# Assessment of the Supply Chain Management as a Comprehensive Evaluation of the Labour Potential of the Region

Tatyana V. Tselyutina*[1], Tatyana A. Vlasova*[2], Olga A. Timokhina*[3], Yana V. Maslova*[4]

*Belgorod State University, Russia

[1]Fersh.alizadeht@gmail.com, [2]A.Vlasova4682@gmail.com, [3]A.TimokhinaO2468@gmail.com, [4]V.MaslovaY765@gmail.com

***Abstract*— The trajectory of future competitive development of the Russian Federation on the basis of innovation is closely correlated with the development of labor potential, the designation of the vectors of an effective tactical and strategic management which should be based on a comprehensive assessment of its formation, reproduction and applying. The methodological basis of the study were the monographic method, system approach and the method of analysis, statistical and economic analysis techniques, such as clustering and dispersion analysis, as well as principal components method. The research carried out a critical analysis of existing labor potential assessment methodologies at the regional level, which allowed taking into account the identified deficiencies offer the author's approach to express diagnostics, which does not require a special wide survey, allows to get objective results and it is the basis for identifying the most important problems and priority ways of solving them. The essence of the approach is to conduct regional clustering procedure on the level of the state of the labor potential on the basis of the author's indicator system. The result of research was defined typology of the subjects-regions of Central Federal District of Russia, which made it possible to carry out inter-regional comparison of the level of labor potential, taking into account the innovation component, highlight the characteristics of the obtained clusters of regions that are important in the acceptance of administrative solutions. The proposed toolbox can inure as a basis for analysis and information developed at the regional and federal level program activities aimed at formation and development of the labour potential.**

***Keywords*—** *labor potential, the indicators of formation, reproduction and applying, supply chain management, condition assessment, assessment methodology, clustering, regional differentiation.*

## 1. Introduction

The present stage of evolution from an industrial to a postindustrial society, combined with the conditions of globalization and geopolitical competition, the need to overcome the crisis in the Russian economy and ensure its dynamic development consider that the human factor is a major.

At the state level, the elevation of the role of the human factor at all stages of social production is recognized as the main competitive advantage and the basis of solving the problems of the Russian Federation advanced development, including the development of innovation-based economy. Thus, in the Concept of long-term of social and economic development of the Russian Federation for the period up to 2020 notes that the level of competitiveness of modern innovative economy is largely determined by the quality of professionals and by the level of their socialization and cooperation.

Unfortunately, it must be noted that in 2017 Russia ranked 46th place out of 63 possible in the ranking of competitiveness of countries around the world, compiled by the International Institute for Management Development (IMD).

The founders of the concept of human capital and the owners of Nobel Prize in Economics in the late XX century initiated to consider human capital as a valuable resource which is much more important than the natural resources and natural resources and accumulated riches [1-6]. Expert opinion is that the further growth of the world's GDP defines the human factor by two thirds [7, 8]. It must be noticed that the share of human capital varies between 70 and 80%, and in Russia it is only about 50% in the structure of the national wealth of the most developed countries around the world.

It is known that generalizing indicator of the process of formation and development of the person in the labor force is the labor potential of society. Thus, the trajectory of the future competitive development of the Russian Federation on the basis of innovation is closely correlated with the development of labor potential of the new

formation, capable of evolving in difficult conditions to overcome the effects of the factors that hinder the competitive development of all spheres of the Russian economy.

Today it is still has not been developed a clear system of characteristics that fully disclose the essence of the "labor potential" category [5], therefore, besides the applying of the concept of "employment potential" in the economics and practice there used such concepts as "labor force", "human resources", "human factor", "employment potential", "human capital", which are also pithy and have semantic load. They complement each other, revealing any one of the parties to support these concepts - the human [9]. In this research, there will be used the concept of labor potential, as the most constructive and applicable in attitude of settlement and territorial systems, the region acts in this role which the most versatile and fully implemented the entire spectrum of the population. The original idea of this concept is that labor determines the maximum potential of the final economic result that is possible at the optimal mode of reproduction of the labor force in the region.

