

Predictive model of the potential for the use of public-private partnership mechanisms

*Victor Prokhorov*¹, *Ivan Rozhnov*^{2*}, and *Lev Kazakovtsev*^{1,2}

¹Reshetnev Siberian State University of Science and Technology, Krasnoyarsk, Russia

²Siberian Federal University, Krasnoyarsk, Russia

Abstract. The study the economic stimulation approaches under the conditions of sanctions restrictions. We propose to increase the growth of investment activity through more effective public investment and widespread involvement of domestic private investment resources in business economic circulation, including various mechanisms of public-private partnership (PPP) and municipal-private partnership (MPP). The problem of using public-private partnerships or municipal-private partnerships is considered, which is associated with the lack of understanding among the participants of such partnerships of the prospects for its development, therefore there is a need to assess the existing development potential of the selected PPP mechanism. The developed methodological foundations of predictive analytics for carrying out in stages using established procedures for quantitative and qualitative assessment of the potential of MPP make it possible to assess the potential of any public-private partnership.

1 INTRODUCTION

The implementation of sanctions policies by a number of developed countries against seriously changes the conditions for the functioning of the national economy. International commodity and financial markets were closed for domestic enterprises, and the transfer of new and latest foreign technologies was stopped. The current situation, in general, has a negative impact on the macroeconomic situation in the sanctioned state. Our country faces a rather acute task not only of neutralizing the consequences of hostile sanctions policies, but also of finding new directions to transfer the Russian economy to the path of successful economic development.

A number of problems must be solved, including the development and implementation of a comprehensive national investment policy. In particular, it is necessary to increase the efficiency of public investment itself in the most important sectors of the state's economy. This is due to the fact that one of the consequences of a hostile sanctions policy is a further reduction in the possibilities of public investment, since problems may arise with filling the revenue side of the budget. An equally important task is the need to more widely involve existing domestic private investment resources in the country's economy.

* Corresponding author: ris2005@mail.ru

One of the solutions to the stated tasks is the wider use in the interests of the state of various mechanisms of public-private partnership (PPP) or municipal-private partnership (MPP). They mean joint cooperation between the state and private enterprise in the construction, reconstruction, financing, management and operation of various infrastructure facilities, as well as the provision of various other public services.

PPP (MPP) allows us to accumulate private investment capital for the implementation of socio-economic projects that are important from the state point of view. Thus, as of September 1, 2022, 3724 projects related to public-private partnerships were being implemented in the Russian Federation. The volume of investments in these projects reached 5.4 trillion rubles. At the same time, the volume of private investment amounted to 3.9 trillion rubles, that is, about 72% of the total volume [1].

This ratio between public and private investments clearly shows how public investment resources can be saved when implementing the most important infrastructure and other projects from the point of view of the Russian Federation. At the same time, there are certain problems in using PPP (MPP) mechanisms in practical activities. And one of them is that in order to justify a management decision on the possibility of using a particular PPP (MPP) mechanism and its further legal registration with the participation of all interested parties, there is a need to analyze the prospects for its development. This analysis primarily consists of assessing the existing potential of the selected PPP (MPP) mechanism.

The purpose of this study is to develop a methodology for assessing the potential of PPP (MPP) based on a qualitative and quantitative approach. This assessment of the potential of PPP (MPP) allows us to understand the prospects for the development of partnerships. All this allows, based on the obtained assessment results, to make informed management decisions even at the stage of preparing an agreement on the implementation of PPP (MPP).

2 Materials and research methods

It should be noted that currently there are no methods for assessing the potential of PPP (MPP). There is also no stable definition of the very concept of the potential of public-private partnerships (municipal-private partnerships). At the same time, it is clear that in order to determine the potential of public-private partnerships, it is necessary to take into account a number of its key elements. These include those elements that allow us to consider PPP (MPP) from various points of view, on this basis, then assess the possibilities for further development of a particular partnership.

