

# Public-Private Partnerships: approach to financial modeling, risk analysis and effects assessment

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**Abstract.** *The article is devoted to the analysis of actual changes in the legal framework, the identification of relevant approaches to the assessment of economic effects for stakeholders, as well as the construction of financial models in the framework of the implementation of public-private partnership agreements. The authors propose their approach to building a financial model and assessing the effects and risks of PPP projects. The article describes the algorithm for building a financial model, as well as the author's approach to the evaluation of the integral effect taking into account the complex structure of the partnership participants.*

**Key words:** *public-private partnerships (PPP), effects and benefits for PPP stakeholders, PPP financial model, evaluation of PPP project risks and effects, forecast of PPP project development, concession*

## 1 Introduction.

PPP is studied in detail and multilaterally in Russia and abroad. In a generalizing study, ed. E.R. Yescombe (Yescombe, 2018) there are studied: the specifics of the application of PPP standards in different countries of the world, the shortcomings of PPPs, the decision-making processes for investing and holding state competitions in PPPs, the practical issues of organizing financing for private companies entering into PPP agreements and other. An empirical analysis of the involvement of small and medium-sized businesses in PPPs and amendments to the concluded contracts was carried out by the authors of the American Planning Association, the World Bank and the EBRD (Sagalyn, 2007; Chao, Toro, 2017; Beuve, de Brux, Saussier, 2014).

In works (Makovsek, 2013; Caperchione, Demirag, Grossi, 2017; Buso, Marty, Tran, 2017; Burke, Demirag, 2017; Benitez-Avila, Hartmann, Dewulf, Hensler, 2018; Diaz, 2017) such aspects of PPP as prices for services in PPP projects in traditional sectors, the impact of public sector reforms on PPP, budget constraints on PPPs, risk transfer and stakeholder relationships, the influence of trust and established relationships, regulatory regulation of PPP contracts are covered. In (Kweun, Wheeler, Gifford, 2018; Kim, 2018; Klijn, Teisman, 2003), regional experience was analyzed - assessing the effectiveness of PPPs in the construction of toll roads in the United States, implementing an integrated urban mega-project in the city of New Songdo in South Korea, institutional and strategic barriers to PPP in the Netherlands. In a recent paper (Macomber, 2018) Professor of the Harvard University J. Macomber discusses the possibilities of using PPPs in the four types of urban agglomerations allocated by him.

The authors of this work suggest a practical approach to the construction of a financial model when assessing the effectiveness of PPP projects by the plan for the respective dependencies. The article describes the principles of building a financial model, as well as the author's approach to assessing the integrated effect, taking into account the complex structure of the participants in the partnership and assessing economic effects for stakeholders.

## 2 Methodological approaches and analysis

The article analyzes the legal foundations and trends in the development of this form of interaction. Modern methods for assessing risks (Burke, Demirag, 2017), benefits and effects for different stakeholders of projects implemented in the form of PPPs are considered. The authors propose to consider and evaluate PPP projects in terms of 3 aspects: organizational, methodological and managerial (stakeholder). The organizational aspect is that we evaluate the benefits of the project at different levels of functioning of economic entities participating in the project. The methodological approach is that there are many methods that can be adapted for use in the process of assessing the effectiveness of PPP projects. From the point of view of the theory of project management in projects implemented in the format of public-private partnership, there are several stakeholders: the state, business, society. By stakeholders we mean all individuals and / or legal entities that are directly or indirectly interested in the results of the project.

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For each of the stakeholders, we can identify the effects that they can assess in the process of analyzing projects implemented in the format of public-private partnership. By effects we mean quantitative and qualitative project results that can be identified and, as a rule, measured (Kweun,Wheeler,Gifford,2018).

### ***2.1 Trends in the development of public-private partnership in Russia.***

On January 1, 2016 in Russia took force Federal Law No. 224-FZ of July 13, 2015, "On Public-Private Partnership, Municipal-Private Partnership in the Russian Federation and Amendments to Certain Legislative Acts of the Russian Federation" (hereinafter - the PPP Law ).