Issues of development of labor potential in order to modernize the economy are currently being addressed at the regional level. At the government level the legislatively fixed general principles of development of labor potential are implemented, operates a general mechanism of influence on motivation, the state policy in this area is mainly focused on the development and formation of the system of professional education. This fact is explained and justified by the existing high degree of differentiation of social and economic development of regions, the asymmetry of the availability and applying of productive resources, which is the natural and inevitable condition any contemporary organized economic space.

However, the main priority of regional policy is to provide qualitative standards of life, defined by positive and dynamic development of the entire spectrum of vital activity of society. In this context, the principle and objectively significant is to create favorable preconditions for the formation of high-quality and sustainable development of labor potential at the macro and micro levels. A sustainable system of formation and development of labor potential of the region, identifying qualitative and quantitative composition of the labor force is a determining condition and the foundation of competitiveness and investment attractiveness of the national economy [7, 24].

It should be noted that in the UN development program in Russia, states: " It is impossible to imagine the formation of a society, which was based on knowledge, in a country like Russia, without the economically strong regions and an effective coordinated regional policy. An integral component of such a policy should serve as the regional program of human development».

The purpose of building this kind of program is to improve the quantity and quality of labor potential of the regions, meanwhile the basis for making program activities should be the monitoring of the current state of the labor potential.

It is natural that in the course of implementation of program activities the peculiarities of the demographic situation in the region, the state of the education system in general, which is carried out of social and economic policy, should be taken into account. In this case, the inhabitants of the region are not considered as a resource, but as human capital, for which the laws of general capital management are applicable. Application of this technology allows to identify not only quantitative but also qualitative state of personnel maintenance in the organic connection with social and economic policy system. An essential element of the modernization process is the application of the best practices of analysis of labor potential, especially in the civil service authorities, since they are the main actors of social control [10].

In our opinion, it is possible to assess the level of the state of the labor potential, define and synchronize the vectors effective tactical and strategic management only on the basis of a comprehensive comparative evaluation. The most important task is to carry out such rapid diagnosis, which does not require a special wide survey, is not labor-intensive and low-cost, but at the same time allows you to get an objective and reliable results, and is the foundation of identifying the most important issues and priority ways of solving them. Only after that it is advisable to conduct additional research on the most important, already identified areas.

Carrying out this diagnosis allows to contribute to the regional administration a comprehensive,

reliable and operative information on the state of labor potential, the peculiarities its formation and development, the comparative advantages and disadvantages. Besides the descriptive purposes of the state labor potential, the problems, that are aiming to assess the effectiveness of social and economic policy in the region and the state as a whole, can be solved during the diagnosis. Thus, the problem of methodological tools of labor potential evaluation has not only a theoretical, but also an important practical nature.

## 2. Information Procuring And The Methods Of Research

Due to the undeniable importance the evaluation of labor potential has been the subject of active research at various levels in recent years. Note that the methods of evaluation of labor (personnel) potential at the corporate level are the most developed. Despite the considerable amount of research in this area the problem of the comprehensive assessment of the employment potential of sectoral and regional level is not solved, it remains controversial and requires further investigation.

We have already emphasized that the monitoring of the state of the labor potential is very time-consuming process and requires special research that often leads to the use of the simplified approach, which uses data on the number of employees, their gender and age differentiation, educational and qualification level. It should be added that the composition of the components of the evaluation of labor potential doesn't have complex nature, it is baseless, contains inaccurate or duplicated data, based on the expertise of subjective assessments.

In addition, existing approaches do not allow to carry out dynamic and inter-regional comparisons.

Thus, some authors hold the opinion that the analysis of the region's human resource capacity at the beginning of the XXI century must correspond the following criteria:

1) the number of employees in the region's manufacturing, educational level, age and gender composition, the level of qualification, training for the last five years;

2) index of labor productivity;

3) the number of employees engaged in research, scientific and technical developments;

4) the volume of produced products (goods and services) as a main indicator of the effectiveness of innovation activity on the modernization of the regional economy.

On the basis of these parameters the integral index of evaluation of personnel potential of the region, consisting of two components can be calculated: the formation and use of human resources potential in the region [11].

