

# The Mechanism of Infrastructure Mortgage and Evaluation of Its Performance in the System of the Regions Economic Growth Ensuring

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**Abstract.** The article presents the theoretical and methodological foundations of financing infrastructure projects, the current state and problems of the development of infrastructure mortgages which based on the mechanism of public-private partnership in Russia. A theoretical approach to clarify the conceptual apparatus and determine the essence of infrastructure mortgages has been proposed, as well as criteria for choosing the interaction model between the state and business by using infrastructure mortgages, based on existing PPP forms analysis and forms of attracting private investors to implement infrastructure projects, best practices for project implementation. The authors have identified the main differences between infrastructure mortgages from the current mechanism of mortgage lending and financed infrastructure projects at the regional level. The effectiveness assessing methodology of the infrastructure mortgage use for the implementation in infrastructure projects at the regional level has been developed by the authors.

## 1. Introduction

Ensuring intensive and sustainable economic growth of the national economy in the face of modern challenges and threats is one of the state top priorities. Many researchers believe that the development of public infrastructure is one of the main factors for stimulating economic growth. The significance of investments in infrastructure was also confirmed by the World Bank calculations, which indicate that a 10% increase in financial investments in infrastructure provides 1% of the economic growth [1]. However, today there are a number of problems in the development of public infrastructure in the Russian Federation, including: significant deterioration of the "Soviet infrastructure heritage", a 10-15% reduction in real infrastructure investments in infrastructure development from budgets of all levels, "distortions" in financing various spheres of economic activity amid a simultaneous decrease in the growth rate of private sector investment.

According to expert estimates, at least 3 trillion rubles extra will be required for the development of public infrastructure in Russia in 2020, while a significantly larger investment is needed for the development of industries - in the total amount of about 6.5 trillion rubles [2]. At the same time, the budget system potential is extremely limited.

Given the limited budgetary funds and foreign investments, following the beginning of a new round of sanctions, the search and research of new sources of financing infrastructure projects with the subsequent development of new theoretical approaches to developing a financial and credit mechanism to ensure them is of particular relevance. Raising private funds for the implementation of

infrastructure projects on a parity basis with the state by way of public-private partnerships and one of the new ways of financing it - infrastructure mortgages - is a possible solution to the problem.

## 2. Literature review

Theoretical and methodological foundations for financing infrastructure projects, including using public-private partnerships, were developed in the works of leading Russian researchers: V.A. Taracheva, E.M. Petrikova, M.A. Limitovsky, O.V. Malinovskaya, A.V. Brovkina, O.I. Gulakova, V.I. Suslova, T.S. Novikova, K.A. Makarevich, I.A. Freidina and others.

The works of such authors as Yescombe E.R., D.A. Babiy, O.G. Belaya, O.E. Gudz, Yu.O. Ereshko, G.G. Kireytshev, I.S. Koziy, M.I. Krupka, V.M. Oparin, I.R. Chui, G.K. Yalovaya, S.Ya. Ogorodnik, V.M. Fedosova S.V. Levochkin were focused on the study of theoretical and practical issues of financial support and financial and credit mechanism.

Banking resources used in mortgage lending and banking practice were studied in the works of a number of Russian researchers: G.N. Beloglazova, A.P. Vozzhov, E.F. Zhukov, V.I. Kolesnikov, J.I.H. Krasavina, O.I. Lavrushin, A.M. Tavasiev A.D. Sheremet, as well as scientists from near and far abroad - M.D. Alekseyenko, A.V. Vasyurenko, A.Dzyublyuk, Zh.N. Dovgan, E.D. Dollan, D. Campbell, T.U. Koch, J. Matuk, A.M. Moroz, F.S. Mishkin, P.S. Rose, M.F.Savluk, J. Sinki, R.I. Tyrkalo and others.

The problems of assessing infrastructure projects were considered by V.I. Suslov, N.V. Gorbacheva, N.M. Ibragimov, A.V. Kuznetsov, L.V. Melnikov, T.S. Novikov, O.I. Gulakov, P.S. Zvyagintsev and others.

However, in modern scientific literature, the nature of infrastructure mortgages has not been fully studied; further research of mechanisms for financing infrastructure development projects is necessary, including at the regional level; a balanced approach to assessing the effectiveness of infrastructure projects and the risks of their lending should be developed [3,4,5,6,7,8,9].

## 3. Methodology

### *3.1. A theoretical approach has been proposed to clarify the conceptual framework and determine the nature of infrastructure mortgage*

To date, the essence of infrastructure mortgage has not been fully studied, often the concept of "infrastructure mortgage" is considered merely as a kind of public-private partnership (hereinafter - PPP) in relation to financing infrastructure objects [10].