Prior to that, most of Russia's PPP projects were implemented under the Law on Concessions, adopted in 2005, and also on the basis of regional legislation on PPPs (according to data for 2015, 71 laws of the subject of the Russian Federation in the sphere of PPP acted in Russia).

The current Russian legislation on PPP is developing in three main areas: the PPP law and the expected amendments to it, concession legislation, regional legislation (Krjukova,Lemieva,2016).

At the end of the 1st quarter. 2017 «Association PPP Development Center» published the results of their research "Public-Private Partnership in Russia 2016-2017: Current Status and Trends, Regions' Rating." Experts identified the main trends in PPP development in Russia (Markovskaya et.al.,2017).

As of the beginning of 2017, the Russian Federation has passed the stage of deciding on the implementation of 2,446 infrastructure projects that involve private investment on the principles of PPP. At the same time, more than 480 projects are in the work of authorities and about 1,000, according to expert estimates, are structured by a private partner for launch using the "private initiative" mechanism. Among the PPP projects that passed the decision-making stage on the implementation of the 17th federal level, 238 of the regional level; 2191 - the municipal level. Note that in a similar study published in the 1st quarter. 2016 reported on 1300 PPP projects, for which a decision was made to implement: 15 projects at the federal level, 191 projects at the regional level, and more than 1100 projects at the municipal level. Thus, the largest growth for 2016, almost 100%, is noted for municipal level projects, while at the regional and federal level the growth in the number of projects implemented is more moderate. With regard to municipal PPP projects, it is noted that for 2017 so far, their implementation has been delivered to a maximum of 15-20 regions of the Russian Federation, where concession mechanisms are actively used. Thus, with the expansion of the geography of implementation in the coming years, the significant growth in the number of municipal-level PPP projects is likely to continue.

The main form of implementation of projects in the form of public-private partnerships continues to be a concession. 2,200 infrastructure projects (mainly in the municipal sector at the municipal level) are already being implemented and will be implemented in the form of a concession agreement. The term "private partner" has been used more actively since 2016, after the adoption of the law on PPP, mainly in PPP / PPP agreements in the social sphere (health, education). To date, there are 70 such projects, concluded within the framework of regional legislation.

The study notes that a number of projects are being implemented today in other organizational and legal forms close to PPP, for example, such as: a long-term investment agreement and a life-cycle contract concluded within the framework of the 223-FZ; life cycle contract within the framework of 44 FL; long-term lease of public property, which implies certain investment obligations of the lessee (the RF Civil Code and 135-FZ).

Most PPP projects are implemented in the following areas: communal and energy infrastructure (84% in terms of the number of projects and 27% in terms of investments), social infrastructure (11% in terms of number of projects and 13.5% in terms of investments), transport infrastructure 3% for the number of projects and 56% for the volume of investments). Projects in the information, communication and other spheres of PPP are 2% in terms of the number of projects and 3.5% in terms of investments. In such areas as defense, maintenance of law and order, fundamental science, legislative activity of PPP is not used.

### ***2.2. Some aspects of project evaluation implemented in the form of public-private partnerships***

The need to assess the effectiveness of projects implemented by the format of public-private partnership, starting from the moment the PPP Law comes into force, is part of the organizational scheme for reviewing and analyzing the project by authorized representatives of government bodies (Benitez-Avila,Hartmann,Dewulf,Hensler,2018)).

We can single out several important aspects of the project evaluation, implemented in the format of public-private partnership, from our point of view.

*Organizational aspect.* Organizationally, the evaluation process depends on the level at which decisions are taken on the project. For example, the materials of the Public-Private Partnership Development Center contain such an organizational chart of the decision of the Investment Fund of the Russian Federation on PPP projects, which is set forth in Government Resolution No. 134 of March 1, 2008, "On Approving the Rules for the Formation and Use of Budgetary Appropriations of the Investment Fund of the Russian Federation "(with amendments and additions).