Single out a methodology for the rapid analysis of human resources potential in terms of economic modernization. At the core of human resource capacity assessment is the calculation of the developed integral index, which assesses the processes of formation and use of human resources by means of coefficients reflecting the quantitative and qualitative characteristics. The indicator takes into account the formation of personnel potential values of the coefficients that characterize the tertiary level of education and the level of public expenditure on education. The utilization index of personnel potential is based on indicators of the applying of personnel potential of technical, technological and organizational renewal and human resource capacity of innovative activity. For the final evaluation of the use of personnel potential the author lays down the simplest model of the summation of scores for all constituent components.

The most meaningful and system for evaluating the region's labor potential, in our view, is a methodological approach developed by A. N Tretiak. In accordance with this approach, estimation of working potential is carried out by seven blocks, each of which consists of several parameters.

1. The demographic potential (the proportion of the working population, the percentage of working pensioners, the natural growth rate, expected duration of life at birth);

2. The social potential (morbidity, the proportion of museum visits, the proportion of disabled people, the number of registered crimes);

3. Industrial potential (unemployment rate, employee turnover, the proportion of victims in

industrial accidents with a disability at one working day or more, the degree of depreciation of main funds);

4. Professionally-qualifying potential (the proportion of the employed population with higher education, graduates of educational institutions SPO and VPO, GDP per employed person, the proportion of the employed population with NGOs);

5. Motivational potential (share of employment in small enterprises, the share of informal employment of the population, the level of employment, the share of employees working part-time and being on leave which was initiated by the employer);

6. Creative potential (innovation activity of organizations, the share of personnel engaged in research and development, the share of advanced production technology, the share of innovative goods, works, services);

7. The migration potential (percentage of foreign citizens engaged in labor activities in Russia, the share of internal immigrants, the share of internal immigrants aged 14 and older, who have higher education (including profit), the share of internal immigrants aged 14 years and older with higher education (including retired)).

According to this methodology for measuring labor potential at the regional level should be based on comparative assessments received during the ratings of official statistics [11].

A study of discussed and a number of other modern labor potential valuation techniques allowed us to draw the following conclusions:

1.The problem of the choice of indicators or evaluation indicators of the labor potential is still enough debatable. At the same time, most of the authors are unanimous in the opinion that the cumulative assessment of the employment potential of the region must include both the formation of indicators and indicators of applying.

2. The question of the application of diagnostic tools to assess the analysis of labor potential is even more controversial.

During the research we made an attempt to create an integrated assessment of the author's technique of labor potential of region.

Justifying its features and advantages, we can note the following.

Firstly, at the selection stage of the set of initial indices of comprehensive assessment of labor potential, we went by the following requirements to them: relevance, accessibility and reliability of information, clarity of content, ease of calculation, objectivity. Should be noted that in addition to indicators of formation and use of the labor potential we also identified the indicators of the reproduction of labor potential. In addition, referring to the dominant role of the labor potential as a factor in the modernization of social and economic development of regions there were represented indicators which characterizing the innovative component in the formation, reproduction and use of labor potential. Information base of research is exclusively based on official statistics.

Secondly, because of the possible heterogeneity and multi-directional of chosen indicators, the instrument of diagnostic analysis is a procedure of the clustering of the initial data. The choice of this instrument is caused by the distinguishing feature of cluster analysis, which makes it possible to use any type of data source without limitation. Another advantage of the cluster analysis is the ability to conduct an objective and comprehensive assessment of the individual entities on selected indicators in the course of study [12, 13].

Third, the use of this technique makes it possible to carry out fast dynamic and inter-regional comparisons.

## 3. The Analysis of Results

The approbation of the proposed analytical tools will be carried out by using the statistical and mathematical package «Statistica 8.0» on the basis of average data for the Central Federal District of the Russian Federation 2014-2016.