The key elements of the potential of the PPP (MPP) should include, among other things: the concept (definition) of the PPP (MPP) itself; agreement between partners on PPP (MPP); participants; objects of the PPP (MPP) agreement; the PPP (MPP) mechanisms used; PPP (MPP) models; forms of public private partnership; possible restrictions on the development of PPP (MPP); concept of potential. Each of these key concepts takes into account a wide range of features of a particular public-private partnership or municipal-private partnership.

In turn, the agreement between the partners on PPP (MPP) represents a fixed-term civil law contract between a public partner and a private partner, where it is a question of achieving the stated goals by combining the common resources of the partnership participants. The PPP agreement (MPP) includes a number of essential conditions. These should include, among other things: what models and forms of PPP (MPP) will be used; criteria for the effectiveness of partnership activities; information about the object of the agreement within the partnership; obligations of the public and private partner; duration of the partnership agreement; the procedure for the emergence of ownership rights to the object of the agreement; procedure for securing obligations; liability of the parties; etc.

The object of a PPP agreement (MPP) can only be state or municipal property, which cannot relate exclusively to state or municipal property, and according to it there should be

no ban on alienation into private property. In general, the objects of a PPP (MPP) agreement may include, among other things: transport infrastructure facilities; social facilities; agricultural sector facilities; industrial and IT sector facilities; and a number of other objects.

PPP mechanisms (MPP) mean the use in various combinations of models and forms of PPP implementation, which reflect the essence of the processes occurring within the framework of public-private partnerships or municipal-private partnerships. At the same time, at present, stable definitions of the concept of a PPP model (MPP) have not yet been developed in Russian methodology. Quite often it is understood as form, type, approach, scheme, etc. Therefore, when considering the potential of PPP (MPP), one should define the concepts of model and form.

It should be noted that the following definition most accurately reflects the concept of a model. PPP (MPP) models should be understood as a set of techniques and operations for the direct implementation of the public-private partnership (municipal-private partnership) process, defined within the framework of the form of participation of the public and private partners. It follows from this that the form of PPP is, accordingly, defined by law and (or) established by constituent and other regulatory documents, accepted in economic practice, the method of participation of a public and private partner in a PPP (MPP) [2].

The methodological literature provides quite a lot of classifications of PPP (MPP) models. Among these classifications, the generally accepted international classification most objectively describes the process of direct implementation of public-private partnerships (municipal-private partnerships). It presents 20 main PPP models, including: the Build-Operate-Transfer (BOT) model; Build-Own-Operate-Transfer (BOOT) model; “reverse BOOT” model; Build-Transfer-Operate (BTO) model; Buy-Build-Operate (BBO) model; Build-Own-Operate (BOO) model; Build-Lease-Operate-Transfer model (Build-Lease-Operate-Transfer (BLOT); Design-Build-Finance-Operate (DBFO) model; Design-Build-Finance-Transfer model (Design-Build-Finance-Transfer, DBFT); design-build-finance-maintain (DBFM) model; design-build-finance (DBF) model; design-build-operate model, or operator model (Design – Build – Operate, DBO); Build-Operate-Maintain-Transfer (BOMT) model; Design-Build-Own-Operate-Transfer (DBOOT) model; design-build model (Design-Build, DB); Finance Only (FO) model; model “right to operate” (Operation License, OL); model “operation and maintenance contract” (Operation License, OL); model “Long-term rent/leasing” (Long Term Lease, LTL); Lease-Develop-Operate (LDO) model [3].

From the analysis of the above international classification of models, it is clear that they are based on a description of certain stages of the PPP (MPP) life cycle. And therefore, depending on the number of stages and their content, a specific PPP (MPP) model is determined. This allows us to say that the model represents a certain set of stages (operations) of the direct implementation of the process of public-private partnership or municipal-private partnership.

Identification of the model in practice makes it possible to determine not only the organizational structure of PPP (MPP) management, but also the scope of participation of both public and private partners in the partnership being implemented. All this together allows you to choose the legal basis for cooperation between public and private partners, that is, choose the form of PPP (MPP). In practice, several classifications of forms of PPP (MPP) are used [2, 3].

The most important key element necessary to assess the potential of PPP (MPP) is the possible limitations and opportunities for its development. These restrictions include, but are not limited to: the duration of the partnership life cycle; resources used; services (work) provided within the partnership; the level of socio-economic significance of the partnership; risk sharing within the partnership; and other.