Since the current legislation provides no definitions of either the concept of "infrastructure mortgage" or the mechanisms for its application both at the federal and regional levels, the authors clarified the concept of "infrastructure mortgage", which is designed to take into account, on the one hand, the specifics of the form of organizational and legal alliance between by the state and private partners (commercial bank, legal entities and individuals), in which the bank performs an intermediary financial and credit function, and, on the other hand, disclose the essence of infrastructure mortgages as a special mechanism for financing infrastructure projects implemented on the principles of PPP, based on bank credit instruments (mortgage loan) and bank credit mechanism. The proposed definition takes into account the organizational - legal and financial - credit aspects of the infrastructure mortgage implementation as an economic mechanism.

In our opinion, infrastructure mortgage is a symbiosis of PPP and mortgage lending, aimed at solving priority and socially significant problems, relevant to the development and modernization of infrastructure facilities in the Russian economy [11,12].

### *3.2. Selection criteria have been proposed and models of interaction between the state and business using infrastructure mortgages have been selected*

On the basis of analysis of existing PPP forms in Russia and forms of raising private funds to implement infrastructure projects [13,14], as well as best practices for project implementation, the

criteria for choosing models of interaction between the state and business in terms of using infrastructure mortgages, have been proposed (see table 1). The selection of criteria is based on the ability of a private partner to fulfill obligations under a loan agreement with a bank.

**Table 1.** Criteria for choosing models of interaction between the state and business using infrastructure mortgages.

Partnership models	Criteria					
	Project return	High degree of readiness to share risks of the project and operational stages	Opportunity to raise the budget the operational stage	Ownership and the possibility of pledging an object with a public party	Ownership and the ability to pledge a private partner	Feasibility of using infrastructure mortgages
Concession agreement with direct payments from consumers	yes	no	no	yes	no	yes (in case of steady demand)
Concession agreement with direct payments and guarantee of minimum income from the grantor (mixed form)	yes	yes	yes	yes	no	yes
Concession agreement with concession payments <i>Концессионное соглашение платежками концедента</i>	yes	yes	yes	yes	no	yes
PPP Agreement	yes	yes	yes	yes/ no (the property is in state ownership, if the investment of a public partner is > 50% of the value of the property)	no	yes
State property lease agreement with investment obligations of the tenant (private partner)	yes	yes (minimization of rent at the stage of operation of the facility)	no	yes	no	yes (in case of steady demand)

Source: developed by the authors on the basis of publications by [13,14,15]

In the course of the analysis, on the basis of the above criteria, the models of interaction between the state and business, that are most suitable for the use of infrastructure mortgages were selected: a mixed form of concession with direct payments by consumers and a guarantee of minimum profitability on the part of the public partner; concession with direct payments by the public partner, PPP agreements (PPP), and in case of consistent demand - a lease of state property with investment obligations.

Developing a model for financing infrastructure projects using infrastructural mortgages, it should be taken into account that in terms of mortgage lending, collateral can be applied not only for existing real estate, but also for those under construction.

Considering that the infrastructure mortgage is a project financing mechanism, which includes both the PPP mechanism and bank mortgage lending, this model should also include a refinancing mechanism for banks participating in infrastructure projects, based on the issuance of bonds by a commercial bank that provides loans to a private partner. At the same time, the state takes a direct part in the implementation of infrastructure mortgage projects: in the person of regional and municipal authorities, it redeems bonds from a creditor bank using budget funds of the adequate level.

### *3.3. The main differences between the infrastructure mortgage and the existing mechanism of mortgage lending and financing of regional infrastructure projects have been identified*

The above approach is based on the mechanism of mortgage lending, but its main difference from traditional mortgages consist in the following aspects. Firstly, the infrastructure mortgage mechanism does not provide for the placement of mortgage bonds in the stock market to raise funds, and, therefore, saves on the listing procedure; secondly, the bank receives resources for long-term lending, and the budget receives additional income in the form of interest on bonds; thirdly, the bank may require, in addition to collateral, state guarantees as a loan security; fourthly, non-traditional real estate objects (landscaping objects, roads, tunnels, port facilities, park complexes) that are not used as collateral in the traditional mortgage lending scheme may act as collateral, which requires new approaches to the valuation of such objects.