Organizational aspects of the decision-making process on investing in PPP projects are fixed in the following normative acts: Resolution of the Government of the Russian Federation No. 590 of 12.08.2008 "On the procedure for inspecting investment projects for the effectiveness of using federal budget funds aimed at capital investments" from 13.09.2010 № 716 "On approval of the rules for the formation and implementation of the federal targeted investment program," Decree of the Government of the Russian Federation of 03.08.2011 № 648 "On the selection and coordination of the implementation of priority investment projects of the federal districts and amendments to some acts of the Government of the Russian Federation ", Resolution of the Government of the Russian Federation No. 382 of April 30, 2013" On Conducting a Public Technological and Price Audit of Major Investment Projects with State Participation and on Amending Certain Acts of the Government of the Russian Federation ", RF Government Decree of 05.11. 2013 No. 991 "On the procedure for assessing the appropriateness of financing investment projects at the expense of the National Welfare Fund and (or) retirement savings held in the state management company, on a returnable basis."

*Managerial aspect.* In terms of the theory of project management in projects implemented in the format of public-private partnership, there are several stakeholders: the state, business, society. By stakeholders we mean individuals and / or legal entities that are directly or indirectly interested in the results of the project.

For each of the stakeholders, we can identify the effects that they can assess in the process of analyzing projects implemented in the format of public-private partnership. By effects we mean quantitative and qualitative project results that can be identified and, as a rule, measured (Makovsek,2013).

*Methodical aspect.* Methodological bases for the evaluation of projects implemented in the PPP format are set out in several normative acts: The methodological recommendations for assessing the effectiveness of investment projects (approved by the Ministry of Economics of the Russian Federation, the Ministry of Finance of the Russian Federation and Gosstroy of the Russian Federation of June 21, 1999, No. V 477) ,the Order of the Ministry of Regional Development of the Russian Federation of October 30, 2009, No. 493 "On Approving the Methodology for Calculating Indicators and Applying Criteria for the Effectiveness of Regional Investment Projects ..." (Markovskaya E.I. et al.,2018)

### ***2.3. Estimation of the integral economic effect in case of participation of foreign or international organizations in public-private partnership projects***

To determine the integral economic effect of involving a foreign partner in joint activities to create an innovative product within a PPP, the following basic formula can be used:

$$Eief = FRf * k1 * k2 * k3 - FRd \quad (1)$$

where: FRf (NPVf) - the expected financial result from the implementation of the project to create an innovative product in the PPP with the involvement of this foreign (international) company;

k1 - coefficient defining the scale of the project in the suggested range [0,8; 1,2]: 0,8 - municipal project, the total cost of the project is up to 100 million rubles; 1 - the regional project, the cost is from 100 to 500 million rubles; 1.1 - a regional or interregional project, costing between 500 million and 5 billion rubles; 1,2 - the federal project, the cost of more than 5 billion rubles.

k2 - coefficient determining the level of business reputation (fame) of this foreign (international) company involved in the implementation of the project to create an innovative product within the PPP framework in the range [1; 1.5]: 1 - the company is known in its country; 1,5 - the company is the world leader, cooperation with which has the highest reputation effect;

k3 is the ratio of the share of private capital in the project for the creation of an innovative product within the framework of PPP with the involvement of this foreign (international) company in comparison with the involvement of domestic partners or other foreign (international) companies that participate in the tender, the coefficient is determined by the private respective shares;

FRd (NPVd) is the expected financial result from the implementation of the project to create an innovative product within the framework of PPP with the involvement of a domestic or foreign company that is accepted as the base option

Moreover, formula (1) can take into account other factors, the influence (weight) of which can be determined by the method of expert estimates (Radoushinsky,2016;Markovskaya, Radoushinsky,2017).

### ***2.4 Approaches to building a financial model and assessing the effects of a project implemented in the form of PPPs: Russian practice***

Implementation of the project in the form of public-private partnerships should provide mutual benefits for both sides involved in the transaction, for both the public and the share of the private partner.

On general, the base principle of formation of the remuneration understand at a basic level - for the implementation of the project costs must be offset by income from private business project, as well as getting some profit. This principle is particularly significant for the private partner, as the public partner in projects of public-private partnership performs primarily its social function, which provides taxpayer funds. Therefore, the public partner does not need to extract any financial benefit from the project.