One of the last key elements required when assessing PPP potential is the concept of potential itself. In general, the general concept of potential in the scientific literature is

considered as sources, opportunities, means, reserves that can be put into action and used to achieve a certain goal. The concept of “potential” is defined as means, reserves, sources that are available and can be mobilized to achieve certain goals, implement a plan, solve a problem, as well as the capabilities of an individual, society, state in a certain area”.

Also, “potential” is defined as “the totality of available funds and capabilities in any area” [4]. From this definition, it is clear that potential is defined as the totality of available means and opportunities in any area, however, at the same time, the term “available” included in this definition means that the potential itself is determined by a probabilistic factor.

There is a definition of potential in the context of socio-economic systems, where it is defined as a set of resources with the obligatory and dominant participation of the human factor, combined to achieve some goal of an economic nature, organized properly and acting as a single whole [5]. In this case, the totality of resources can include material, labor, financial, organizational, information and other types of resources. By identifying the availability of resources with the concept of potential, in general, labor, technical, organizational, property, financial and other potentials are distinguished, which determine the ability of a socio-economic system to achieve its goals.

We also need to take into account that potential is something more than just a given set of specific system capabilities for effective functioning for various purposes. But these opportunities can only appear and be appreciated in the process of using them. That is, it turns out that potential consists of resource capabilities and organizational actions to use them.

As a result, potential is one of the basic elements of the socio-economic system itself. It combines the goals, driving forces and sources of its development. Therefore, its content can be determined by the following characteristics, including: potential is a dynamic characteristic and manifests itself only in the process of its use; the use of potential must be accompanied by its growth; the process of leveraging and building capacity is continuous and mutually reinforcing.

The analysis of various definitions of the content of the concept of potential made it possible to conclude that the concept of potential is dedicated to such an assessment indicator as economic potential. And it can be interpreted in different ways.

Concerning the potential of PPP (MPP), its concept is close to the concept of the economic potential of the socio-economic system. PPP potential can be defined as the totality of the ability to produce products for various purposes or provide services to the population. This potential depends on the quantity of labor resources, the quality of their professional training, the volume of production capacity, the degree of development of industrial sectors, achievements of science and technology, resources and a number of other factors. At the same time, it can be presented as a valuation of all available resources, the further use of which will be determined by the degree of sustainability of the development of PPP (MPP) and external environmental conditions. At the same time, the external environment significantly influences the efficiency of using the resources available to public-private partnerships, and therefore affects the potential of PPP (MPP). Therefore, PPP (MPP) cannot be considered as a closed system. The dependence of PPP (MPP) on external conditions predetermines the need for constant assessment of its potential.

The content of the concept of the potential of public-private partnership (municipal-private partnership) can be considered on the basis of three main approaches that have already been described in the scientific literature, including: resource-based, effective and targeted approaches. They are used to describe the content of the economic potential of an enterprise. They can also be used to describe the concept of partnership potential for a certain model and form of PPP (MPP).

The resource approach identifies the potential of PPP (MPP) with the totality of resources at the disposal of a public-private partnership (municipal-private partnership), including

financial and non-financial assets. In this case, assessing the magnitude of PPP potential comes down to determining the cost of available resources.

In the effective approach, the potential of PPP (MPP) is considered as the availability of resources and their ability to bring certain results in the course of financial and economic activities, including an increase in production volume or the volume of services provided, the amount of revenue or profit, etc. Assessing the magnitude of potential comes down to determining the potential volume of production of material goods and services based on technical, economic and other financial indicators of the activities of public-private partnerships (municipal-private partnerships) [6].

With a targeted approach, assessing the potential of PPP (MPP) comes down to determining the ability of a public-private partnership (municipal-private partnership) to carry out further activities and achieve set goals based on the use of a system of available resources [7, 8].

The reason for the existence of several approaches to assessing the potential of PPP (MPP) is based on the difference in goals, content, and tasks to be solved. When considering the above approaches to forming the content of the concept of PPP potential of an enterprise, the following conclusions can be drawn.