The main advantage of the infrastructure financing scheme using infrastructural mortgages over the classical scheme for attracting financial resources in the stock market through the issuance and placement of bonds, which is provided for by the legislation on force, in particular for use under concession agreements, lies in the fact that bonds are issued not by a concessionaire, but by a bank, and they do not enter the stock market, but are bought out by a designated organization. This mitigates the risks associated with the placement of securities and their quotation (market demand risk), besides there are no listing costs.

### *3.4. A methodology for assessing the efficiency of using infrastructure mortgages for the implementation of infrastructure projects at the regional level has been developed*

An important step in the implementation of infrastructure projects in the framework of PPP is the assessment of their efficiency. However, there is no single assessment system in this area. There are "Methodological Instructions" worked out by the Ministry of Economic Development and Trade [16], as well as a number of other scientific approaches to the assessment, but with regard to infrastructure mortgages there is no methodology for such an assessment. On the basis of the research results, the authors proposed a methodology for assessing the efficiency of the use of infrastructure mortgages for financing PPP projects using an integrating indicator.

With the purpose of determining priority infrastructure areas for investment, the authors propose the calculation of the integral indicator of economic growth drivers in a particular area, based on the following indicators: regional significance (contribution to the formation of regional value added (VA), budget efficiency (BE), taking into account the contribution to budget revenue generation through tax deductions, development priority assessment (share of investments in infrastructure in the total regional investment), an assessment of social significance (the share of people employed in a particular area in the total number of people employed in the region) [16,17]. The integral indicator of

the efficiency of the of economic growth drivers in the infrastructure sector (IGDis) is calculated as per the formula 1:

$$ИДР_{ic} = K_{cori} * (K_{3H} * k_i + K_{БЭ} * k_i + K_{IP} * k_i) \tag{1}$$

where  $K_{cori}$  - is the coefficient of the relationship of a particular sphere  $i$  with other spheres (industries),

$K_s$ - coefficient of significance of a particular sphere (its share in the formation of regional value added);

$K_{BE}$  - coefficient of budgetary efficiency (the share of taxes of a particular sphere in the total amount of taxes in the region);

$K_{PR}$  - development priority coefficient (the share of investments in a specific area in the total amount of investment in the region)

$k_i$  - is the specific gravity (relative share).

The coefficient of the multiple correlation of this sphere with others (weight) ( $r_i$ ), which is calculated as per formula 2, is the basis of the coefficient of the relationship of a particular infrastructure sphere  $i$  with other spheres (industries) ( $K_{cori}$ ):

$$r_i = r_{x_i|x_1, x_2, \dots, x_{i-1}, x_{i+1}, \dots, x_n} = \sqrt{1 - \frac{\Delta}{\Delta_{ii}}}; \tag{2}$$

where  $x_i$  - is the value added generated in a particular area of infrastructure;

$n$  - is the number of analyzed areas;

$\Delta$  -is the determinant of a sample matrix of pair correlations  $R$  of the regional infrastructure areas;

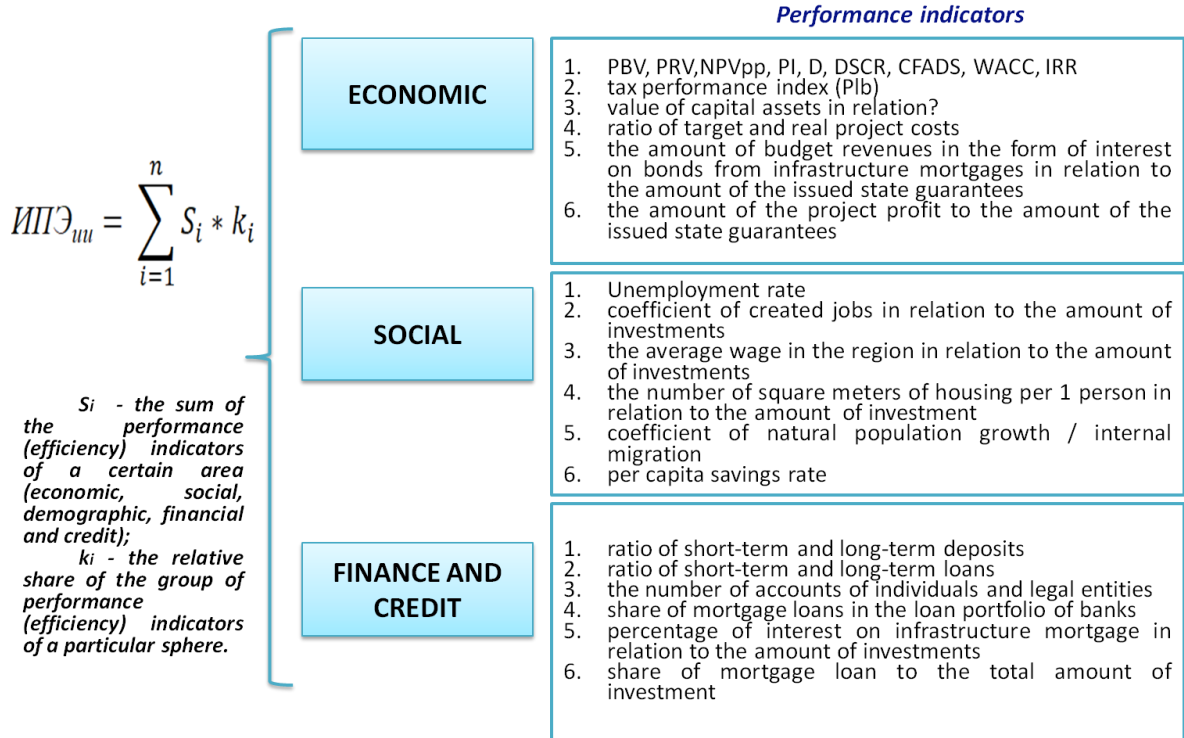
$\Delta_{ii}$  - is the algebraic complement of the element of the pairwise correlation matrix in the  $i$ -th row and in the  $i$ -th column (determinant of the matrix obtained by deleting from the  $R$   $i$ -th row and  $i$ -th column).

