Investigation of optimal approaches to assessing the innovative potential for regional transport improvement. part i: choice of methods

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Abstract. In the article, the authors set a goal to identify the most accurate and eco-nomical methods for assessing the innovative potential of regions for the de-velopment of their transport infrastructure in terms of the resources used. There two parts of the work which are going to be published in different is-sues. To achieve the goal, methods were selected, calculations were carried out for two of them, which are suitable for the goal and described in detail in the methodological literature, and the results of two methods presented in the public domain for comparable periods of time for three selected regions were used. The study used materials from Russian and foreign sources. Based on the results, certain conclusions were made that allow more accurate selection of methods for assessing the innovative potential of regions, taking into account the objectives of such an assessment, as well as the resource availability of a researcher group. However, none of the methods considers the development of transport infrastructure as a separate factor. A critical view on the further application of all methods is going to be presented in the next issue.

1 Introduction

The innovative potential of the transport enterprise, as well as the industry, is very important at a time when logistics links and supply chains are torn. At the same time, it is inseparable from the innovative potential of the region. It is the latter that is decisive for the transport enterprise and creates incentives for its innovative development. In other words, an innovative region naturally forces the transport enterprise to innovate. The reverse relationship does not give such an effect. Thus, the innovative potential (IP) of the region is the capability and ability of the region to form and use the innovative resources necessary for the innovative development of both the territory and its economic agents, which al-lows creating, distributing and using various types of innovation (new types of goods and services).

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Regional statistics of the constituent entities of the Russian Federation, pre-sented in many official documents and reports, demonstrate an increase in the number of startups being implemented and registered patents. However, this does not always have a positive effect on the indicator of the level of innovative po-tential. Such dynamics makes one think and makes it necessary to analyze the methods for assessing the innovative potential, as well as the data on the basis of which the innovative indicators of the regions are calculated, in order to answer in this part of the study the questions:

1. How complete are such methods and do they take into account a sufficient range of innovativeness indicators?
2. Is it possible to manipulate the indicators included in the methodology?

Thus, the aim of the study was to search among the known and frequently used methods for the optimal assessment of the innovative potential for the develop-ment of transport in the region. The objectives of the first part of the study in-cluded:

- identification of the most commonly used methods for assessing the innova-tive potential of the region;
- conducting a comparative analysis of methods with the identification of their strengths and weaknesses.

The object of the study is the assessment of the innovative potential for the development of transport in the region, while the subject of the study is the tools for such an assessment.

Research limitations. The main limitations are associated with the use of only published methods for analysis, which were either applied with detailed explana-tions, or described in the literature in such detail that they could be applied inde-pendently. In addition, this study is limited by the number of authors, as well as only their own resources to conduct the study. Therefore, some methods that involve a large use of labor, time and financial resources are considered already being applied by third-party authoritative groups of researchers. At the same time, this imposed a limitation on the present study in the period of its conduct, which should be fully comparable (i.e., coincide) with the period of secondary data obtained, which the authors used to compare the results. In addition, the last stage – comparison – is especially limited by the study period, since for all se-lected methods, only 2019 is a comparable comparison period. Also, due to the limitation of the publication volume, for comparing the results, the number of regions – constituent entities of the Russian Federation – for which the assess-ment of innovative potential was carried out, taking into account the level of development of transport infrastructure and to which the studied methods were applied, is limited.

Among the many works devoted to innovation potential over the past three years, several areas stand out clearly. First, the high innovative potential is rea-sonably recognized by the authors as one of the strongest factors of economic growth [11; 10], along with investments and the stability of the conditions for the functioning of enterprises. Secondly, an important factor in increasing the inno-vative potential is personnel both at the microeconomic level and at the regional level [9; 5].

An important factor affecting the level of innovative potential is the region where the enterprise is located. Many studies carried out within the framework of this aspect, for example, [2; 3; 9], clearly demonstrate this.

Ridel L.N. [12] and Kuzmin S.A. [4] attaches great importance in their works to the methodological aspects of the formation of innovative potential and its assessment, A.I. Devyatilova [1] – to development methodology.

