11+5+2) * 850 * 40000 = 1428000 \text{ thousand hours} \quad (22)$$

11. Out of the 100,000 people 40% of those employed in the household could work part-time (specified on the basis of demand). On average, these are citizens with secondary vocational education and their potential will be:

$$LP_{10} = (9 + 3) * 880 * 40000 = 422400 \text{ thousand hours} \quad (23)$$

In fact, among the employed in the reporting year they worked on average with a time fund of 440 hours only 10,000 people:

$$F_{10} = (9+3) * 440 * 10000 = 74800 \text{ thousand hours} \quad (24)$$

Thus, the total labor potential of the region, taking into account quantitative and qualitative characteristics, will be:

$$LP_{total} = LP_1 + LP_2 + LP_3 + .. + LP_{10} \quad (25)$$

$$LP_{total} = 11880000 + 4224000 + 3168000 + 5280000 + 985600 + 404800 + 550000 + 324000 + 29568000 + 422400 = 30195600 \text{ thousand hours}$$

Actually hours worked taking into account the required qualifications:

$$F_{total} = F_1 + F_2 + F_3 + .. + F_{10} \quad (26)$$

$$F_{total} = 10710000 + 3060000 + 3060000 + 4717000 + 476000 + 357000 + 275000 + 90000 + 1428000 + 74800 = 24247800 \text{ thousand hours}$$

The utilization rate of the labor potential of the region (K_{ur}) in this conditional example is:

$$K_{ur} = 24247800 / 30195600 = 0,803(80,3\%) \quad (27)$$

It is not difficult to calculate the partial coefficients of use of individual structural components of the labor potential (K_i), which are determined by the formula:

$$K_i = F_i / LP_i \quad (28)$$

where F_i is the time actually worked out by this group of labor potential in hours, LP_i – labor potential of this group in hours.

So, in our example, the utilization rate of labor potential, high school students and students will be 0.27 [90,000/324,000] pensioners 0.5 [275,000/550,000], etc.

In our opinion, using this approach, it is quite possible to calculate in the region (district) both the total value of the labor potential and its individual components, as well as indicators of the actual use of labor potential, taking into account quantitative and qualitative characteristics of potential.

V. DISCUSSION OF RESULTS

The question may arise: will the labor potential be accurately determined without taking into account the gender and age composition of the population included in the calculation? The age and sex structure of the population, of course, has a definite effect on the size of the labor potential. Some researchers are trying, for example, to quantify the

labor force taking into account the demographic structure of the population. As a reference unit, the number of men aged 30-39 years is most often used as the most effective part of the labor force according to the results of labor. For certain age groups of the population, their coefficients are set, the value of which is taken less than unity, and for women this indicator is taken lower than for men.

However, in our opinion, it is not necessary to take such factors into account the labor potential. Firstly, this will greatly complicate the calculations, and it is unlikely that the labor efficiency coefficients of various age and gender groups will be sufficiently accurate. Secondly, (and this is the main fundamental objection) when using such coefficients, various requirements of different industries and industries to the gender and age structure of workers are ignored. In a number of industries (for example, the textile industry), the efficiency of female labor, for example, is much higher than that of male labor. With age, the physical abilities of a person decrease, but in older age groups, qualifications and experience are much higher. Therefore, it will be unnecessary to introduce correction factors for the age and sex structure of the population when calculating labor potential and it is possible to differentiate labor efficiency by individual groups through a potential labor time fund. For example, for retirees, given that many of them can work on a part-time basis, the potential working time fund may be 35–40% lower than for full-time employees.

Another aspect of calculating the potential time fund for pensioners is related to raising the retirement age. In connection with the change in the boundaries of the retirement age, in order to maintain the health and working capacity of workers, it is necessary to reduce labor stress. So, for men from 63 years old, women from 58 years old, it is advisable, in our opinion, to set lower production standards for toolmakers, and lower service standards for temporary workers, speed up work on automation and improve working conditions, especially in jobs where workers of pre-retirement age work. One of the possible options for facilitating labor for people of pre-retirement age may be to reduce the working day by 1 hour, and provide vouchers for health resorts. The easiest way to implement these measures is in state corporations, and in the private sector these issues with the participation of trade unions should be enshrined in collective agreements.

