Calculation of a Complex Indicator of the Innovation Potential

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Abstract. This article describes a possible approach to the analysis of a complex indicator of the innovation potential of a region. The definition of the concept is given, the components included in its structure are singled out, the model of a complex indicator of the innovation potential of a region is offered. The calculation of a complex indicator of the innovation potential on the basis of the proposed methodology is made and the conclusions on the obtained result are formulated. The article also offers a method of analysis of integrated indicators – the components of the regional innovation potential on the basis of the used technique. The summary table of the normalized values of the integrated indicators - components of the innovation potential of the regions of the Central Federal district and their estimated values on the basis of which it is possible to draw conclusions about the level of the regional innovation development is presented. The approach used is acceptable for assessing the innovation potential of various organizational systems, for ranking regions relative to each other and for making recommendations to improve the level of the innovation development of regions.

1. Introduction

Modern economy is an innovation economy based on knowledge. It prioritizes factors of production and natural resources that have become traditional. Intelligence and knowledge are presented in the form of intellectual resources. Modern global economy is based on intellectual property, which is becoming an integral part of the activities of competitive companies.

The current state of the Russian economy and its position in the world is characterized by contradictory trends. On the one hand, there are large reserves of natural and labor resources, large production potential, and leading positions in export of certain groups of goods. On the other hand, economic crises significantly weaken Russia's position in the world market. At the moment, the structure of the modern Russian economy is under transformation. There is a transition from raw materials to innovation and high technology, which requires well-established mechanisms of interaction between the state, the scientific and technical sphere and market forces, the creation of a system of the rise in knowledge and the implementation of this knowledge in innovation. The effectiveness of these mechanisms determines the innovation ability of the economy, i.e. the ability to create and implement diffusion of innovations in the economic environment [1,2].

2. Relevance of the article

Currently, the improvement of the mechanisms of scientific and technical development of the economy is the main foundation for intensive economic growth.
One of the main mechanisms of restructuring the Russian economy, its modernization and sustainable recovery should be a national innovation system, as this mechanism creates the necessary conditions and prerequisites for the transition of the economy to its new technological setup, providing an innovation type of economic growth [3].

3. Problem statement
One of the features of innovation development of Russia is a high degree of uneven regional development. This is due to a number of factors: the specific character of each region, the historically established leading industries, the geographical position, as well as the innovative potential. In today's economy, it is the value of innovation potential that determines the potential and growth rates of the regional innovation system. All this determines the relevance of the study of this concept, the disclosure of its essence and content, as well as the need to find methods for assessing this value.

4. Theoretical part
After the analysis of the existing approaches to the definition of "innovation potential", we can formulate the following definition: innovation potential is a set of resource and organizational capabilities of an economic system to innovation development and ensuring a continuous innovation process.

In order to ensure a continuous innovation process, a region must have a set of factors and conditions conducive to innovation:

1) scientific and production factors – factors of scientific potential of a region, personnel potential; production potential – the material and technical means, advanced technologies, economic, scientific and technical infrastructure.

2) economic factors – availability and sufficiency of a region’s own financial resources to implement innovation activity. Economic, scientific and production factors are the main resource component of the innovation potential, the foundation for the emergence of the innovation process.

3) legal factors include legislative measures (especially benefits) that encourage innovation activity and government support for innovation.

4) organizational and administrative factors act as indicators of the region's ability to implement and disseminate innovations. This group includes factors of organizational potential – innovation activity of enterprises. It is also the demand for the results of innovation, foreign economic cooperation, export of innovation goods and services, technological exchange in organizations that implement innovation. Factors of investment attractiveness of a region can be also referred to this group.

In this consideration, the innovation potential is an integral value, which includes a system of factors-indicators that reflect the four main components of the innovation potential discussed above.

Thus, the mathematical model of the innovation potential of a region can be presented as follows (1):

$$\Pi_P = (H_N, \Pi_P, OY_P)$$

where $\Pi_P$ is a generalized indicator of the innovative potential of a region, $H_N$ is a complex indicator of scientific and production factors, $\Pi_P$ is a complex indicator of economic factors of a region, $OY_P$ is a complex indicator reflecting legal support for innovations, $OY_P$ is a complex indicator reflecting organizational and administrative factors.

In turn, each of the integrated indicators included in the model can be represented as an integral value of the factors included in it.

A complete list of factors-indicators and methods of calculation of the complex indicator are given in the "Assessment of the innovation potential of a region" [4].
5. Practical significance
Calculation of the integrated indicator of the innovation potential of a region was performed using the method of area diagrams described in [4].

The calculation of the areas of the diagrams was performed according to the following formula:

$$S_r = \sum_{i} k_i \cdot k_{i,r} \cdot \sin\left(\frac{360}{i}\right)$$

where $S_r$ is the area of the constructed chart for the $r$-th region, $k_i$ is the normalized value of the $i$-th factor-indicator for the $r$-th region in the considered data array, $i$ is the number of factors-indicators selected for modelling.

Thus, the values of the innovation potential were calculated and a summary diagram of the values of the innovation potential of the regions of the Central Federal district was built (Fig.1).

![Figure 1. The summary diagram of the values of the innovation potential of the regions of the Central Federal district.](image)

The results allow us to analyze the "strong" and "weak" indicators of the regional development. Voronezh region has high and average indicators for all selected complex indicators. It is confirmed by the first place in the ranking list for the complex value of the innovation potential. Belgorod region with the second largest innovative potential, has a high potential in the economy and the organizational and administrative sector, but it shows an average result in science and production and low in the legal potential. Yaroslavl region with the third largest innovation potential has a high level of scientific and industrial base, an average indicator of the economic potential, but low legal, organizational and administrative indicators.
Similarly, it is possible to consider all regions and identify good and bad sides of their development in order to make recommendations for increasing the value of the innovation potential.

6. Conclusion
Belgorod, Voronezh, Tula and Yaroslavl regions have high resource potential. Voronezh region has a high economic ability to create innovations. However, if we take the average values as a satisfactory indicator, we can also note Belgorod, Kaluga, Lipetsk and Tula regions.

It should be noted that the used approach is acceptable to assess the innovation potential of different organizational systems. However, depending on the object of study, the system of factors included in the components of the generalized indicator will differ. For the evaluation procedure the formation of a system of factors and their aggregation into a single complex indicator are of great importance.

The need to form regional innovation systems, as well as to create effective mechanisms to control them at the present stage of development of the Russian economy is beyond doubt.

Building an innovation system should take place in accordance with the needs and capabilities of the regions. To build a model of innovation development of a region, it is necessary to analyze the components of the innovation potential, its assessment and a possible forecast of development for the coming years. Only by a comprehensive consideration of the problem of innovation development we can build an innovation system that affects the processes of stabilization of the country's economy and increase its competitiveness.

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