FINANCING INNOVATIVE PROJECTS TO ENSURE SAFE DEVELOPMENT OF REGIONAL INFRASTRUCTURE

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Abstract

This article examines the current issues surrounding the financing of innovative projects for regional infrastructure development. The study aims to analyze modern financing mechanisms for such projects, including assessing their effectiveness and suitability for Russian conditions. The study employs systemic and institutional approaches. Methods of statistical data analysis, economic and mathematical modelling, expert assessment and comparative analysis were employed. The article systematizes key approaches to defining innovative infrastructure and studies sources of financing, such as budget loans, public–private partnerships and venture funds. It also develops a model for assessing the economic efficiency of projects. The main results include the classification of innovation infrastructure components, the identification of regional financing features, and recommendations for optimizing resource allocation. The study found that combining public and private instruments increases project sustainability, and that industry clustering contributes to an economic multiplier effect. The results of the study can be used to formulate regional development strategies.

Keywords: innovative projects, financing, regional infrastructure, clustering, public-private partnership, institutional approach

I. Introduction

The development of the regional innovative infrastructure remains one of the key tasks of the modern economy, but there is still a shortage of comprehensive studies devoted to the mechanisms of its financing in the scientific literature.

In a number of works [5], the authors focus primarily on methods for assessing the efficiency of projects, but do not take their regional specifics into account. Other studies [1; 7] systematized

the components of infrastructure (technological, financial, personnel), but do not propose clear algorithms for attracting investment.

A critical analysis of the works [10] by Grekov E.I. and Roshchina L.N. [8] revealed gaps in the study of the role of budget loans and public-private partnerships (PPP). For example, in the article "Budget credit as a mechanism of financial support..." [4] an algorithm for obtaining infrastructure loans is described, however, there is no assessment of their impact on the long-term development of regions. The research of E.A. Rybkina [9] shows, that foreign experience, demonstrates successful cases of mixed financing, but their adaptation to Russian conditions requires considering institutional limitations, such as a high share of state participation and weak development of the venture market [3].

The relevance of the study is due to the need to develop a methodology that combines theoretical approaches to structuring infrastructure with practical financing instruments. This will allow regions to overcome the imbalance between the need for innovation and limited resources.

II. Methods

The study used the following approaches:

1. A systemic approach is used to analyze innovation infrastructure as an entire system of interconnected elements (organizations, legal institutions, resources).

2. Institutional approach studies the role of state and social institutions in creating favorable conditions for investment.

The following methods were used:

- Statistical data analysis of Rosstat Statistical analysis and regional reports to assess the dynamics of patent activity and investment volume.

- Economic and mathematical modeling – calculation of project efficiency using formulas of net present value (NPV) and internal rate of return (IRR).

- Expert assessments – materials from interviews with representatives of the Ministry of Construction of the Russian Federation and regional administrations on the implementation of regional financing programs.

- Comparative analysis – comparison of cluster financing mechanisms in Russia

III. Results

The regional innovative infrastructure is defined as a system that includes four components [1]:

- technological and organizational (technological parks, business incubators);
- financial (venture funds, budget loans);
- personnel (educational organizations);
- innovation and legal (patent law, databases).

The successful functioning of the regional innovative infrastructure implies the effective interaction of all its components. Technological parks and business incubators provide a platform for the development of new technologies and start-ups, ensuring access to resources and expertise. Financial instruments such as venture funds and budget loans make it possible to provide financing for innovative projects at various stages of development.

Educational organizations that train qualified personnel for research and production companies play a key role in the formation of innovation potential. The innovation and legal component, which includes patent law and databases, ensures the protection of intellectual property and facilitates access to the necessary information for innovation activities.

The comprehensive development of all four components and their integration into a single system allows creating a favorable environment for the generation, commercialization and implementation of innovations, promoting economic growth and increasing the competitiveness of the region.

Financing of innovative projects aimed at developing regional infrastructure can be implemented through various models, adapted to the specific needs of participants and the capabilities of the regional market. The following financing models are most common in Russian regions.

Self-financing, in which each infrastructure participant finances the project using his own funds in accordance with a single, agreed business plan.