2 Materials and Methods

According to the results of the study of theoretical and methodological sources, the main research method is a comparative analysis of methods and results of assessing the innovative potential of regions after their application. The study was carried out sequentially in the following stages:

1. Selection and study of sources containing a description of methods for assessing the innovative potential of the region, comparing their strengths and weaknesses;
2. Search for reports and publications containing the results of applying individ-ual methods. The choice of a time period in the recent past for the practical application of the methods.
3. Selection of regions for calculating the level of innovative potential using methods, the results of which have not been published in recent years.
4. Application of selected methods to assess the level of innovative potential of several regions over several years and a comparative analysis of the results of calculations between methods, as well as with reports on the use of other methods, taking into account the level of transport development.
5. A critical approach to the results of studying methods for assessing innovative potential through the prism of optimality criteria, as well as the choice and recommendation of a methodology for its further improvement and applica-tion.

The optimality criteria for the method for assessing innovative potential in-clude the following provisions:

1. The method evaluates a sufficient range of internal factors of the region that affect the increase of its innovative potential in accordance with the chosen definition of the region's IP;
2. The method is applicable in a short time and by a small number of researchers;
3. The possibility of data manipulation when applying the method is excluded or less likely due to its obviousness;
4. If all of the above conditions are met, the method is less labor-intensive and produces the same evaluation result as most of the methods that inspire confi-dence. This criterion is applicable at the last stage of the study, in the process of debriefing.

3 Results and Discussion

For the practice of assessing the innovative potential of regions, 2 methods were selected, the results of which were not published in open sources. The reasons for their choice were: the simplicity of calculating the innovative potential of the regions, the calculation of indicators of which more accurately demonstrates the results achieved in a particular area of activity, as well as the visibility of the results obtained based on the constructed graphs. According to the authors, they correspond to 1-3 optimality criteria. At the same time, the second method, according to its claims, is closed on the need to develop transport.

At the same time, some methods were rejected due to an incomplete report on the innovative components of the regions, which required additional research into certain areas of activity of the regions and the identification of gaps in innovation policy. The limitations of the study prevented this.

Method 1. Comparative analysis of the levels of innovative potential use of the constituent entities of the Russian Federation.

This method is based on the study of individual entrepreneurs of the constituent entities of the Russian Federation, and the algorithm is based on three sequentially implemented stages.

The first stage - Description of the normative model of the state of innovative potential through a system of quantitative and (or) qualitative requirements for the resource

and performance characteristics of the potential. First, it is necessary to identify a list of indicators that will be used to analyze the innovative potential of the region
The formula for this study can be described as follows (formula 1):

Innovative potential = resources + infrastructure + result (1)

The second stage - Assessment of the actual (current) state of the IP (taking into account the developed normative model). The assessment is carried out by analyzing the discrepancy between the normative and actual parameters of the potential – highlighting its strengths and weaknesses.

There are three types of inequality that can characterize the innovative potential and highlight the strengths and weaknesses of the constituent entity.

I < = R An unsatisfactory state requiring radical changes is classified as a weak side of the innovative potential

R < I < Z Crisis state requiring limited changes in order to achieve the goals of innovative development.

I > = Z A satisfactory state, adequate to the set tactical innovation goals, requires changes aimed at maintaining positive dynamics, and is classified as a strong side of the innovation potential.

At the second stage, to analyze the discrepancy between the normative and actual parameters of the innovative potential of the region, systems of inequalities are determined that link the generalizing indicators with their boundary characteristics, where I is the actual value of the generalizing indicator characterizing one or another component of the innovative potential, and R and Z are the threshold values of the generalizing an indicator of innovative potential expressed through the characteristic of a parameter that reflects the boundary of the minimum acceptable level of decline in the state (in the case of R) and the boundary of its pre-crisis state (in the case of Z) [8].

The third stage is a description of possible directions for strengthening the innovative potential of the region, taking into account the results of the analysis. This stage allows determining the directions for the implementation of innovative transformations. At this stage, the results of the analysis of the comparison of normative and actual parameters serve as the basis for identifying the relevant zones of the state of the region's innovative potential and determining directions for the implementation of innovative transformations.

