

Financial Models of Public-Private Projects

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Abstract—The authors carried out the study of the factors that determine the attractiveness of infrastructure projects initiated by the state or municipalities for private investors. Research object is types of public-private partnership. Research subject is the economic relations of economic agents. Aim of the study is to analyze the financial mechanisms of interaction between the public and private sectors in the implementation of infrastructure projects. In the process of the research, the analysis of factors contributing to the implementation of infrastructure projects with the participation of the state and municipalities was carried out, foreign and domestic experience in attracting investments into state or municipal projects was considered, analysis methods and comparison of various financial models for the implementation of investment projects were used. As conclusions, the authors note that the existing legal regulation currently acts as a constraining factor in the development of private investment in significant infrastructure projects, which requires the development of new mechanisms for organizing interaction between the state and business.

Keywords—public-private partnership (PPPs), infrastructure project, concession, multiplier effect, synergistic effect, investment protection, digital financial asset, blockchain, digital ecosystem

I. INTRODUCTION

The implementation of new projects aimed at the efficient use of natural and labor resources, the development of domestic and international economic relations is due to the need to ensure a comfortable living environment for the population and the competitiveness of the economy in the international arena.

The peculiarity of infrastructure projects is manifested in their implementation for a long time with the attraction of significant capital investments and in a long payback period. Such investments are often unaffordable for the budget, in connection with which the question arises of the formation of institutions uniting the state and private investors, the purpose of which is aimed at creating a certain infrastructure object.

The current interest in public-private partnership (PPP), although their pedigree is much longer, began two or three decades ago when, in the face of public expenditure constraints, they were seen as a means for accelerating the provisions of infrastructure that, in the past, was generally seen as a purely public sector activity. This latter, traditional view stems very much from Adam Smith who argued that

government has the «... the duty of erecting and maintaining certain public works and certain public institutions, which it can never be for the interest of any individual, or small number of individuals, to erect and maintain; because the profit would never repay the expense to any individual or small number of individuals, though it may frequently do much more than repay it to a great society» [20].

Smith highlights the historical importance of this role in facilitating the Transport Revolution in that allowed the UK's industry and commerce to grow in the later part of the eighteenth century: the Industrial Revolution [17].

In the past few years, there has been an increased interest to PPPs in Russia due to the recognition of the fact of infrastructure development as the economy driver.

July 21, 2020 at the Forum "Infrastructure Business Initiatives" the problem of the slow recovery of consumer demand in the Russian Federation was noted, in connection with which it was noted that in these conditions the high multiplier effect of infrastructure projects could provide a quick exit of the Russian economy from the crisis, as well as a successful post-crisis economic breakthrough [6].

The formation of the investment financing architecture is the most important element of financial modeling, which depends on the different costs of attracting investment sources for projects.

The choice of sources for the formation of investment resources is carried out taking into account the following factors: the cost of servicing investment sources and their availability, the level of taxation, risk appetite, capital structure and the reliability of the financial discipline control system of participants

The issue of cooperation between the state, municipal and private sectors of the economy consists in administrative barriers and the absence of government regulations that stimulate private investment in infrastructure, in connection with which the implementation of projects is faced with the need to attract additional budgetary allocations, which in turn repels potential investors.

II. HISTORICAL DEVELOPMENT OF PUBLIC-PRIVATE PARTNERSHIP

Governments have used this combination of public and private efforts throughout history [5]. Muhammad Ali of Egypt used "concessions" in the early 1800s to obtain public works at minimal cost, while concession companies made most of the profits from projects such as railways and dams. Much of the early infrastructure of the United States was built on what might be considered a public-private partnership. This includes the Philadelphia and Lancaster Line in Pennsylvania, which began in 1792, the early steamboat line between New York and New Jersey in 1808; many of the railways, including the nation's first railroad, were chartered in New Jersey in 1815; and most modern electrical networks. In Newfoundland, Robert Gillespie Reid was contracted to operate the railways for fifty years from 1898, although they were originally to become his property at the end of the period. In the late 20th and early 21st centuries, there was a clear trend towards the increased use of various PPP mechanisms by governments around the world.