Note that part of the public-private partnership projects at the same time is subject to the necessary and additional state regulation of tariffs. This state regulation (see. Law of the Russian Federation of the PPP No. 7) affects the preparation and formation calculations on financial model. If, in accordance with the agreement on public-private partnership provides for the production of goods, works and services carried out at regulated prices/tariffs and (or) based on established allowances to the prices/tariffs, procedures and conditions for establishing and changing prices/tariffs on manufactured goods, performed work, rendered services, allowances on prices (tariffs), long-term parameters of regulation of the private partner's activities (see. Law of the Russian Federation of the PPP No. 7), subject to approval in accordance and the Russian Federation in the field of price control legislation (tariffs).

Thus, the final version of the financial model for this project of public-private partnership can be formed only after the prices / tariffs on manufactured goods / services will be agreed with the relevant regulatory authorities.

In addition, the agreement on public-private partnership may be a charge made by the private partner public partner during the operation and (or) maintenance of the facility agreement (see. Law of the Russian Federation of the PPP, Ch. 9).

The introduction of such a payment may be provided both during the entire life of the service and / or maintenance of the object of the agreement, and during certain periods of its operation and / or maintenance. The amount of such payment, as well as its form, procedure and timing of its introduction are established by the PPP agreement [4].

In the construction of the project's financial model [5] is necessary to make a series of actions that will form a model more accurately and correctly.

The following scheme for constructing a financial model is proposed:

1. Formation of the overall project of PPP model (including various production and basic financial indicators).
2. Construction of the forecasted statements (including balance sheet, profit and loss statement, cash flow statement).
3. Calculation of the pure discounted cash flow.

In building the financial model for this scheme, it is necessary to consider that the amount of state participation in the transaction is determined by the size of the rate of profit and the amount of depreciation in the absence of borrowed funds.

In the presence of debt financing to private investors also offset by interest paid for the use of debt financing.

Thus, in order to determine the amount required to be paid, the project is preparing a financial model of the project of PPP.

Formation of a financial model for the implementation of the public-private partnership project takes place taking into account the use of own and borrowed funds.

As part of the formation of the financial model, the amount to be paid by the private partner from the project to cover its expenses is calculated.

The amount is calculated for each year of the provision of services / sales of products, on the following conditions:

The expected amount to be received by a private partner for each calendar year for the provision of services / sales of products is calculated by the following formula:

$$P_t = P(I_t) + P(FC_t) + P(VC_t) \quad (1)$$

where:

- $P_t$  - the expected value in year t;
- $P(I_t)$  - part of the expected investment in year t;
- $P(FC_t)$  - expected permanent costs in year t;
- $P(VC_t)$  - expected variable costs in year t.

The expected value of the constant operating part in formula (1) for each year of the provision of services / sales of products is calculated by the following formula:

$$P(FC_t) = \sum_{j=1}^n FC_{tj} Ind(t) \quad (2)$$

where:

- $FC_{tj}$  - compensation of j-type costs for t-year;
- $Ind(t)$  - the forecasted index in t year.

The expected value of the operating variable part in formula (1) for each t service year is calculated using the following formula:

$$P(VC_t) = \sum_{i=1}^n V_t(i) \sum_{j=1}^m VC_{tj} Ind_j(t) \quad (3)$$

where:

- $V_t(i)$  - expected volume of the i-th type of services / goods in year t;
- $VC_{tj}$  - compensation costs in the form of j-th for year t;
- $Ind_j(t)$  - forecast the index j-th species in year t.

When building a financial model of public-private partnerships must take into account that the magnitude of the sum necessary for the private partners for the project should be not less than the sum (formula 1).

Thus, if we calculate the financial model of a project implemented through a public-private partnership scheme (a simplified example of such a calculation is given below, see Table 2.), the amounts of subsidies received should be calculated taking into account the constraints obtained by formulas (1) - (3).