Firstly, an essential feature of the considered approaches is that to what extent they take into account the specifics of PPP (MPP) activities. Therefore, it is necessary to take into account that the model and form of PPP (MPP), which respectively determine the conditions and restrictions characteristic of a particular model and form, have a significant impact on the potential of PPP (MPP) and its structure. The specific features of the industry determine the structure of the PPP (MPP) potential and establish the nature of the relationship between its components.

Secondly, the potential has a two-component structure. The first component represents the achieved potential. However, of no less interest is the development potential of PPP (MPP), that is, part of the advanced opportunities within the framework of PPP (MPP), which can and should be used to achieve certain goals in the conditions of optimal activity of PPP (MPP), taking into account existing restrictions. Therefore, development potential is the second component of public-private partnership potential. At the same time, the ability of the PPP (MPP) to carry out its activities determines the size of the advanced part of the potential itself.

3 Results and discussion

In general, the assessment of the potential for using PPP mechanisms is carried out on the basis of an analysis of available resources. At the same time, there may be two main approaches to assessing the potential of using PPP mechanisms. The first approach is based on methods for quantitative assessment of the potential for using PPP mechanisms, the second approach is based on methods for qualitative assessment of the potential for using PPP mechanisms.

An approach based on a quantitative assessment of the potential for using PPP mechanisms can be applied if the necessary statistical information on PPP is available. A qualitative assessment approach can be used if the necessary statistical information on PPPs is not available. Here we are actually talking about an expert assessment of the potential for using PPP mechanisms.

In an approach based on a quantitative assessment of the potential for using PPP mechanisms, the method of calculating the integral indicator of PPP potential (K_p) can be used. This indicator combines the values of several types of resources used in PPP. These include, but are not limited to: the share of the value volume of product output (provision of services); cost share; share of jobs; share of investments in fixed assets used within the

framework of PPP activities. In this case, a weighted average indicator is calculated, where the weighting coefficients reflect the specifics of the targets (obstacles) for the development of PPP, and it also takes into account the model and form used in the PPP. The final data for calculating the integral potential indicator (K_p) are presented in Table 1.

The calculation of the integral indicator of PPP potential is carried out by multiplying the specific weight of the corresponding indicator and its individual value of the resource, followed by their addition:

$$K_p = \sum_{t=1}^4 W_i \times K_i$$

where W_i is specific weight of the indicator,

K_i is the i th indicator used in the calculation.

TABLE 1. Indicators for calculating the integral indicator of PPP (MPP) potential.

Indicator	Formula for calculating the indicator	Weighting coef.
1. Indicator of the share of the value of production (provision of services) (K_{Prod})	$K_{Prod} = V_{AProd} / V_{TotProd}$, where V_{AProd} is the actual volume of products, works and services produced (performed) under the PPP; $V_{TotProd}$ is the total volume of products, works and services produced (performed) both within the framework of PPP and outside of PPP.	0.40
2. Cost share indicator (K_{Cost})	$K_{Cost} = V_{ACost} / V_{TotCost}$, где V_{ACost} is the actual cost volume of costs for industrial products, raw materials, materials and components, works and services, within the framework of PPP; $V_{TotCost}$ is the total cost volume of costs for the production of works and services produced (performed) both within the framework of the PPP and outside the PPP.	0.25
3. Job share indicator (K_J)	$K_J = N_{AJobs} / N_{TotJobs}$, where N_{AJobs} – number of jobs occupied under PPP; $N_{TotJobs}$ is total number of jobs occupied both within and outside the PPP.	0.20
4. Indicator of the share of investment volume (K_{Invest})	$K_{Invest} = V_{AInvest} / V_{TotInvest}$, где $V_{AInvest}$ is volume of investments in fixed capital within the framework of PPP; $V_{TotInvest}$ is the total volume of investments in fixed assets both within the PPP and outside the PPP.	0.15

The standard level of the integral indicator of PPP potential may vary depending on the model and form of PPP. The average recommended value of the indicator is 0.4-0.6, which corresponds to a situation where the main goal is to utilize the economies of scale in production (providing services) and reducing production costs (providing services).