Changes in the existing model of state financing of infrastructure projects began to take place in 1970-1980. Japan approached the solution of the arisen problems most radically, highlighting the structure of the economy in the third sector, in which joint corporations operate, invested by both the public and private sectors.

The UK has had a systematic public-private partnership program since 1992, with the aim of the 1992 Program, which aimed to reduce the need for public sector borrowing, although, as noted, the impact on government accounts was largely illusory. In 1997, the program was expanded with a shift in emphasis towards achieving "value for money", mainly through appropriate risk sharing. The UK Government Audit Office found that the private funding initiative model was more expensive and less effective in supporting hospitals, schools, and other public infrastructure than public funding. Practice has shown that public-private partnership is ineffective when creating social facilities such as hospitals, schools, and other public infrastructure.

III. GOVERNMENT REGULATION OF PUBLIC AND PRIVATE SECTORS IN RUSSIA

In Russia, at present, direct interaction between the state and private investors in the process of creating new facilities or solving other resource-intensive tasks is regulated by Federal Law № 224-FZ dated July 13, 2015 «On public-private partnership, municipal-private partnership in the Russian Federation and amendments to certain legislative acts of the Russian Federation» (as amended on July 26, 2019) (hereinafter - the Law on PPP).

This law establishes one of the ways to develop public infrastructure, based on long-term interaction between the state and business, in which the private party (business) participates not only in the creation (design, financing, construction / reconstruction) of the infrastructure facility, but also in its subsequent operation and / or maintenance for the benefit of the public side [Public-Private Partnership Law: Application Guidance, 2015]. PPP allows a public partner to:

- fully or partially transfer the obligations to finance the creation of an infrastructure facility to the private partner;

- to share or completely transfer to the private partner the risks of higher construction costs, the quality of construction work carried out, non-compliance with the terms of commissioning of the facility, the quality of maintenance, the risks of revenue, etc.

The main PPP criteria correspond to the concession form of the implementation of infrastructure projects, which is a kind of monopolization of semi-open market positions. Since the public partner is bound by government laws and political commitments that do not apply to private entrepreneurship, there is little interest in PPPs from private investors. The existing problems of the main agents can change due to asymmetric information and fiscal freedom, a decrease in the level of importance of political or public interests, which become less priority in comparison with the commercial interests of participants in the oligopolistic market [19].

Nevertheless, PPP has a certain appeal for both the public sector and the private investor.

TABLE I. THE MAIN ADVANTAGES OF USING PPP

Public Sector	Investor
1	2
The ability to attract a private investor makes it possible to implement infrastructure projects even in the absence of budget funds, without increasing the debt burden	The ability to shift part of the risks of revenue to a public partner (application of: minimum guarantee of profitability, payment for availability and other mechanisms for guaranteeing repayment)
Allows you to improve the quality of the object being created and reduce the risks of overestimation by combining various stages within one project	The ability to invest in a long-term project with a fixed income under guarantees / obligations of the state
Promotes the development of competition in the market of socially significant services	The ability to increase your project revenue by providing additional paid services and / or using various solutions that reduce costs

Analysis of the table 1 shows that from a financial point of view, the advantage of PPP is the minimization of budgetary funds for the creation of infrastructure facilities, and for a private investor - the presence of a multiplier effect in the form of guaranteed income from investments and additional income.

IV. CONCESSION

Of the many types of concession agreements existing in practice Law on Concession Agreements provides only the type BOT («Construction - Management - Transfer»), but at the same time the type is used - BTO («Build - Transfer - Control»).

In Europe, Latin America, Asia, the WTO scheme is used to develop new toll road projects [2].

In the world, the most common concession schemes are two: BOOT BOOT «Build - Own - Operate – Transfer» and BOT BOOT «Build - Own - Operate – transfer», which assume that the facility being built with funds from a private investor will eventually be transferred to the ownership of the state. Since within the framework of the implementation of infrastructure transport projects, transport infrastructure

facilities of regional or national importance are most often built, these two options for organizing PPP in practice are more in demand.

In Russia, there is an insufficient level of investment in infrastructure through PPP contracts. The volume of investment obligations assumed under the concluded concession agreements is about 1.6% of the GDP in 2019. At the same time, in the UK, for example, the volume of investments in PPP projects is at least 6.6% of GDP, in Canada - 8.1%.

