

# Innovative activities in Primorsky Krai: a methodical approach to assessing the effectiveness

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**Abstract.** The purpose of this work is to offer a model of the assessment of innovation effectiveness. Innovation activity is a basic component of the innovation potential and is a tool and mechanism for the innovation economy. The authors propose a holistic model for assessing the effectiveness of innovation from several points of view. The methodological approach to determining the effectiveness of innovations involves comparing the results of innovation activities with innovative expenditures that provided this result. This allows taking into account the synergistic effect expressed in improving the economic efficiency and effectiveness of activities. When assessing innovation efficiency, it is necessary to consider not only the design criteria for evaluating investment projects, but also the assessment of the degree of influence of the results of innovation activity on the development of production. The obtained results can be used when forming the project measures by the federal and regional municipal authorities to increase the efficiency of the managerial impact on regional processes. These elements allow forming the set of instruments that increases the efficiency of the managerial impact.

## 1 Introduction

The innovation development policy in the context of global transformations is a strategic task of the Russian Federation. The key priorities of the state innovation policy are increasing the demand for innovations in the economy, as well as the development of cooperation between various participants in innovation activities. In this connection, new instruments of public-private partnership in the innovation sphere are being developed. State development institutions are created to solve problems that cannot be optimally implemented by market mechanisms in order to ensure sustainable economic growth and diversify the economy. Innovative territorial clusters providing a synergistic effect, expressed in increasing economic efficiency and effectiveness of activities. Clusters have

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significant growth potential. The main directions for the development of clusters are the development of the research and development sector, the development of production and investment activities. The development and implementation of the largest companies with state participation of innovative development programs are intensified, within which it is planned to increase companies' spending on research and development and production modernization, as well as expanding cooperation with scientific and educational organizations, small and medium-sized businesses [1].

The innovation infrastructure is the basic component of the innovation economy, the innovation potential of society; it is a tool and mechanism of the innovation economy. Innovation infrastructure is a kind of bridge between the results of scientific research and the market, government and business. Development institutions are one of the public policy instruments that stimulate innovation processes and infrastructure development using public-private partnership mechanisms [2].

## **2 Materials and Methods**

The methodological approach to determining the effectiveness of innovation is well known: the results of innovation are compared with the innovation costs that provided this result.

The main stages of the formation of the methodology associated with the first need to improve productivity and efficiency in the enterprise. As part of this, the works of F. Taylor "The Foundations of the Scientific Organization of Labor" 1910, G. Ford "Conveyor Assembly Technologies" 1920, Taichi Ono "The Concept of Lean Production (TPS)" 1950 research are known. Since 1920, the requirements of quality production have been added and the achievement of quality has become synonymous with innovation. A method of statistical process management has emerged to control processes and improve their stability. For this purpose, the main statistical quality control methods were used. In 1990, Morolla, General Electricians introduced the Six Sigma method in corporate governance to minimize the likelihood of defects in operations. The next important stage in the development of innovation management was their perception as a necessary response to changes in the world, which in turn generate changes in enterprises.

ISO international standards provide enterprises with a coordinated organization of quality management activities, which is closely related to innovation. Methods of managing innovations as changes for products were created thanks to the Theory of Inventive Problem Solving (TIPS) by G. Altshuller in 1950. R. Cooper's Stage-Gate Method (Stage-Approach). 198 ideas prior to product launch. Both of these methods are designed only for product innovation [3].

Today, global studies of innovation processes are conducted, and a methodological basis is created for the conceptual apparatus of innovation processes. Innovation management requires portfolio management methods and the development of a system of indicators for evaluating innovation in accordance with an enterprise strategy. In this regard, when implementing innovative projects, their conformity with the strategy is assessed, respectively, the use of the methodology for assessing the strategic performance of Bacapse Scorecard (BSC) is unavoidable. Innovative projects are inevitably a highly risky activity, therefore at all stages, it is necessary to use risk management standards, among which I would especially like to highlight the corporate standards COSO and FERMA. The quality standards ISO 9000, CMM and CMMI have become widespread in evaluating innovative projects. Of course, a major role in managing innovations, especially improving innovations, is played by the standards of "Six sigma".