Initially, the following parameters were selected for the evaluation of labor potential contact: average annual population, human rate of natural increase (decrease) of population, ‰; mechanical coefficient of increase (decrease) of the population,

‰; the life expectancy at a birth, the number of years; average number of employed in the economy, thousand. people.; the specific weight of the population of working age in the average annual population, %; unemployment rate, %; the number of students enrolled in undergraduate, graduate and specialties per 1,000 inhabitants of the region; the share of employed in economy, with a higher education, %; the share of employed in economy, having secondary professional education, %; the average age of employed in economy, years; the number of personnel engaged in research and development, people.; average nominal accrued wages of employees of organizations, RUB.; the gross regional product per employed person in the economy, RUB. / person.; the average index of labor productivity, %; growth of highly productive locations, %; unit weight of innovative products, works and services in the total volume of shipped goods, performed works, services, %; innovative activity of organizations, %; the share of production of high-tech and knowledge-intensive industries in GRP, %.

At the next stage during the analysis and interpretation of obtained matrices of correlation of the selected indicators. the duplicating indicators were excluded. Later in during the principal component analysis by plotting the coordinates of factor visually were identified those selected indicators that are well reproduced by a certain set of selected indicators. As a result, there was determined the final, authorial set of 12 indicators for the assessment of labor potential:

$X_1$ - average number of employed people in the economy, thousand. people.;

$X_2$ - rate of natural increase (decrease) of population, ‰;

$X_3$ - coefficient of the mechanical increase (decrease) of the population, ‰;

$X_4$ - the life expectancy at birth, the number of years;

$X_5$ - the share of employed people in the economy, with higher education, %;

$X_6$ - the average age of employed people in the economy, years;

$X_7$ - the number of personnel engaged in research and development, people.;

$X_8$ - the average nominal accrued wages of employees of organizations, RUB. ;

$X_9$ - the gross regional product per employed people in the economy, RUB. / person.;

$X_{10}$ - growth of the highly productive locations, %;

$X_{11}$ - unit weight of innovative products, works and services in the total volume of shipped goods, performed works, services, %;

$X_{12}$ - innovative activity of organizations,%.

Before the clustering, data have been subjected to the standardization process that allowed to recognize all the signs as equal from the position finding the similarities of these objects. To ensure the objectivity of the clustering results we used as the joining (tree clustering) - method (hierarchical agglomerative algorithm) and K - means clustering (divizimny algorithm). Going by the specificity of research and indicators, hierarchical clustering was performed with the help of the Ward's method. Various types of distances between objects were used to construct the group of objects, the most meaningful results were obtained with the help of the Euclidean metric. The results of the classification and the research of the graphics dependency between the number of clusters and the value of the coefficient fusion showed that the most optimal is the separation into 4 clusters. The results of clustering by K-means are presented in Table 1.

**Table 1.** Stable association of CFD regions derived from clustering on the dedicated performance comprehensive assessment of labor potential

| № кластера | Conditional name of the labor potential level | Number of regions in a cluster | The list of the regions included in the cluster |
|---|---|---|---|
| 1 | the highest | 2 | Moscow city, Moscow Region |
| 2 | high | 8 | Belgorod Region, Vladimir Region, Voronezh Region, Kostroma Region, Lipetsk Region, Ryazan Region, Tambov Region, Yaroslavl Region |
| 3 | medium | 5 | Kaluga Region, Kursk Region, Smolensk Region, Tver Region, Tula Region |
| 4 | low | 3 | Bryansk Region, Ivanovo Region, Orel Region |

In order to test the significance of differences between the clusters obtained and convergence inside them was conducted analysis of variance clustering results. The values of F-statistics indicate statistical significance and appropriateness of the use of set of indicators for the assessment of the labor potential which was determined by the authors. The differences of the standardized values of cluster generatrix average indices in the division by 4 cluster are graphically presented in Figure 1.