Method 2. Integral assessment of the innovative potential of the Northern and Arctic regions.

Method 2 makes it possible to assess the innovative potential and the need to calculate indicators based on three stages of assessment. It identifies a system of generalizing indicators, on the basis of which a graph of the innovative profile of the regions of the North is built to determine the strong and weak characteristics. This makes it possible to characterize the innovative potential. In addition, the development of these regions is impossible without the development of transport. The indicators were divided into groups in order to highlight different segments of the region's development depending on the types of activities or other components. The systematization and generalization of indicators made it possible to form five groups of them: personnel, technological, financial, scientific and productive components. In each group, the main indicators were identified that can reveal the level of innovative activity of the regions.

For a complete study, a system of indicators was also developed that characterizes the state of development of the knowledge economy in the region in a developing economy. The input indicators, the analysis of which is presented in the form of innovation costs, are divided into three categories – human resources, knowledge creation, knowledge transfer and application. The outgoing indicators, which are presented in the results of innovation activity, have been singled out in one category – this is the entry of products to the market,

intellectual property and the application of knowledge. Each category plays an important role in the development of the region's innovative potential [13].

The potential value of each of the indicators (Ii) is evaluated on a scale from 0 to 1 in order to get rid of the dimension, and is calculated as follows (formula 2):

$$I = \frac{Xi - Xmin}{Xmax - Xmin} \quad (1)$$

where *Xi* – the actual value of the indicator in the i-th year;

Xmax (min) – the maximum (minimum) value of the indicator in the i-th year.

The final index of the region is calculated as the average score of all indicators (formula 3).

$$SII = \frac{\sum_{i=1}^{n} Ii}{n} \quad (2)$$

where *n* – number of indicators included in SII.

Also, for comparison, the published results of the analysis of the HSE Rating of Innovative Development of Regions [6] and the report on the assessment of the RIA Novosti Rating [7], which are comparable in time and carried out in all regions of the Russian Federation, were taken.

In this part the study showed that the second method for assessing the innovative potential is more extensive, complex, but not too complicated. This gives more accurate indicators for different types of activities of the regions, compared to the first one, and also allows drawing indirect conclusions in relation to the transport infrastructure. The first method, in turn, is aimed at identifying indicators of industrial production, which was also necessary for our study, because all indicators had to be evaluated. At the same time, an assessment of industrial production alone is not enough, since it does not take into account the sector of innovative services, in which Russia often occupies a leading position. Thus, the factor of development of transport infrastructure as a necessary element for ensuring physical communication, speed of delivery and comfort of movement of labor resources was not taken into account.

In addition, such a significant difference in their results when focusing on similar factors – innovative production – slightly discredits Method 1 and RIA Novosti. Most likely, a deeper analysis should be carried out and identify the strengths and weaknesses of each region in order to re-evaluate the factors of innovation potential and not allow falling performance. There are good reasons to believe that the results of factor analysis will be quite different.

4 Conclusion

In response to the questions posed in the introduction, we can say the follow-ing:

Firstly, different methods are aimed at estimating different parameters, which allows, with the correct interpretation of the results, considering them quite com-plete and complex. However, method No. 1 is the most compact in terms of the number of parameters to be evaluated, method No. 2 is more labor-intensive in terms of the number of parameters to be evaluated, and the methods of NRU HSE [6] and RIA Novosti [7] (will be described in details in the next part of the study) are the most complex in terms of the volume of parameters and their calculations.

Second, manipulation is possible. Many of the indicators taken into account in the assessment in each methodology can be assessed in different ways. For ex-ample, the number of personnel employed in innovative production, internal costs of research and development, the share of innovative goods, works, ser-vices in the total volume of shipped goods, work performed, services, the share of small enterprises in the region that carry out

technological innovations and others can be considered and interpret differently. This imposes a special respon-sibility on the group of researchers involved in the collection of information, calculations and their interpretation, which requires the protection of the group of researchers from pressure from their leadership, as well as the administration of the regions. The results of the practical application of the methods will be dis-closed in the next publication.

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