Value engineering of public-private partnership infrastructure projects

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Abstract. The lack of developed infrastructure leads to a decrease in the country's economy, quality of services to the public, and business activities. Infrastructure is very important so most countries create and improve it at the expense of treasury funds. At the same time, public resources are not sufficient to fully support investment. Most countries carry out capital-intensive infrastructure projects with the involvement of private investors, using the form of private-public partnership (PPP). This form provides the most efficient ways to use public and private property. Based on analysis of domestic and foreign practice government generally supports PPP. Nevertheless, there are no approaches to involving private investors in the projects. The system of value management projects is an important part of investment construction in the social sphere. The value of the project must be control to avoid budgetary diversions. With this in mind, the article identifies factors affecting the value of the project. Thus, recommendations have been identified to reduce the adverse impact on the project.

Construction is a key area of the economy. The infrastructure’s created for productive and non-productive sectors based on investment and construction projects. The government is the main provider of infrastructure. However, the budget is insufficient to meet the needs of the population for such facilities, and private financing is therefore needed. Public-private partnership is a tool for this task. The essence is that the private investor carries part of the work on the design, construction, and commissioning of capital objects, combining private and public financing. The program of the PPP establishes a flexible relationship between the state and business, which makes it possible to achieve public goals through the synergy of the two partners today.

The mechanism of implementation of infrastructure projects, using the form of PPPs, has great potential for development in the territory of the Russian Federation. This can positively influence the development of a modern, innovative, and socially-oriented economy. The state faces many important infrastructure issues that require immediate solutions today. This situation is also typical in the social sphere, which is the object of direct government management and funding. This area requires resources and the introduction of advanced technologies in the implementation of infrastructure projects, which can be obtained through public-private partnerships. PPP serves to attract missing financial, technological, and managerial resources.

The application of the PPP mechanism has been discussed in the work of V.I. Bazhenov, O.V. Belov, K. Henderson, G.Y. Kallaur, and others [1]. Despite a detailed study of this issue, there is an insufficient organization of the management of infrastructure projects in the social sphere. This makes it impossible to explore in detail such an infrastructure instrument as public-private partnerships. With the help of
PPP it is possible to implement social infrastructure, and in the future to improve the quality of life of the population of the Russian Federation.

It is believed that the idea of PPPs was first developed at the turn of the 1980s in the UK. In Russia, the stage of development of this form of partnership took place at the beginning of the 21st century and was connected with the emergence of projects financed by the Investment Fund. In parallel with the projects of the Investment Fund, concession projects have developed and have been hampered by the lack of legislative regulation. There were also contradictions in the Federal Law "On Concession Agreements". Among other things, the global financial and economic crisis has threatened the realization of large-scale PPPs in Russia, because the state and private businesses have become even more conservative in their approach to investing [2]. However, the need to develop infrastructure projects has not disappeared at both the state and private levels. That is why the issue has become relevant in the search for new forms of interaction between state and private businesses.

It should be noted that there are difficulties in classifying models, mechanisms, and forms of PPP, as each researcher interprets these concepts based on early research and opinion. Nevertheless, the main PPP models are similar both in Russia and abroad. The most common form is a concession, but public-private and municipal regional partnerships (MRP) agreements are gaining popularity of the federal law 224 and various recommendations and methodologies. The cooperation scheme, which has already proved its effectiveness in foreign countries, has become a life-cycle contract (LCC) [3]. On the one hand, this interaction does not imply the elimination of budgetary funding, which is potentially interesting for the private partner. On the other hand, the state is confident that the budget is being spent efficiently and the infrastructure project meets the established functional parameters. At the legislative level, the possibilities of applying forms of public-private partnership are being improved, both in the framework of concession agreements and in the framework of the contract system, to solve socially significant problems of the state.

According to the Ministry of Economic Development of Russia and the National PPP Centre in 2020, the stable growth of the Russian infrastructure investment market was interrupted by restrictions imposed in connection with the spread of a new coronavirus infection (Fig. 1).

![Figure 1. Infrastructure investment market with cumulative results.](image)

The first graph shows that in the three quarters of 2020, the total volume of investments attracted to the market was half that in the same period of 2019: 243 billion rubles this year compared to last year 462 billion rubles [4].
In the second figure, the most capital-intensive area of infrastructure is transport, attracting more than 60% of the total investment, while the number of transport projects is only 4.5% of all implemented. The second-largest sector of investment is utilities (18%), and the third is social, with 8.9% (Fig. 2).

Figure 2. Investment in infrastructure in 2019-2020 years [5].

Compared to other areas, the social sector needs financial resources, modern management, advanced technology, and service delivery. It has been the object of direct state administration for many years. The main tasks of the state in the long term are to provide for the needs of the retired, persons with disabilities, the creation of favorable conditions, the functioning of the family institution, and the birth of children. To improve the quality and safety of social services for the population and to house the permanent establishments of the constituent entities of the Russian Federation for the period up to 2022. Measures are planned for the construction, modernization, and reconstruction of buildings, as well as the re-profiling of social service institutions. In implementing these measures, the state is faced with the problem of insufficient budgetary and earmarked funding, which makes it impossible to meet these challenges. Private sector investment should therefore be attracted through PPPs [6].

