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On assessing the contribution of an innovation factor to the results of the regional economic development

Nowadays, innovations are regarded as the main factor of economic growth in the region that is recognized by both public authorities and scientific community. In this regard, one of the major scientific challenges is to assess the contribution of an innovation factor to the results of the regional economic development. The researches of this problem presented in the literature are based on the use of production functions apparatus – Cobb – Douglas model, Solow growth model. The author suggests assessing the contribution of an innovation factor to the results of the regional economic development basing on the assessment of various aspects of effective innovation activity – the efficiency of innovation projects, innovation activity of enterprises in the region, management efficiency of innovation processes in the region. Integrated assessment proposes to compare in dynamics the growth of gross regional product and regional innovation cost.

Innovation factor, innovation activity of an enterprise, assessment of innovation management efficiency.

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Under present-day conditions the economic development of a region should be based on the extensive use of innovation and formation of innovation economy, because the forced consumption of natural resources and subsidies from the federal budget, which is typical for the recent years, can not provide the long-term sustainable development of regions.

The necessity of innovation economy is recognized by both the state and scientific community. This way is called the strategic direction of our country's development in the first half of the XXI century [4]. Foreign scientists (F. Fukuyama, A. Toffler, D. Bell, J. Naisbitt, etc.) believe that innovation economy ensures the world economic supremacy of most developed countries that implement it [3, 6, 8, 11].

The Strategy for Innovation Development of the Russian Federation for the period until 2020 emphasizes that the innovative development is the main source of economic growth. According to this document, economic transition to the innovative socially-oriented model of development is the only possible way to ensure a high level of public welfare and secure our country's geopolitical role as one of the global leaders [7].

There are different approaches to innovations in literature. However, it is possible to point out the main feature of innovation that is noted by most authors: it is a practical application of innovations [1, 2, 4, 10]. Thus, the innovation is understood as a result of science, engineering and technology, which is used in practice.

Accordingly, the innovation factor is a driving force of regional economic development aimed at enhancing innovation, the development, commercialization and implementation of innovations for ensuring economic growth in the region. In our opinion, the innovative factor in the development of regional economy, as opposed to natural resources, should be used and significantly improved. In order to use innovations as a developmental factor, it is necessary to assess their contribution to the regional economy.

The problems of innovation factor's influence on the development of economic systems have been actively studied since the mid last century. Macroeconomic modeling with the apparatus of production functions was used to fulfill this task. Modern neoclassical models of economic growth are based on the production function, and they are focused on the prerequisites for full employment, flexible market prices, as well as the complete interchangeability of production factors. The attempts to study the influence of production factors' quality (their efficiency) over economic growth have led to a model of the Cobb – Douglas production function [9].

The Cobb – Douglas production function is a result of mathematical transformation of a simple two-factors production function $y = f(x_1, x_2)$ that reflects the dependency between the amount of output y and two types of resources: material x_1 (costs raw materials, energy, transportation) and labour x_2.

The Cobb – Douglas function is of the following form [5]:

$$N = A \times L^{\alpha} \times K^{\beta},$$

where: N – national incomes;

A – dimensionality coefficient;

L and K – the amount of labour and capital expended, respectively;

α and β – constants (coefficients of production elasticity of labour and capital K).

The Cobb – Douglas function shows the share of the total product that is awarded to the production factor that is used in manufacturing of this product. This feature of the model was considered by an American economist, 1987 Nobel Prize winner for the fundamental research in economic growth theory Robert Solow, who proposed to complete a model with such a factor as technological progress. Solow meant the totality of the qualitative changes in labour and capital under the technological progress.

The Solow growth model describes the mechanism of long-run economic growth, preserving economic balance and full employment of factors. The model identifies the technological progress as the only basis for sustainable welfare growth. However, the Solow model, emphasizing the importance of technological progress for economic growth, does not allow us to determine its impact on this growth (such as to other factors – labour and capital).

Russian authors prove the possibility to use the model of production function, which involves exogenous controlled function of "involvement in innovation processes" besides endogenous neutral technical progress, in order to assess the influence of an innovation factor over economic growth rates. The contribution of innovation factors is to be calculated through this function as a relative change in the complex of indicators of innovation factors prevailing in the world experience, i.e. as a dimensionless rating quantity [9]. Author's conclusion is interesting: scientific-technical progress plays quite a serious role in the economy of Russia, however, the net contribution of innovation factors (including institutional innovation) is too low. Innovation factors have not reached the level of use, which allows transition to accelerated economic growth.

In our opinion, it is possible to assess the impact of the innovation factor on the regional development basing on the evaluation of innovation efficiency.

In this case some different aspects of innovation effectiveness can be considered:

- effectiveness of innovation projects that are strategically important for the regional development;
- innovation activity of enterprises in the region;
- effective management of innovation processes in the region.

The methodology for assessing the effectiveness of innovation projects is widely represented in the literature. Such projects can be considered as investment ones; it is possible to use the Guidelines for the evaluation of investment project efficiency, UNIDO methodology, the works of Russian and foreign scholars that are devoted to this subject [1, 2, 10].

All methods of assessing project's efficiency can be divided into two groups based on discounted and accounting estimates. In modern Russian conditions the discounted methods for evaluating project's effectiveness are preferable because they take into account inflation, interest rates, rates of return, etc. According to these methods, the indicators of project's effectiveness are net present value, internal rate of return, payback period, etc.