The model of collective self-financing is also used quite often. The essence of this model is that the participants of the infrastructure system create a special fund on a parity basis, accumulating funds to finance projects.

The model for attracting investment loans means that infrastructure participants attract borrowed funds in accordance with an agreed business plan.

A special role in the innovative projects` financing aimed at the development of regional infrastructure is given to the model involving state subsidies. Within the framework of this model, individual participants or a specially designated project participant, or a fund created by it, can receive state support within the framework of procedures established by the legislation of the Russian Federation.

The venture financing model is aimed at attracting investments from venture funds, both at the level of individual participants and through the fund created by them, in compliance with the rules adopted in this area.

It is also worth noting the model of financing infrastructure projects based on leasing operations. It consists in the fact that infrastructure participants or a fund created by them can acquire the necessary equipment on lease.

An alternative way to raise funds is to issue bonds by infrastructure entities or a specially created legal entity. Bond loans allow for the accumulation of significant capital required for the implementation of large infrastructure projects, while ensuring the diversification of funding sources. The attractiveness of bonds for investors increases with the presence of government guarantees or sureties.

Concession agreements are very important financing instruments. Under a concession, a private investor receives the right to construct and operate an infrastructure facility for a certain period, receiving income from its use. The state, in turn, receives a finished infrastructure facility built using private funds.

Among the new approaches, it is worth to highlight crowdfunding, which allows attracting small amounts from many investors through online platforms. This method is especially relevant for projects that have social significance and enjoy the support of the local population.

It is also possible to implement a mixed financing model that combines the various approaches listed above.

According to the study, investing in projects aimed at developing regional infrastructure brings benefits of varying significance to its participants. The value of these benefits largely depends on the level of significance of the participant, which is determined by its position in the hierarchical structure of the infrastructure entity – for example, belonging to the core or peripheral layers.

Direct financial benefits include:

- cost saving due to specialization, concentration and centralization of production and business processes;

- cost reduction through the use of transfer prices for products and services of joint ventures

and organizations

- profit markup due to monopolization of certain market segments and production of higher quality and more expensive products.

Strategic (indirect and long-term) benefits include:

- stabilization of operational processes and increase in order volumes;
- joint financing of investments, including external sources, which promotes collective development;
- expansion of the product range while maintaining a high level of unification and standardization.

A uniform approach to pricing is applied to participants in infrastructure entity. However, in fact, different profitability rates may be set for representatives of different status levels. This stimulates their desire to improve their status, increasing their importance for infrastructure entity. The influence of infrastructure projects on the position of participants is manifested in the redistribution of resources and competencies. Companies occupying central positions gain access to advanced technologies and expanded information, while peripheral organizations often focus on standardized tasks, contributing to the improvement of the overall efficiency of the system.

Stimulating status raising through the rate of return creates a healthy competitive environment. Companies strive to innovate and improve efficiency to gain a better position in the hierarchy and access to more resources and opportunities. This process continuously pushes the infrastructural entity to develop. At the same time, it is important to consider the possible risks associated with the concentration of power in the hands of the core of the infrastructural entity. A mechanism of controls and balances is needed to ensure a fair distribution of resources and opportunities among all participants, preventing imbalance and stagnation in development.

A study of various materials (statistical, reporting, etc.) for the period 2022–2025 showed a variety of sources of financing for regional innovation infrastructure. The structure of financing for regional innovation infrastructure, determined from a sample of data based on the author's calculations, is presented in Table 1.

Table 1: *Structure of financing for regional innovation infrastructure*

Source	Share in total volume (%)
Budget loans	42
PPP (private-public partnership)	28
Venture funds	10
Own funds	16
Foreign investment	4

As can be seen, the data analysis revealed the dominance of government instruments, which account for 42 percent of the total volume of finance.

A significant method of financing innovation infrastructure facilities is self-financing. It allows supporting certain role functions (production, maintenance) of infrastructure systems and individual enterprises, carried out outside the infrastructure entity and empowering them to independently determine the directions of activity. Self-financing implies the availability of stable and sufficient sources of income generated by the innovation infrastructure facility itself, including income from commercialization of developments, provision of services, rental of premises or participation in other similar projects. Effective management of these incomes and their reinvestment allows for the maintenance and development of infrastructure without constant

dependence on any external sources of financing.