In the Russian practice of innovative project management, project management standards are used. One of the most popular standards in the world are the Project management institute (PMI), International Project Management Assotiation (IPMA)

standards. PMI standards include standards for project, program and portfolio management, but they do not take into account national specifics [4].

It can be argued that the assessment of innovation is a separate block of economic analysis of the effectiveness of entrepreneurial activity. According to the author, to assess the effectiveness of innovation, a holistic model for assessing the effectiveness of innovation from several points of view is necessary:

- 1) meet the needs of interested parties;
- 2) input from interested parties;
- 3) innovation strategy;
- 4) process;
- 5) opportunities.

Consideration and analysis of the innovation project throughout its life cycle (the billing period) and modeling the flow of products, resources, and money at all stages of the implementation of the innovation project [5].

Analysis of numerous studies on the problem of evaluating the effectiveness of activities has shown that most authors identify innovative efficiency with an assessment of the effectiveness of investment projects. It is also worth noting that the coefficients for evaluating the effectiveness of investment projects, such as net present value, payback period, and return on investment, are mainly focused at the micro level. According to the author, when evaluating innovation efficiency, it is necessary to consider not only the design criteria for evaluating investment projects, but the assessment of the degree of influence of the results of innovation activity on the development of production [6].

The effectiveness of innovation is a relative value that can be measured by indicators such as: the profitability index of innovation; accounting rate of return; internal rate of return; efficiency of use of own and borrowed capital; budget efficiency, etc. The scientific and technical effectiveness of the results of applied research and development works is determined in conjunction with the assessment of their economic and social efficiency using indicators of the scientific and technical level.

### **3 Results**

The formation of a mechanism for the sustainable development of the industrial complex of the Far Eastern region as a whole, in Primorsky Krai in particular, should be based on innovations, which are the instrument determining its sustainable development.

This can be achieved through an increase in industrial production; strengthening the financial and economic position of industrial complex enterprises; increase in labor productivity; cost reduction of products; growth of profitability of production; reduction in the share of unprofitable enterprises; implementation of measures to improve the competitiveness of goods, works and services on the basis of improving the quality of products; development of integration processes based on interregional and inter-sectoral cooperation; introduction of innovative products and technologies into production; the intensification of work to attract investment resources to the industrial complex of the region; increase employment; saving and increasing the number of jobs; implementation of the task of increasing the average monthly salary of production personnel; ensuring healthy and safe working conditions at the enterprises of the regional industry. Innovative efficiency is the result obtained from the use of innovative developments, which is expressed in bringing to the market products (goods and services) with new consumer properties or a qualitative increase in the efficiency of production systems and production lines

In many ways, the economy of Primorsky Krai today can be considered one of the most competitive in Russia and investment attractive for both domestic and foreign investments.

Industry as a leading sector of material production occupies a special place in the regional economy and plays a key role in the process of reviving the country's economic potential.

Based on statistical data from the Federal Statistical Service and the Ministry of Economic Development on a number of the most important indicators of regional development, the Primorsky Krai is a moderately promising region, although it occupies a high place in terms of “foreign investment” - 17. Businessmen from Japan, the Republic of Korea, China and Norway [7].

Elements of the infrastructure of the regional innovation system in Primorsky Krai: technology parks, innovation and technology centers,

innovation and industrial complexes, innovation and technology clusters, technology transfer centers

Despite the rather favorable economic and geographical position of the Primorsky Krai, the proximity of dynamically developing and highly developed countries such as China, Japan, Korea and the Asia Pacific in general, the opportunities opening here are poorly used and have a framework, non-strategic character in the sphere of investment and innovation. The potential of this region is not fully used.

In many ways, the economy of Primorsky Krai today can be considered one of the most competitive in Russia and investment attractive for both domestic and foreign investments. On the territory of the region, many targeted federal target programs are being implemented.