Statistical data on the largest concession agreements at the federal level and participants in the financing of large investment projects in the Russian Federation indicate that transport concessions are the largest in terms of total investment - they account for 70% of the funds, mainly projects for the construction of road infrastructure, more of all agreements (94%) were concluded at the municipal level, mainly they relate to the field of utilities. However, the largest volume of investments (42%) is envisaged within the framework of concessions concluded at the federal level, of which 96% falls on the transport infrastructure.

We consider the problem of attracting private investors is rooted in the mechanism for forming sources of financing. A review of the participants in the financing of large investment projects revealed that there are investment projects, but in practice the state acts as an investor in one form or another.

The financial model of the concession agreement within the framework of PPP is the concessionaire's lending to the grantor for the duration of the project and the term of the concession agreement, during which the grantor will reimburse the funds invested in the project. It follows that the payment for the use of the provided funds should be higher than the key rate of the central bank, taking into account discounted cash flows. The concession agreement does not imply a direct payment for the use of monetary resources, and the concessionaire's benefit is to receive income in the process of managing the object during the period of the concession agreement. Obviously, the object under construction must have characteristics that are attractive to the investor.

Regional authorities are taking various incentive measures to attract private investors in order to increase the attractiveness of the public-private partnership mechanism in the region, such as lowering the property tax rate, preferential rentals, increasing the volume of attracted investments, the quality and volume of services provided to the population [10]. But these measures are valid only for regional projects and do not apply to federal projects.

V. SYNERGISTIC EFFECT

The implementation of infrastructure transport projects creates a long-term systemic effect, which is formed as a result of the interaction of several factors. For example, new types of economic activity are developing (construction, trade, medicine, etc.) and, accordingly, new jobs are being created, territories adjacent to the transport infrastructure are developing, and working conditions are improving, which has a positive impact on the socio-economic development of the regions, the growth of the regional gross product, and sometimes the country's GDP.

The combination of these factors form a synergistic effect as a component of the cumulative income from investments in an infrastructure project.

The economic substantiation of the most attractive method of investing in an infrastructure project for investors is carried out by comparing a comprehensive assessment of economic efficiency, taking into account the synergistic effect of different investment methods.

Organizational and economic mechanism for project implementation is a form of interaction between project participants in order to ensure the implementation of the project, taking into account the interests of each participant in the investment project [1]. In general terms, the model of funding sources is as follows:

$$S = Sg + Sk, \text{ where}$$

S - project cost

Sg - state investment (grantor)

Sk - investment of the concessionaire

Due to the specificity of infrastructure projects, due to the required amount of financing and the duration of implementation, the question arises of the possibility of attracting several co-investors. The optimal structure of funding sources at the expense of concessionaires is determined by the expected size of the investment effect, equal to the sum of the profit from participation and the synergistic effect. This determines the criterion of the aggregate of possible beneficiaries, which makes it possible to form a financial model for the project.

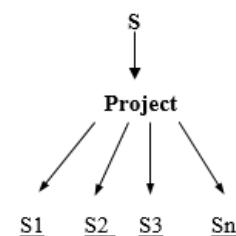
$$\text{Project effect } SPpr = Ppr + Ps, \text{ where}$$

$SPpr$ - total effect.

Ppr - the effect of exploitation of the created object

Ps - synergistic effect.

Possible factors of attractiveness for private investors:



Where

S - investment,

S_i - synergistic effect

Examples of synergistic factors:

1. Social factor, labor resources. Effect:

a) creating new jobs (falling unemployment);

b) the quality of human capital (due to the development of social facilities).

2. Environmental factor, reduction of emissions. Effect: Calculate vehicle emissions when transporting similar goods by road over the same distance.

3. The budgetary factor, an increase in budget revenues from taxes. Effect:

a) increasing the revenue base of the regional budget at the expense of personal income tax and part of the income tax;

b) an increase in the revenues of the federal budget due to VAT receipts and part of the income tax.

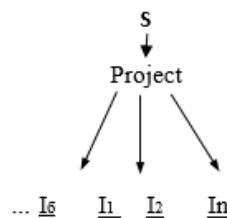
In addition to the listed synergistic factors, the investor may be interested in the project due to the possibility of optimizing his business. An example is the investment project for the development of an airport in Krasnodar [3].