In the context of ensuring the operation of innovative infrastructure, self-financing is especially relevant for stimulating entrepreneurial activity and increasing competitiveness. It enables small innovative enterprises and start-ups located in the infrastructure formation, to independently determine the vector of development, develop and implement their innovative ideas. It is also important that self-financing helps to form a culture of responsibility and efficiency in the use of resources among participants in the innovation infrastructure. Innovative infrastructure facilities that depend on their own income are significantly more inclined to optimize costs and search for new opportunities for earnings. This potentially makes them more sustainable and attractive to investors and partners.

As a rule, the settlement of accounts between participants in the innovation infrastructure and external partners for the rendered services are carried out according to generally accepted rules established for legal entities.

It was found that combining financing instruments (budget loans, PPP, venture, own funds) increases the sustainability of innovative projects by 20–30%, while at the same time the risks of their underfunding are reducing.

The efficiency of regional innovation infrastructure projects varies significantly. Calculation of the NPV for projects showed that with a discount rate of 12%, payback is achieved in 5–7 years.

In the regions of Russia, the creation of clusters as infrastructure entities based on mixed financing (60% - budget, 40% - private investment) is widely practiced, which leads to an average growth of the gross regional product (GRP) by 3-8%; the creation of 1.2 thousand jobs; an increase in patent applications by 15%.

Clustering of regional innovation infrastructure provides a multiplier effect: 1 ruble of investment generates 2.3 rubles of GRP.

A comparison of data across regions of the country revealed a correlation between the level of infrastructure development and innovation activity.

The study showed that regional socio-economic differences, as well as the specifics of the regions' innovative infrastructure, require appropriate adaptation of financing models. They should consider, for example, the specifics of the formation of transport infrastructure for the regions of Siberia, or tourism clusters for the South of Russia.

IV. Discussions

The results confirm the hypothesis about the key role of state financing under weak development of the private sector. At the same time, it was revealed that exceeding the share of budget loans over 50% reduces the flexibility and efficiency of innovative projects.

In Russia, the share of venture investments is 3 times lower than in the EU, which requires the stimulation of tax incentives.

Successful experience in clustering infrastructures in a number of regions of the country does not solve long-standing problems with insufficient diversification of the economy, the output of products with a low share of added value, the aging and shortage of engineering and labor personnel.

To improve the financing of regional innovation infrastructure, further institutional reform measures are needed, including tax incentives, simplification of administrative procedures, and private capital raising.

V. Conclusions

The conducted study allowed us to identify key aspects of financing innovative projects for the development of regional infrastructure, as well as to offer recommendations for increasing their effectiveness. It was established that innovative infrastructure is a complex system, including technological, financial, personnel and legal components, which require an integrated approach to financing. Data analysis showed that in Russia state financing instruments such as budget loans and public-private partnerships (PPP) dominate, which is due to the underdevelopment of the private sector and venture capital market. However, exceeding the share of state financing above 50% reduces the flexibility and efficiency of projects, which emphasizes the need for a balanced approach.

The results of the study confirmed that combining various sources of financing (budget loans, PPP, venture funds, own funds) increases the sustainability of innovative projects by 20-30% and reduces the risks of their underfunding. Particular attention is paid to clustering as an effective mechanism for the development of regional infrastructure. Clusters based on mixed financing (60% budget, 40% private investment) demonstrate a multiplier effect: 1 ruble of investment generates 2.3 rubles of gross regional product (GRP), which contributes to economic growth, job creation and increased innovation activity.

Nevertheless, problems related to the insufficient economy diversification, low share of added value of production and shortage of qualified personnel have been identified. To solve them, further institutional reforms are needed, including tax incentives, simplification of administrative procedures and stimulation of private investment. The results of the study can be used to develop regional development strategies adapted to the specifics of each region, which will help overcome the imbalance between the need for innovation and limited resources.

CONFLICT OF INTEREST.
Authors declare that they do not have any conflict of interest.

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