An approach based on a qualitative assessment can be used in the absence of the necessary statistical information on PPP (MPP) and here, in fact, we are talking about an expert assessment of the potential for using PPP (MPP) mechanisms.

The approach is a set of logical and mathematical procedures aimed at obtaining information from specialist experts (at least 3-5 experts take part in the work), analyzing and summarizing it in order to select an assessment of the potential for using PPP mechanisms. It has the following interconnected stages:

1) At the first stage, specific resources used in PPP are determined. They are determined jointly by experts, usually using a resource tree, which makes it possible to decompose groups of resources into smaller ones that can be assessed and described.

2) At the second stage, the importance of each resource is identified. At this stage, each expert, based on the identified resources, compiles his own combined table for all these resources, where for each resource its importance (from 0 to 1) for PPP is determined.

3) At the third stage, an integral arithmetic average indicator is calculated for each resource, which is determined based on the data of all experts, taking into account the level of their competence and the importance of risk. The level of expert competence is assessed jointly by all experts on a 10-point scale (from 0 to 1).

4) At the fourth stage, the influence of each resource and group of resources on the final result of the implementation of the PPP (MPP) is determined.

To do this, a summary table is compiled, where all resources are grouped according to the resource tree and the resulting integral indicator is determined for each group, which makes it possible to evaluate their impact on the final result. At the same time, there is a certain dependence of the integral indicator on the impact on the assessment of the potential for using PPP mechanisms. This influence is shown in Table 2.

TABLE 2. The influence of the integral indicator on assessing the potential for using PPP (MPP) mechanisms.

The value of the integral indicator	Potential assessment
up to 0.05	Very weak potential
0.05-0.1	Weak potential
0.1-0.2	Average potential
0.2-0.3	Potential above average
0.3-0.4	Strong potential
0.4-0.7	Very strong potential

Analysis of the table of the influence of the integral indicator on the assessment of the potential for using PPP (MPP) mechanisms enables us to draw general conclusions, which can then be clarified or refuted using various methods.

4 CONCLUSION

Assessing the potential of the used PPP (MPP) largely allows us to clarify the models and forms of public and private partnership. Determine the necessary resources to achieve the goals set in the partnership. All this together allows us to largely avoid possible mistakes when concluding a partnership agreement between interested parties.

The methodology proposed in this study for assessing the potential of PPP (MPP) based on a quantitative and qualitative assessment allows the public and private partner to gradually, using established procedures, assess the potential of any public-private partnership or municipal-private partnership. This, in turn, makes it possible, at the stage of preparation of the PPP (MPP), to assess the prospects for its development and, on this basis, make an informed decision on its implementation.

This work was supported by the Ministry of Science and Higher Education of the Russian Federation (Grant No.075-15-2022-1121) and grant of the President of the Russian Federation NSh-421.2022.4.

REFERENCES

1. Investments in infrastructure and PPPs in 2022. Analytical review based on data from the Rosinfra platform (2022). <https://rosinfra.ru/digest/documents/one/investicii-v-infrastrukturu-i-gcp-2022-analiticeskij-obzor>
2. V. Prokhorov, I. Rozhnov, O. Maslova, A. Kuklina, E3S Web of Conferences **443**, 04001 (2023)
3. A.M. Kiseleva, K.A. Samodinskiy, Herald of Omsk University. Series: Economics. **17**, 125-137 (2019).
4. A.N. Azriliyan (ed.), *Big Economic Dictionary* (Institute of New Economy, Moscow, 2002)
5. V.V. Kovalev, *Financial analysis: methods and procedures* (Finance and Statistics, Moscow, 2001)
6. P.A. Fomin, M.K. Starovoitov, Peculiarities of estimation of industrial and financial potential of industrial enterprise.
http://www.smartcat.ru/p_finance/books/book_9/note.shtml
7. V. Shtansky, M. Zhemchueva, The Economist **8**, 30-39 (2005)
8. K.M. Rakhlin, O.Y. Serova, Potential of the organisation as the basis of its competitiveness. <http://quality.eup.ru/MATERIALY9/potencial.htm>