The economy of Primorsky Krai, the largest in the Russian Far East of the region in terms of population and the size of production assets in the course of market reforms, was transformed from an industrial raw material to a service type.

Dynamically developing in recent years, the Primorsky Krai is increasingly positioning itself in the global geopolitical space as a major global logistics center, as a link between the long-established Europe and the rapidly growing pace of the Pacific part of the globe. At the same time, the innovative way of development has already become obvious and unopposed for everyone.

In this context, it becomes extremely important to determine the strategy of the innovation activity of Primorye, which takes into account equally the economic, social and other resources of the region of today and tomorrow, the dynamics of regional integration processes [8].

Imagine the results of innovation in industry and services. In the table 1 we present the data characterizing the level of innovation activity, the cost of innovation and the release of innovative products (works, services).

**Table 1.** Volume of innovative goods, works, services in 2017 million rubles

	<b>Shipped goods of own production, completed works and services on their own</b>	<b>including innovative</b>	<b>of them are newly implemented or have undergone significant technological change in the last three years</b>	<b>In% to the total volume of goods shipped</b>
Total for the surveyed economic activities in the field of innovation	293528.9	1560.7	1560.7	0.5
agricultural activities	4740.4	-	-	-
industrial activities	261104.0	917.1	917.1	0.4
mining	21572.4	113.8	113.8	0.5
metal ore mining	6007.0	113.8	113.8	1.9
processing industries	179717.7	803.2	803.2	0.4
wood processing and manufacture of wood and cork products, except furniture, manufacture of products	2956.8	6.9	6.9	0.2

	Shipped goods of own production, completed works and services on their own	including innovative	of them are newly implemented or have undergone significant technological change in the last three years	In% to the total volume of goods shipped
from straw and materials for weaving				
manufacture of other finished products	671.2	671.2	671.2	100.0
telecommunications activities	20737.9	628.4	628.4	3.0
food production	34947.8	2.0	2.0	0.0
manufacture of machinery and equipment not included in other groups	2189.6	5.7	5.7	0.3
manufacture of computers, electronic and optical products	4505.1	117	117.3	2.6
research and development	1372.1	15.3	15.3	1.1
Agro-industrial complex	56747.3	23.0	23.0	0.0

According to the table, it should be noted that the maximum amount of economic activity in the sphere of innovations is occupied by the processing industries (803.2 million rubles); the production of other finished products (671.2 million rubles); in the sphere of telecommunications (628.4 million rubles) and the production of computers, electronic and optical products (117 million rubles.); in the field of scientific research (15.3 million rubles.) and development and agro-industrial complex (23 million rubles.).

Efficiency is determined by the ratio of the volume of economic activity in the field of innovation to the costs of economic entities in this area (140.5 million rubles) [7].

**Table 2.** Costs of organizations for technological innovations by sources of funding in 2017 (million rubles)

	<i>Total</i>	<i>of which types of economic activity</i>		
		<i>Agriculture</i>	<i>industrial production</i>	<i>agro-industrial complex</i>
Costs of technological innovation - total	2087.8	3.0	1241.5	117.2
by sources of financing:				
own funds of the organization	1832.9	3.0	1044.3	27.0
federal budget	135.6	-	81.0	54.3
regional budgets and local budgets	47.1	-	44.0	-
other	72.2	-	72.2	35.9
made with loans and borrowings	69.2	-	69.2	35.9
by type of technological innovation				
grocery	405.4	-	379.6	26.6
process	1682.4	3.0	861.9	90.6
Number of cost organizations on innovation - total	31	1	18	11
of them on:				
marketing	2	-	2	2
organizational	1	-	-	-

The maximum amount of sources of financing innovations belongs to the own funds of organizations, the main share of which goes to financing process innovations.

The strongest industries of Primorsky Krai in terms of innovation potential are ocean development technologies and pharmaceuticals, mariculture, food production, and fisheries.