The social sector, like any other, is subject to the influence of external factors that predetermine the strategy for the management and development of infrastructure facilities. Based on an analysis of the factors of the external environment, the main trends have been identified to identify the future directions of the area under consideration:

- The availability of children’s infrastructure in most sectors is declining, while the number of children is increasing. Since 2015, the number of children in the country has increased annually by 1-2 percent [7];
- The need to overcome the economic consequences of the pandemic reduces the opportunities for infrastructure investments, including in the development of infrastructure for children;
- As real incomes fall, demand for domestic infrastructure increases.

These trends are relevant for most constituent entities of the Russian Federation. The prevention of threats from the highlighted trends can be solved through effective and mutually beneficial interaction between the state and business. The need to introduce the mechanism is due to the presence of problems associated with the poor-quality provision of public services due to a lack of funding for the social sphere. It is through the PPP mechanism that resources, both public and private, are brought to bear on these issues.
During the implementation of the project based on the PPP mechanism, it is necessary to modernize and expand the concept of the life cycle of the investment and construction project in the social sphere. The PPP project is broader than the classical investment and construction project because the implementation phase is not limited [8]. However, work is included for the operation, maintenance, and repair of the capital facility. Also, each of the PPP project participants has its area of responsibility. It must effectively manage the value of the facility. Based on this, it is necessary to expand the concept of a life cycle and distinguish three of its components: the life cycle (LC) of a capital object (LC), the life cycle of a PPP contract (life cycle of PPP), and the life cycle of an operation project (life cycle of PE).

![Figure 3. Lifecycle of PPP.](image)

The figure shows that an LC PPP has two life cycles. The first is an LC investment construction project. The second is the operation of a capital facility by a private partner, under a PPP contract - a maintenance project. The start of an LC project involves the identification of a private partner through a competitive process. The completion of a PPP project is determined by the termination of the contract, with an average duration of 15-30 years, and with the transfer of the capital facility to the ownership of the public partner. PPP project activities are defined by the responsibilities of the private partner under the PPP contract. Research, preparation of design and documents, construction resources, commissioning of the facility, its maintenance, overhaul, closure (transfer of the facility to a public partner) are also carried out.

The complexity of the PPP life cycle makes it necessary to manage the value of the project at all stages, to fulfill the contractual obligations of public and private partners. There is a need to control the value of the project because of the influence of factors that lead to budgetary diversions.

The experience of other countries shows that the economic crisis does not always prevent infrastructure investments and PPP projects [9]. The crisis limits economic activity in all sectors of the economy, including construction. In our opinion, during such a period, private investment, government investment may be reduced in large-scale projects and non-priority construction projects. As a rule, deals in the field of public-private partnerships are less affected, especially since they are attractive to investors and help to save budget funds for other purposes.
Many countries have introduced a regime of self-isolation and social distancing in response to the coronavirus pandemic. These restrictions have led to a record low in consumer demand and have harmed the profitability of social infrastructure projects. Thus, PPPs are fully aware of the negative impact of the pandemic.

The suspension of the construction of the object of the agreement and the increase in the value of the object being created or renovated for several reasons are the main problems of investors in the circumstances [10]. Not only private partners but also participants in the entire supply chain, including manufacturers of materials and equipment, are facing increased project value and deteriorating working conditions. The cost of materials, equipment and the bankruptcy of manufacturers and suppliers may in the medium term lead to a rise in the value of building and PPP project cancellations.

At the stage of construction of PPP projects, a large share of imported equipment and materials is used. The supply of which may be restricted or suspended until the pandemic is over, the price of the goods may increase, which will be a deterrent to the project.

There is a mechanism for the return on investment of PPP projects, which depends on user payments. The risk of falling consumer collections against the backdrop of the crisis could have a significant impact. Such assets, whose income is calculated based on demand for services, are less protected. Income from the provision of fee-based services may decline because of reduced demand due to general social insolvency.

During the operation of the building, the investor and the state are more protected from «crisis» risks than during the operation of the building. Most risks can be minimized by insurance, some of them - «force majeure» - have no consequences for the investor. Thus, the implementation of a concession or PPP is beneficial to both parties to the agreement. If it is not possible to perform work of adequate quality and at a certain cost in time, the State may approach the private partner and renegotiate the terms of the transaction [11].

A study of the economic factors influencing the values of each stage of the life cycle of a facility made it possible to calculate risk situations that increase the total cost of construction for each subject of an investment-building project.