Indicators of the use of labor potential can be divided into two groups: indicators of the results of the use of labor potential and indicators of the use of the potential itself. Performance indicators are the output of national income (NI) per unit of labor potential (P_1), and in the region, the output of net products (NP) per unit of labor potential (P_2).

$$P_1 = ND(\text{rub.}) / LP(\text{hours}) \quad (29)$$

$$P_2 = NP(\text{rub.}) / LP(\text{hours}) \quad (30)$$

The use of labor potential itself is characterized by a general indicator (P_g) and private indicators (P_i).

$$P_g = F_1 / LP, \quad (31)$$

where F_1 is the total worked out hours (man-hours), LP – labor potential of a country, region (man-hours).

Private indicators (P_i) characterize the use of individual components of the labor potential: full-time employees, retirees, students, etc.

$$P_i = (N_{ai} * F_{ai}) / (N_{ni} * F_{ni}), \quad (32)$$

where N_{ai} is the actual number of employees of this group, F_{ai} – actually worked time for a year by individual employees of this group in hours, N_{ni} – number of people in this group who can participate in social production, F_{ni} – potential annual fund of working time for one employee of this group in hours.

Currently, we can distinguish the following ways of managing employment and labor potential. Consider each method separately, indicating its main characteristics, advantages and disadvantages.

- Creation of more jobs in those sectors of the economy that have the highest growth rate (for example, trade, services, etc.). The advantage of this method will be the growth of small and medium-sized enterprises, low investment. However, a slowdown in the economy or its recession may entail an increase in unemployment or a decrease in the income of employees.
- An increase in the number of jobs in the public sector. A positive thing will be the reduction in unemployment among first-time job seekers. In connection with the creation of additional jobs, an increase in budget expenditures will be required.
- The increase in jobs in high-tech industries. The positive side of this method is that the issues of structural restructuring of the economy are solved, and jobs are created with a high level of income. Among the shortcomings, it should be noted the length of the period of formation of new jobs, large investments.
- Active training and retraining of retired workers to ensure future employment of the workforce. The advantages of this method of employment management: low investment, lower unemployment in the long term. Disadvantage: it is necessary to have

a very accurate forecast of the economic development of a country or region.

- Creation of a mobile system for job placement (for example, moving from one region to another, on a rotational basis). It solves employment issues in a fairly short time. The disadvantages are the lack of the usual mode of work and rest, the psychological drive-fort.

The latter method includes the migration of labor within the constituent entity of the Federation, first of all, trips to work of the population from small cities to larger cities. For example, the studies of Mkrtychyan N. and Florinsky Yu. testify to “the high labor and spatial mobility of the population of small towns and its positive impact on the households of labor migrants and on the economy of the cities themselves” [10].

In practice, the first and second methods are now used, and the third is used in limited sizes. So, in the Omsk region over the past ten years, the share of employees in public administration has grown by 1.4 times, trade - by 1.2 times, financial activity - by 1.3 times, and even decreased in manufacturing industries.

The described methods are differentiated depending on regions, industries (for example, for agriculture, construction, etc.).

A very important object of research should be an analysis of the impact of labor potential on the use of material and technical potential of the country and its individual regions.

So there are many examples when expensive equipment purchased for currency is idle due to the lack of qualified personnel or there is frequent downtime of this equipment due to improper operation. For example, such situations often arise with both imported and domestic sophisticated medical equipment. Such cases with equipment and machines for industry, transport, agriculture and other industries are not uncommon. Often the cause of accidents, fires, floods is the human factor. The main directions of the influence of labor potential on material and technical potential are presented in Figure 1.