Technological solutions in the field of autonomous underwater vehicles, in particular, solar batteries, developed by the Institute of Marine Technologies, are being implemented in various large-scale ocean development projects. It is very promising to use these developments in early warning systems for natural disasters, which can be in high demand in the Asia-Pacific region.

The Free Port of Vladivostok contributes to the inflow of investment resources from both the state and private investment from residents of the free port

## 4 Discussion

Consequently, there is a need for the formation, refinement and systematization of tools for assessing innovation efficiency.

Practical methods for evaluating economic efficiency include the calculation of several indicators: an integral indicator of efficiency; index of profitability of investments; internal rate of return; payback; break-even point of the project [9]. In addition to formalized indicators for evaluating performance, one should take into account various restrictions (deadline for recoupment, requirements for environmental protection, personnel safety) and informal criteria (penetration into new sales markets, crowding out competing firms from the market, political motives) [10].

The economic effect is determined by the excess of the valuation of the results of innovation activities over the valuation of the costs associated with it and is calculated by the formula:

$$E_{\pi} = \sum_T (P_{\pi} - Z_{\pi}) \alpha_T$$

$E_{\pi}$  — the economic effect of innovation for the billing period;

$P_{\pi}$  — valuation of results for the billing period;

$Z_{\pi}$  — cost estimate of costs for the billing period;

$T$  — discount factor [11].

In the process of researching the innovation activity of enterprises of the Primorsky Krai, additional criteria have been identified that require consideration in the evaluation of the innovation activities of business entities in addition to the generally accepted indicators for assessing the feasibility of innovation projects.

We present the results of innovation activities highlighted by the authors, affecting the development of production in 2017 and assessing the degree of their influence.

**Table 3.** Assessment of the degree of influence of the results of innovation activities on the development of production in 2017

№	Indicators	Degree of impact			
		low	average	high	no impact
1	Expansion of the range of goods, works, services	4	17	12	41
2	Preservation of traditional markets	2	15	12	45
3	Improving the quality of goods, works, services	2	21	19	32
4	Replacing obsolete products	3	11	6	54
5	Increase in employment	10	6	3	55
6	Increased production flexibility	11	15	3	45
7	Production capacity growth	6	12	11	45

№	Indicators	Degree of impact			
		low	average	high	no impact
8	Reduce costs on salary	10	8	4	52
9	Material cost reduction	5	21	4	44
10	Improving energy efficiency of production (reducing consumption or loss of energy resources)	10	10	6	48
11	Improving labor conditions and safety	6	18	4	46
12	Reduced time to interact with customers or suppliers	4	10	7	53
13	Increased motivation for innovation	8	15	7	44
14	Improving information links within the organization or with other organizations	5	13	9	47
15	Reducing pollution	6	10	5	53
16	Ensuring compliance with modern technical regulations, rules and standards, the requirements of sanitary, veterinary and phytosanitary control	3	10	13	48
17	Increase in yield and / or productivity of livestock and poultry, aquaculture objects	1	2	1	70
18	Preservation, restoration and improvement of soil fertility of agricultural lands	1	-	2	71
19	Smoothing the seasonality of agricultural production; decrease in dependence on weather, climatic and other environmental conditions	1	-	1	72
20	Minimizing the loss of the nutritional value of products during storage, transportation and processing of agricultural products	1	-	3	70
<i>Marketing innovations</i>					
21	Introduction of goods, works, services to new markets in new consumer groups	2	8	3	61
22	Introduction of goods, works, services to new geographic markets	4	5	3	62

These indicators are necessary to be grouped to the subsystems of the economic evaluation of innovation: 1) products, 2) resources and 3) ecology subsystem.