Table 1.-Simplified financial model for calculating the subsidy for falling costs by the public-private partnership model

Indicatorname	Units	2017	2018	2019	2020
Income from goods /services	rub.	54872	58620	61025	64230
Income from non-core activities	rub.	4510	4826	5163	5525
Totalrevenues	rub.	59382	63446	66188	69755
Cost of sales of goods / services	rub.	32923	35172	36615	38538
Productioncosts	rub.	5487	5862	6103	6423
Depreciation	rub.	20500	20500	20500	20500
Propertytax	rub.	560	560	560	560
Expenditures for social development and other purposes	rub.	1540	1540	1540	1540
Projectmanagementcosts	rub.	420	420	420	420
Interestonloans	rub.	890	890	890	890
Totalcosts	rub.	62320	64944	66628	68871
Drop-outcosts	rub.	2938	1498	439	-884
Subsidies from the budget	rub.	2938	1498	439	-884

In addition, in the implementation stage of the project in the formula may also take into account the income of the investor from the project, that is part of the amount  $P_1$  at the stage of operation of the project can be covered through income from the project itself.

Most of the projects implemented in the format of public-private partnerships imply a gradual coverage of the investor's expenses for the project implementation at the expense of revenues received from its implementation.

However, it is also necessary to take into account that the investor pays attention not only to the gross income, but also on the distribution of funds in time.

In conclusion, it should be noted that any project of public-private partnerships involve an interest in the project, as a private investor in the form of financial benefits, as well as from the state party in the form of implementation necessary for the tasks of the state, to ensure public infrastructure, social facilities and other tasks, which are traditionally resolved at the state level (Markovskaya et al, 2018).

### 2.5. Approaches to risk assessment of PPPs: Russian practice

Examples of practical implementation of methodological recommendations for the evaluation of regional projects.

Below are examples of regional approaches to the implementation of guidelines for project evaluation. These approaches are related to the implementation of the rating-rating system of project evaluation.

Example 1. The rating system for the evaluation of projects for the development of entrepreneurship in the Cherek Municipal District of the Kabardino-Balkarian Republic

Table 2 - Criteria for assessing the local administration of the Chereksky Municipal District when giving grants to entrepreneurs:

Criteria	Indicator	Grade	Weight of criteria
1	2	3	
Land for the project implementation	ownership	100	0,2
	rent	80	
Creation of the additional work places	More than 3	100	0,3
	3	80	
Weight of the equity in the total investment	15%	80	0,2
	More than 15 %	100	

Criteria	Indicator	Grade	Weight of criteria
Own fixed assets (infrastructure, equipment, tools etc)	yes	100	0,1
	no	0	
Business lines	agriculture	100	0,1
	tourism	80	
	manufacturing	70	
	services	60	
	arts	50	
	trade	40	
Correspondence with the project documentation	corresponds	100	0,1
	Does not correspond	0	

Source: Developed by Markovskaya E.I. together with Isupov AR, representative of the administration of the Chereksky Municipal District of the Kabardino-Balkarian Republic within the framework of the Presidential Program, 2015.

When submitting an application, the applicant can provide any additional documents, including a letter of recommendation (letter) from public organizations, or guarantors, if he believes that they can influence the decision of the competitive commission. Additionally submitted documents are also subject to inclusion in the inventory. The Commission assesses the submitted additional documents in points by a majority of votes, but not more than 20 points in total.

A project that has earned scores from 70 to 100 is the recipient of the grant.

As we can see, the relationship criteria-indicators-scores given in the methodology express the stakeholder expectations associated with obtaining certain effects of the project.

Projects implemented in the format of public-private partnerships are implemented on the basis of the idea of sharing risks between all project participants. This principle is fundamental for project financing. Therefore, to analyze the risks of public-private partnership projects, it is possible to use methods that are designed to assess the risks of long-term financing. For example, for these purposes, the methodology developed by Markovskaya EI can be adapted.

Initially, this methodology was developed for JSC "AB" Russia "in the period 2007-2008. in order to assess the bank's risks in project financing. Since the project financing involves the participation of several stakeholders, including creditors and investors (the bank can also act as a co-investor of the transaction), this methodology assumes risk assessment in different points of view<sup>†</sup>(Markovskaya,2013).

The purpose of the methodology is to determine the level of credit risk R1 for deciding whether to participate in the transaction. The assessment of the level of credit risk R1 is carried out on the basis of an analysis of the main indicators characterizing the state of the external and internal environment of the initiator of the project.