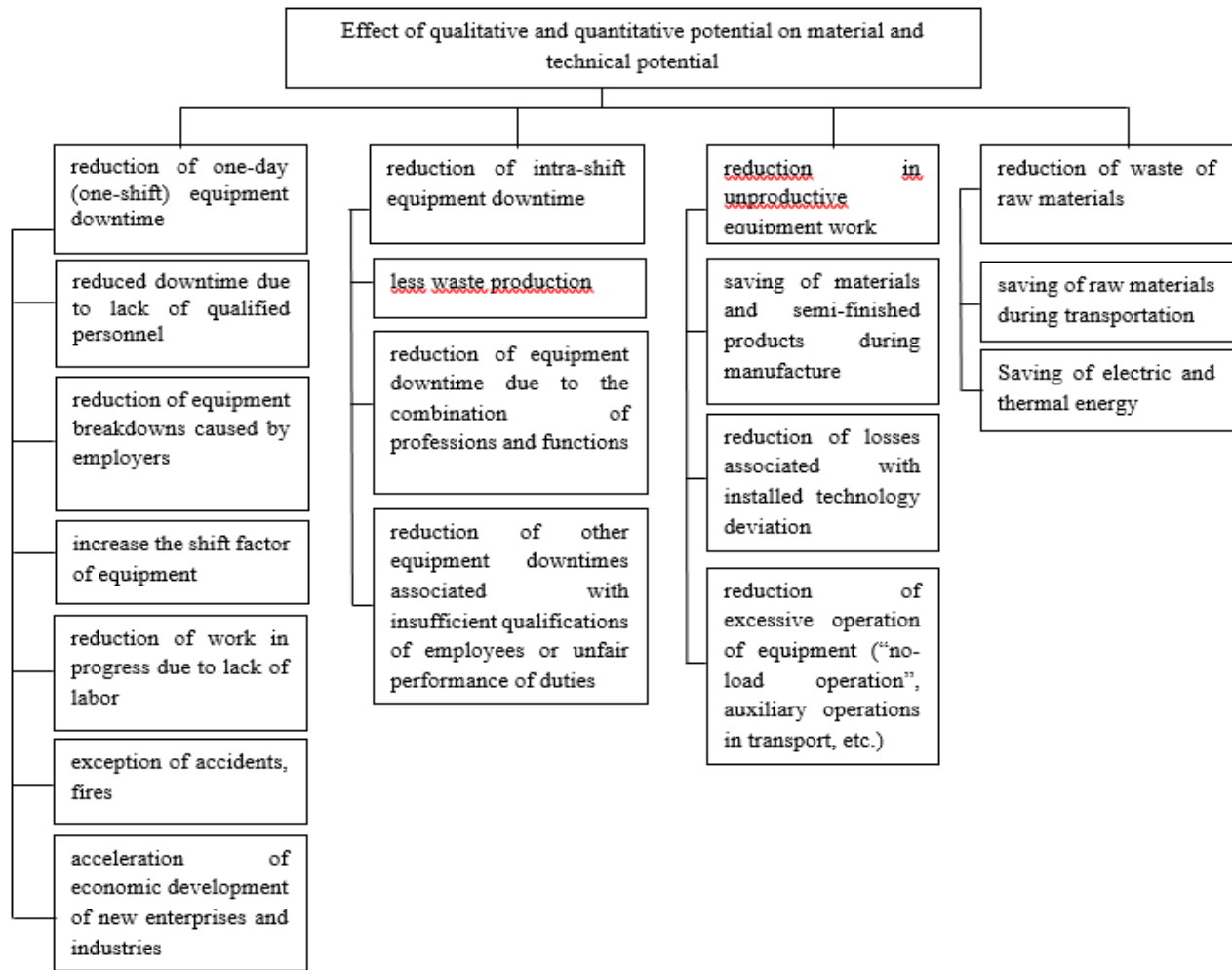


Fig. 1. The main directions of the influence of labor potential on material and technical potential

In modern conditions, the qualitative characteristics of the labor potential for solving environmental problems are important, which is also the subject of special studies. In this regard, one can agree with the opinion of A.A. Anfinogentova, M.N. Dudina, N.V. Lyasnikova, O.D. Protsenko, who believe that “the education system that supplies human resources for the agro-industrial complex should be balanced in the context of introducing environmental disciplines and disciplines in the theory and practice of innovation into the process of training specialists” [11].

VI. CONCLUSION

Summing up, it can be argued that the calculations of labor potential and its elements, the development of the most effective ways to use them are currently a very urgent task both for the country as a whole and for individual constituent entities of the Federation, cities and regions. The methodological basis for determining the value of labor potential should be the calculation of the potential labor time fund for groups of potential elements (employed in social production, the unemployed, pensioners, etc.) in man-hours of simple labor. To change complex labor in to simple, the time ratio in years necessary for training an employee employed in this position can be used. In connection with the increase of the retirement age in Russia, it is proposed to take a number of measures to reduce labor intensity for people of

pre-retirement age (lower standards of production, maintenance, and improvement of working conditions).

The proposed methodology for calculating labor potential and its individual components, systematized methods for managing labor potentials should contribute to a more informed adoption of managerial decisions in the field of labor.

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