The indicators 1, 2, 4, 21, 22 can be referred to the indicators of the product subsystem. The indicators of the resources subsystem include 5, 6, 7, 8, 9, 10, 11, 12, 13, and 14. The resource effect reflects the impact of innovation on the production and consumption of a particular type of resource. The resource effect can be estimated in terms of value and is fully included in the economic effect and is displayed as indicators of improved resource utilization: productivity growth; the growth of capital productivity of fixed assets; the acceleration of the circulation of inventories, receivables, etc. In addition, the tax effect has a significant effect, which is determined by the cash savings of an economic entity due to the range of tax and other benefits provided to executives of innovative programs. The level of development of the subsystem of the ecology is determined by means of indicators 15, 16, 17, 18, 19, 20. The environmental effect characterizes the impact of innovation activities of business entities on the environment and is determined by: reducing pollution of the atmosphere, land, and water with harmful components; reduction of production waste; increased ergonomic production.

Consideration of the factors identified by the authors is necessary for the integral assessment of the effectiveness of innovation using weights. Thus, those factors were selected as factors of the model, which reflect the logics, and progress of the cost

effectiveness of innovation. The main criterion was the selection of adequate particular indicators that shall correspond to the following requirements: they shall reflect sufficiently the level of the development of subsystem; they shall be statistically available and

A general indicator of the economic evaluation of innovation is determined as a resulting indicator concerning the ratio of the evaluation indicators of level of products, resources subsystems and ecology subsystem:

$$K = wpkp + wrkr + weke$$

where  $kp$ ,  $kr$ ,  $ke$  are indicators of the subsystems;

$wp$ ,  $wr$ ,  $we$  are the corresponding weighing coefficients of the indicators of the subsystems.

In the proposed integrated assessment, it is necessary to take into account the principle of alternativeness, which takes into account the various possibilities of using resources, ways to achieve the goal of an innovative project, the choice of the best options for design solutions.

The proposed methodological approach also envisages a multi-stage assessment at the stages of justifying the size of innovative costs, feasibility studies, selection of a financing scheme, monitoring, etc. At each stage, the cost of the project is specified.

## 5 Conclusion

Thus, as a result of the research performed using the methods of horizontal and vertical analysis, comparison, index method within the frames of the analytical approach, the following results were obtained.

The model of the evaluation of the cost effectiveness of innovation was grounded, which is based upon the use of three integral indicators of the subsystems measuring the degree of influence of the results of innovation activity on the development of production on the analogy with the strategic initiatives.

In the process of researching the innovation activity of enterprises of the Primorsky Krai, additional criteria have been identified that require consideration in the evaluation of the innovation activities of business entities in addition to the generally accepted indicators for assessing the feasibility of innovation projects. The proposed methodological approach to evaluating the effectiveness of innovations provides for an integrated assessment taking into account the factors identified by the authors through weighting factors that correct the magnitude of economic efficiency.

Currently, during the period of active integration of the Russian economy into the global economic space, the innovative development path is a priority in the economic policy of the country as a whole and in the Primorsky Krai.

Opportunities for the modernization of technical re-equipment and the introduction of new organizational and marketing processes are largely determined by the general level of development of production and the state of financial and economic activities of enterprises and organizations [12].

To conduct a study of the development of innovation processes, a combined method has been implemented, combining (integrating) federal and regional information resources characterizing innovation activity in the fields of industrial production. The study of the innovative potential of enterprises of Primorsky Krai covers 822 registered and operating business entities.

In order to make the analyzed data comparable, a single circle of the studied economic activities was selected, including enterprises and organizations of the industrial complex (mining industry, manufacturing industries), as well as infrastructure complex enterprises engaged in the field of telecommunications. The scope of services in this study is



represented by the most promising, in terms of innovative potential, activities such as activities related to the use of computers and information technology, research and development, as well as the provision of other types of services.

One of the criteria for assessing the innovation development of a region is an indicator of the level of innovation activity, calculated as the ratio of the number of organizations implementing technological innovations to the total number of enterprises surveyed. According to the survey, in 2017, 37 enterprises carried out innovative activities. Thus, in the surveyed group of 75 economic entities that carried out innovative activities, 37 percent are manufacturing enterprises.

Thus, the survey showed that despite the low level of innovation activity in general, business entities have a high potential and in 2017, there was a tendency towards increased innovation activity.

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