Sources of investment (S) for the implementation of an infrastructure transport project are budget funds and funds of private investors.

$$S = I_b + (I_1 + I_2 + \dots + I_n), \text{ where}$$

I_b - budget investments,

I_i - private investor investments



Synergy factors are attractive for companies implementing a sustainable development strategy of the company that includes environmental and social initiatives, as well as the level of corporate governance, as well as regional socio-economic goals, as well as regional socio-economic goals.

In September 2015, there were 193 countries at the UN General Assembly, including Russia, 17 Sustainable Development Goals (SDGs) were adopted, which are included in the UN agenda until 2030. Among them are general economic well-being, the elimination of poverty, improving the quality of education and health care, the development of renewable energy, rational production and consumption, the fight against climate change, the preservation of ecosystems, justice, the quality of institutions and respect for human rights [4].

Infrastructure transport projects are part of a nationwide sustainable development strategy.

Companies that have developed and successfully implemented sustainable development strategies can obtain loans on preferential terms [7].

For example, the Russian company Polymetal has a positive experience of financing linked to the achievement of sustainable development indicators. The venture entered into a bilateral agreement with Societe Generale to provide a \$ 75 million loan, with interest rates closely tied to the company's five environmental and social policy goals. The assessment of the company's achievement of these goals will be carried out by the Societe Generale group on an annual basis, depending on the degree of their fulfillment, the interest rate on the loan may decrease, remain unchanged or increase every year.

Of particular interest to potential investors are projects that combine the use of environmentally friendly technologies with the social and economic goals of the regions. For example, the Eurasian Development Bank (EDB) took part in financing the construction of three wind farms in the Rostov

region, including the Kamenskaya, Sulinskaya and Gukovskaya wind farms (WPP).

The advantage of the concession form lies in the possibility of making interval investments as the project progresses.

VI. INNOVATION AND DIGITALIZATION OF FINANCIAL MODELS OF PUBLIC-PRIVATE PARTNERSHIPS

Existing PPP financial models do not provide the desired focus on innovation that can improve the efficiency of infrastructure projects and thereby reduce the time and money spent on construction and maintenance. As the complexity of infrastructure projects grows with their scale, it becomes necessary to accumulate international and national experience with unconventional implementation strategies.

The authors of the article propose attracting resources from individuals, including non-residents of the Russian Federation, to finance infrastructure projects based on corporatization. Currently, in Russia, as a result of the reduction in the key rate of the Central Bank of the Russian Federation, deposits are no longer attractive to households and foreign investors. Individual investment accounts (IIA) have become an alternative way of saving savings. IIS is a financial instrument for attracting minority investors to infrastructure projects. The turnover in IIA in the first half of 2020 amounted to 717 billion rubles, which is more than the indicator for the entire 2019, and the number of individual investment accounts (IIA) in the first half of 2020 increased by 46.3%, to 2.4 million rubles [9].

According to US statistics, for 2016, every fifth household with an annual income of less than \$ 35,000. has assets in the stock markets, 88% of households with an annual income of more than \$ 100,000 own shares; the median investment amount is \$ 40,000 [18]. In 2019, the number of US households was 128.58 million [21].

The attractiveness of IIS is also provided by a tax incentive: a tax deduction of 13% of the amount of funds deposited or exemption from taxes on income received from investment. To be eligible for tax benefits, you must not perform any withdrawal operations from an investment account for three years. The maximum contribution to the IIA is 1 million rubles. per year, the funds of the IIA can be used to purchase shares, bonds, shares [12].

In the proposed financial model of project investment, stock brokers play an active role, selling PPP shares to individuals directly or through IIS, thereby simplifying the search for minority investors for infrastructure projects. At the same time, the mechanism for attracting private investment proposed by the authors allows maintaining the transparency of the distribution of shares, while maintaining control of strategic projects for the state.

Popularization and mass character of projects is important for attracting private investment in large-scale projects. For the development of a new blockchain platform Telegram Open Network (TON), which could compete with international payment systems Visa and Mastercard, the amount of applications for the preliminary stage of ICO amounted to \$ 3.8 billion, which was four times higher than the planned investments [8].