The directions of analysis and the indicators included in their composition are presented in Table 3. The distribution of specific weights was made taking into account the importance of certain factors in the analysis of projects financed on the principles of project financing and investment lending. For example, the specific weight of the factor "project characteristic" in the case of project financing is 0.6, and in the case of investment lending it is 0.2. This is due to the fact that in the case of project financing, particular attention is paid to the project in the process of long-term risk analysis because it is the cash flows generated by the project that are the source of

<sup>†</sup> The entire methodology is published in the following sources: Markovskaya EI Evaluation of the risks of long-term financing of investment projects in the Russian environment. // Audit and financial analysis .- No. 5.-2013., Markovskaya E.I. Organization of financing of investment projects: theory and practice. Spb, Publishing House of Polytechnic University, 2013.

income for investors, as well as the source of debt repayment for the bank.

Table 3- The main directions of the study of the external and internal environment of the project / project initiator, the relevant indicators and their specific gravities

Project characteristics	Weight		indicator	Weight	
	Project finance	Investment loans		Project finance	Investment loans
Project Initiator Owners	0,1	0,4	Influence of owners	0,3	0,3
			Stability of business	0,2	0,2
			Experience in Project Realization	0,2	0,2
			Financial Performance	0,1	0,1
			Goodwill	0,2	0,2
Project peculiarities	0,6	0,2	Financial Model	0,2	0,3
			Marketing and Sales	0,2	0,15
			Supply	0,2	0,15
			Assets creation	0,1	0,1
			Exploitation Stage	0,1	0,1
			Political Risks	0,1	0,1
			Other	0,1	0,1
Credit or investment deal peculiarities	0,3	0,4	Guarantees for the loan	0,4	0,4
			Additional Finance Sources	0,3	0,3
			Level of Control	0,3	0,3

Calculation of the numerical value of the risk level R1 is carried out as follows:

- the study of the initiator of the project and its external environment for each indicator is carried out;
- the values of the indicators and their corresponding grades are determined; if the indicator includes subgroups, a score is determined for each subgroup;
- the values of the indicators, which include subgroups, are calculated by multiplying the grades by subgroups by their specific weights and by summing the weighted indicators;
- weighted values of indicators are calculated by multiplying their gross values (the sums obtained by subgroups) by their specific weights;
- an estimate of the level of risk for each direction of the study of the internal and external environment of the initiator is calculated by summing the weighted estimates of the indicators in each direction;
- a final assessment of the level of risk R1 is calculated by multiplying the risk estimates by the research directions by the corresponding specific weights and summing the weighted values.

Based on the numerical risk assessment of R1, the Bank / Investor's participation in project financing and the nature of the financial condition of the initiator (to determine the quality of credit resources in case of participating in financing a bank project) are determined.

Table 4.- Classification of the financial condition and the possibility of participating in the project, based on an assessment of the level of risk R1

Financial Performance	Risk assessment R1	
	grades	interpretation
Good	65–100	Participation in financing is possible
	45–65	Participation in financing is possible with additional conditions
Medium	25–45	The project needs some changes
Bad	0–25	Participation in financing is complicated

### 3 Results

In the descriptive part the issue analyses the trends in the development of public-private partnership in Russia, the new possibilities as well as constraints of a Russian PPP Law which works since 2016. While considering the aspects of project evaluation implemented in the form of PPP the authors seek an approach to the construction of a financial model when assessing the effectiveness of PPP projects by the plan for the respective dependencies. The principles of building a financial model are described which take into consideration the modern methods for assessing risks, benefits and effects for different stakeholders of projects implemented in the form of PPPs. In the final part the article describes an approach for assessing the integrated effect, taking into account the complex structure of the participants in the partnership and assessment of economic effects and risks for stakeholders.

### 4 Conclusion

We examined approaches that can be used by stakeholders in the process of assessing the risks and effects of public-private partnership projects. Taking into account risks, the fair price of participation in the PPP project for both parties is estimated. The proposed financial model can be used to calculate the concession fee in tariff-regulated projects where the state is supposed to participate, usually with the subsequent transfer of the ownership for the created object to the state.

Further areas of research may be the following: developing a methodology for assessing the risks and effects of public-private partnership projects taking into account the industry specificity.

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