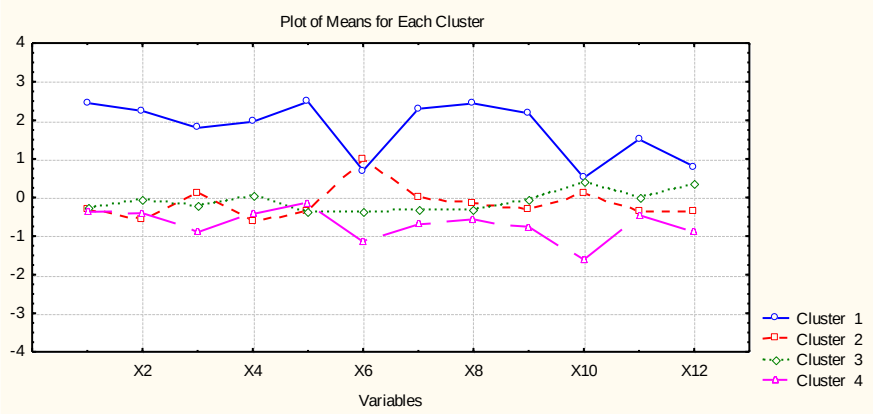


**Figure 1.** The distribution of the normalized values of cluster-averages in the division by 4 clusters

Let us give meaningful characterization of the obtained clusters, which include types of regions with specific gradation of formation, reproduction and use of the labor potential.

The first cluster is represented by two territorial entities of the Central Federal District - Moscow city and the Moscow region, where the indicators of the territorial entities labor potential are significantly higher than the average rate per totality. In general, this indicates favorable conditions for formation and reproduction of labor potential, what gives a positive impact on used value. A defining feature of this cluster is the fact that, with the maximum value of all indicators, the average age of employee in the economy field and the level of growth of highly-productive places are not much higher than the average values in aggregate.

The second cluster is mostly represented and includes the Belgorod, Vladimir, Voronezh, Kostroma, Lipetsk, Ryazan, Tambov and Yaroslavl regions. Regions of this cluster are provided with the stuff of better quality. It is characterized by age and educational structure of employees combined with relatively higher wages. However, the values of indicators of the labor performance rate and

innovation activity can be considered as average in comparison with the rates of other subjects of the Central Federal District.

The third cluster consists of the 5 regions: Kaluga, Kursk, Smolensk, Tver and Tula regions. In the regions of this cluster, there is a comparatively lower share of employed in the economy field with a higher level of education and a lower payroll rate in comparison with all other regions. At the same time, the existing values of the labor performance rate and innovation activity are above the mean.

The fourth cluster includes Bryansk, Ivanovo and Orel regions. These regions are distinguished by a more complex demographic position, which can subsequently cause the shortage of labor forces. The indicators of labor potential formation, condition and reproduction of are the lowest in the aggregate, and as a result, the indicators of utilization efficiency are characterized by low values.

Thus, carrying out the analytical procedures described on the basis of selected by the authors indicators, has allowed not only to conduct a comprehensive assessment of differentiated of the labor potential, but also to identify the characteristics and priority problems which demand to be solved in the regions included in the established clusters. In the regions-outsiders it is advisable to take into account the experience of solving problems of the strategic management of the formation, development and reproduction of labor potential in regions with high employment potential.

## 4. Conclusion

As a result of the research the methodical approach for a comprehensive assessment of differentiated of the labor potential at the regional level, which takes into account the disadvantages of existing techniques was made sequentially.

Thus, the selection and justification of indicators of labor capacity assessment was conducted in view of the requirements which were formulated for them, in addition in the course of constructing a correlation matrix and a factor graphics coordinates were eliminated duplicate and irrelevant to the assessment of performance. The result was determined by the final set of 12 indicators.

At the next stage, the clustering procedure that was based on the average data of selected indicators was performed of CFD entities which allowed to group all the regions in four clusters. Carrying out the cluster analysis made it possible not only to obtain a comparative assessment of regions in terms of employment potential, but also to identify existing problems and especially in the context of formation, reproduction and use of the labor potential.

The proposed approach is the only rapid diagnostic assessment, which enables inter-regional, and, if necessary, the dynamic comparison and provides a basis for further deeper research of the labor potential problems, including the elimination of the regional differentiation of rates of its formation, reproduction and use.

The proposed tool can be used as an information base taken at the regional and federal levels of program activities directed at improvement and development of the labor potential of Russian regions.

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