After that, the coefficient of interrelation of a particular sphere  $i$  with other spheres (industries) ( $K_{cori}$ ) is calculated as per the formula 3:

$$K_{cori} = \frac{r_i}{\sum_{j=1}^n r_j}; \tag{3}$$

After selecting high priority indicators for the development of a specific infrastructure sphere, it is proposed to evaluate the efficiency of using infrastructure mortgages for financing projects at the regional level using an integrated PPP project performance indicator (taking into account the regional component) based on the developed methodology (see Figure 1).

**Integrated PPP project performance indicator (taking into account the regional component)**



**Figure 1.** Methodology for assessing the efficiency of using infrastructure mortgages to finance projects at the regional level. *Source: developed by the authors.*

This integral indicator is based on groups of private performance indicators: economic, social, financial and credit. The construction of the integral indicator is based on the additive model that reflects the assessment of the multiplicative effect of implementing an infrastructure mortgage project in each sphere.

It should also be noted that the implementation of infrastructure mortgage projects has a different impact on different areas of activity. For example, the construction of a preschool educational institution has a slight economic effect but at the same time has high social significance.

In this regard, depending on the characteristics of a particular region and with the aim of directing the infrastructure project onto solving the gravest economic, social or financial and credit problems in relation to the region, it is proposed to divide them into groups according to the criterion of relative share of this socio-economic sphere in the structure of the region functioning, for the purpose of selecting high priority infrastructure projects on basis of the appropriate ranking.

This process can be divided into three stages:

1. Calculation of private performance indicators (economic, social and financial - credit) within a specific group;
2. The distribution of the specific gravities of each group in terms of the economic situation and characteristics of the region (0.2 - low, 0.3 - medium, 0.5 - high);
3. The calculation of the integral indicator, taking into account groups of private performance indicators in various spheres of activity and the specific gravities assigned to them.

The developed scientific and methodological approach to the formation of an integrated performance indicator of PPP projects using infrastructural mortgages at the regional level is put forward as a recommendation for executive authorities, making decisions on the choice of infrastructure projects and assessing their efficiency, and in practical terms it will provide a more accurate calculation of the infrastructure project efficiency.

#### 4. Conclusion

In the course of this study, theoretical provisions and conceptual framework in the sphere of infrastructure mortgages were further developed and broadened; the mechanism for financing infrastructure projects was elaborated regarding the development of selection criteria and justification of an effective model of interaction between the state and business using infrastructure mortgages, private investors and banking institutions.

A methodology for assessing the efficiency of the use of infrastructure mortgages for the implementation of infrastructure projects at the regional level has been presented, which allows us to draw conclusions about the efficiency of invested funds from the perspective of the region's economic growth.

The efficiency of the use of infrastructure mortgages for the purposes of financing the construction and reconstruction of socially significant infrastructure in the context of limited budget funds and external sources of financing should be given special attention.

Further research should be carried out to establish financing mechanisms, the methodology for assessing the efficiency of projects and risks for lending should be tested, the procedure for using collateral in the course of implementing the infrastructure mortgage mechanism with the involvement of banking structures should be specified. The solution of these problems will help raise private investment in the economy in order to ensure economic growth and improve the quality of services provided to the population.

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