Since digital financial assets, in particular, are digital rights for equity securities, the authors propose the use of a

PPP corporation mechanism using a blockchain or a distributed ledger [11].

Blockchain is a distributed ledger with verified blocks organized in a sequentially added chain using cryptographic links, does not allow changes to records, provides the ability to add, but not change records, contains verified and confirmed transactions [11].

According to the authors, blockchain is a new international technology for accounting for the transfer of assets between economic entities with the highest degree of transparency, which is critically important for the development of interaction between private and government agents.

The financial model of corporatization based on blockchain technology involves the use of a smart contract mechanism: after identifying users in the information system, their further behavior is subject to the algorithm of a computer program. The person acquiring a digital right will receive this object automatically when certain circumstances occur. The transaction will be executed without additional orders from the parties: the seller will have digital rights written off, and the buyer will have money. Thus, the will of a person aimed at concluding a contract includes the will aimed at fulfilling an obligation [16].

The model for attracting private investment and the formation of public-state capital is implemented through a blockchain platform of a public-private project, which conducts an initial public offering in the form of a CFA, using a smart contract as a transaction tool and registration of rights to shares.

For the implementation of infrastructure projects, the authors propose the following distribution of shares in the PPP capital:

- Government: 25% + 1 share. Blocking shareholding. It is implemented at the stage of PPP formation;
- Major shareholders: 50%. Formed by direct sales by private subscription;
- Minority shareholders: 25%. It is formed by direct sales through an open subscription, as well as using the IIS tool.

An example of the implementation of the above financial model is CoinOffering Ltd, the first in the world to register shares in the charter that exist exclusively in the form of tokens (shares or CFAs) in a smart contract on the Ethereum blockchain platform, the transfer of which is considered valid only using transactions in the specified smart contract [22]. Thus, the owners of tokens are shareholders, voting is also carried out in a smart contract, the register of shareholders' accounts and transactions with shares (tokens) of the company are in the public domain.

The mechanism is significantly cheaper than a classic IPO, as well as less expensive in terms of implementation time, has the maximum transparency, accessibility and level of confidence of the participating economic agents.

Over the past 10 years, blockchain technology has made fundamental changes in the global financial system and created alternative tools to reduce the intermediary costs of transactions carried out by traditional financial institutions. Blockchain combined with smart contract technology presents an opportunity to change the classic financial models through

which PPPs attract private investment, to introduce new strategies for the implementation of complex large-scale infrastructure projects: a digital ecosystem of public-private projects formed by transparent chains of business processes and cash flows.

VII. CONCLUSIONS

The considered factors of attractiveness of infrastructure projects for private investors indicate the need to use more flexible forms of interaction between the state and business in comparison with the existing financial models for attracting investments.

Concession: hinders the attractiveness of participation in infrastructure projects of private business due to the non-transparent mechanism for the formation of sources of financing, in connection with which the state acts as an investor in one form or another in almost all projects in Russia. Based on the legal regulations of the concession, an individual cannot be a concessionaire, he can participate indirectly as a participant in any society.

Analysts of the Moody's agency estimate the share of the public sector in the Russian economy at 40-50%, which corresponds to the estimates of the Center for Strategic Research, according to which the state occupies 46% of the Russian GDP. The stateization of the Russian economy and the lack of a transparent legal framework for PPP hinders the interaction of state and private economic agents.

Synergistic effect: the investment attractiveness of an infrastructure project can be measured by the cumulative factor of interaction of economic agents in the process of its implementation and use: social, budgetary, environmental.

The existing financial PPP models require the introduction of innovations due to the development of Internet technologies and the digitalization of the economy. The use of modern blockchain technology, smart contracts and CFA allows creating a transparent model of interaction between economic agents with different levels of investment, which will allow you to quickly attract funds from individuals, corporations and the state with the subsequent timely implementation of PPP projects.

The authors of the article consider the concession mechanism to be a priority direction in the development of the financial model of project investment, which allows attracting private investors, including minority ones, contributing to the development and implementation of strategic state infrastructure projects, creating a concessionary society.

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