As it is proposed to consider strategically important projects, the criteria for labelling the projects as strategic should be defined. This can be determined by the share of budget financing of the project – the more the project is important for the regional development the more such share is; it also can be defined by budget efficiency – budget revenue growth due to project's implementation, and by social significance – the acuteness of the social problem that is solved by the project. In addition, since we are talking about innovation projects, it is necessary to take into account the level of results' novelty that can significantly influence a region's competitiveness on the domestic and foreign markets.

The second aspect of effectiveness is the innovative activity of enterprises in the region.

According to the statistics of Russia, innovative businesses are the companies which have implemented innovations over the last three years or the companies which are investing innovations during the reporting year. Three approaches are proposed to be used in science literature for assessing an enterprise's innovation activity: formal, resource and cost-based, resultative [10].

The main task of a researcher in the formal approach is to identify the activities that can be classified as innovative. The resource and cost-based approach is formed on the valuation of various resources that are used by the company at all the stages of innovation process in monetary terms. It is necessary to identify the kinds of activity that are classified as innovative and the types of resources and costs that are considered in the assessment in order to implement this approach. The resultative approach is based on the identification of possible effects that can be achieved by an enterprise due to innovation activity and their money measure. It is necessary to identify the effects that will be taken into account when assessing innovation activity.

In our opinion, it is better to use the resultative approach in the context of this problem. It is possible to use as the results such indicators as value added created through the implementation of innovation, profit, product cost savings that are obtained due to innovations, as well as product quality growth, increase in job satisfaction among employees, etc. A variety of companies' innovation activity indicators demonstrates the versatility of the characteristics and, at the same time, the possibility of an integrated assessment.

There are different methods for the integrated assessment of a complex phenomenon on the basis of heterogeneous factors or characteristics. It is possible to use a graphical method, when a composite index is defined as the area of the polygon, which vertices number corresponds to the number of particular characteristics considered [10].

In this case the actual values of indicators are compared with standard values that correspond to the best value among the regional companies or that are set by experts. The normalized values of indicators are changed in the range from 0 to 1. One shows the highest level of innovative activity for this indicator, zero shows the absence of innovations.

A leaf-type diagram, showing the distribution of indicators' values in the point of origin, is based on normalized values. The graphical interpretation of a complex index helps to interpret the diverse characteristics that determine the intensity of innovation activities of an enterprise. It is possible to carry out a comparative spatial analysis using this method and determine the general state of innovation activity in the region and its dynamics.

The assessment of innovation management efficiency in the region is the most difficult one. We believe that it is possible to assess three positions:

- results achieved;
- conditions that are created at the moment for future results;
- organization of management process.

In order to assess the first position, it is necessary to determine the indicators characterizing the results of innovation activity in the region, then their target values are established, the degree of achieved target values of innovation activity indicators is estimated by comparing them with the actual indicators obtained in the analyzed period.

It is reasonable to include the following indicators among the showings of the regional innovation activity:

- the total number of innovation projects;
- the number of innovation projects that are successfully completed;
- the amount of research fundings at the expense of the regional budget;
- the scientific and technical level of research;
- the share of off-budget financing of innovations;
- the number of patents;
- the number of new products, services and businesses that are launched.

The above list of indicators is not exhaustive; it should be formed taking into account the characteristics of innovation activity in the region.

It is reasonable to assess the possibility of achieving results in future (i.e. the conditions that are created for them) by the amount of diverse resourses, which are involved in innovation activity at the moment.

They are:

- ✓ the number of people employed in the innovation sphere (intellectual capital);
- ✓ the number of scientific, research and educational institutions, innovation and implementation structures, including industrial parks, business incubators, etc. (as the material base of innovations);
- ✓ the number of innovative companies;
- ✓ total financial resources that are invested into innovation activity.

The organization of innovation management is estimated by experts as a quality of conformance to the following requirements:

- feedback efficiency as the possibility to respond rapidly to the signals of external and internal environment (the rational management of organization);
- the ability to influence proactively the opportunities and threats that are caused by the external environment (a variety of interaction forms of different administrative authorities and the structure of their tasks, high quality of planning and analytical support for decision making);
- effectiveness as a low cost value of management system operation.

Some criteria can be used to evaluate the performance of each requirement, which will increase the validity of expert opinion.

We propose that integrated assessment of innovation factor's contribution to the results of economic development (ED) should be based on the ratio of GRP growth to the increase in the cost of innovations:

$$ED_{\text{i}} = \frac{GRP_t - GRP_b}{I_t - I_b} \times 100,$$

where: GRP_t, GRP_b – gross regional product in the reporting and base period, respectively, rub.;

I_t, I_b – total cost of innovations in the region in the reporting and base period, respectively, rub.

Of course, GRP growth is ensured not only by innovations; it is influenced by many factors. Therefore, the assessment by this formula should be considered in dynamics; it is necessary to account it for several periods and analyze the changes.

In summary, we have drawn the following conclusions:

- the innovative factor of economic development plays a key role in the modern world;
- the impact of innovations on economic growth is reflected mainly through macroeconomic modeling using the apparatus of production functions;
- the assessment of innovation factor's contribution to the development of the regional economy was based on assessing various aspects of innovation effectiveness – innovation projects efficiency, innovation activity of enterprises, effective innovation management in the region;
- it is reasonable to compare GRP growth and innovation costs in dynamics in order to assess fully the contribution of innovation factor to the development of regional economy;
- the assessment of innovation efficiency is a separate and many-sided area of economic knowledge, and it has a great potential for further researches.

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