**Table 1. Main factors influencing PPPs during the crisis.**

| Factor                        | Planning stage (concept development) | Investment stage | Operation stage |
|-------------------------------|--------------------------------------|-----------------|-----------------|
| Increase in the cost of borrowing money | Decrease in projects at the implementation stage due to deterioration | Adjustment of the timing and value of construction | Use of re-lending and debt restructuring |
| The decrease in the volume of borrowed funds | Some initiatives may not lend to a bank | Use of debt restructuring |
| Budget cut expenses | Reducing the number of capital intensive projects | Projects under construction are protected against budget cuts | Projects in operation are protected against reduced funding conditions |
| Weakening national currency | Financial models of projects should be adjusted by the exchange rate | The cost of the project may increase due to the lack of hedging of foreign exchange risks associated with the purchase of construction materials, | Project value may increase due to lack of hedging of foreign exchange risks and the need to attract foreign labor, service of debt in foreign currency |
| Loss of purchasing power capacity of the population | The crisis may affect market forecasts in those niches where projects are planned to be launched. This means that the number of initiatives may decrease. | Projects under construction and reconstruction do not depend on economic activity, as they do not directly depend on the income level of the population | Project payback increases |

Some PPP projects are characterized by a high risk of demand for services provided during the operation of the facility. In doing so, projects should be structured to take into account the return on investment to the private party, the profitability of the invested capital, and the operating activities. The risk of demand for services provided during the operation of the facility can be minimized by including the following mechanisms in the PPP / MPP agreement:

- the right of a private party to provide paid services through an agreement [12];
- participation of the public in the costs of the establishment and operation of the facility

Besides, these projects can be structured with the obligation of a private partner to provide an object for social needs: holding non-commercial events (competitions, cultural events, etc.), using the object by socially-oriented public organizations (for example, sports schools) [13]. In this case, the number of such services provided and their cost should be taken into account in structuring the project to pay off the project.

The legislative aspect of PPP regulation indicates that Russian legislation has not been adapted to the implementation of PPP projects based on life-cycle contracts. It is therefore advisable to amend the legislation of the Russian Federation as follows:

1. Include in the Federal Law «On Concession Agreements» the concept of the form of LCC. This is necessary for the possibility of concluding a contract not only under the Federal Law "On the contractual system in procurement of goods, works, services for state and municipal needs".
2. Allow life-cycle contracts for educational facilities.
3. Develop a life-cycle contract form or structure.

Thus, based on the research conducted, it can be concluded that value management is important for the project. It determines the overall performance indicators and the distribution of profits among the project participants [14]. The current value management methods do not fully match the specifications because of the PPP phase of the contract for the capital facility. To form the evaluation and monitoring of such a project, it is necessary to investigate the relationship between the value management processes of the capital LCC, which includes the LCC ICP and the LC of the PPP contract. There is also a need to develop a methodology based on the principles of continuity, risk-sharing, and incentives for partners to improve management decisions.

References

[1] Kudryavtseva V A, Zaslavsky A M and Larina O P 2018 Multicriterial comparison at the inclusion of investment projects of manufacture of building materials into the state program of the region (at the example of Irkutsk region) Proceedings of Universities. Investment. Construction. Real estate 8 pp 60–72 DOI: 10.21285/2227-2917-2018-1-60-72
[2] Varnavsky V G 2009 Public-private partnership: some issues of methodology Bulletin of the Institute of Economics RAS 3 pp 17-33
[3] Dmitrieva E 2018 Performance and problems of the housing sphere in Russia MATEC Web of
Conferences. International Scientific Conference on Integration, Partnership and Innovation in Construction Science and Education 251

[4] Gertsekovich D, Gorbachevskaya L, Grigorova L and Peshkov V 2019 Return on investment in REIT real estate funds Investments. Construction. Real Estate: New Technologies and Targeted Development Priorities IOP Conference Series: Materials Science and Engineering 667 012063

[5] Belkina T D 2013 Housing in Russia: Situation and perspectives Studies on Russian Economic Development 24 pp 265-275

[6] Whitehead C and Monk S 2011 Affordable home ownership after the crisis: England as a demonstration project International Journal of Housing Markets and Analysis 4 pp 326-340

[7] Grabovoi P G 2017 Features and problems of project financing in construction Real estate: economics, management 4 pp 6-14

[8] Grabovoi P G, Manukhina L A and Budanov I S 2019 Features of project financing of investment and construction projects of Residential Real Estate: problems, risks, forecast Real estate: economics, management 4 pp 6-12

[9] Peshkov A V 2020 IOP Conf. Ser.: Mater. Sci. Eng. 880 012081

[10] Abdukhanova N G 2016 Activation of the investment and construction complex on the basis of public-private partnership Russian Journal of Entrepreneurship 17(21) pp 2903-2910

[11] Bezrukikh O A et al 2020 IOP Conf. Ser.: Mater. Sci. Eng. 880 012089

[12] Shupletsov A F and Skorobogatova Y A 2018 System modeling and development of elements of the mechanism of investment decisions in the construction sector of the region Proceedings of universities. Investments. Construction. The property 8(1)

[13] Peshkov V V 2020 IOP Conf. Ser.: Mater. Sci. Eng. 880 012101

[14] Kogan A B 2020 Determinants of the housing engineering entrepreneurship IOP Conf. Series: Materials Science and Engineering 880 012110 doi:10.1088/1757-899X/880/1/012110