International Journal of Economics and Financial Issues

ISSN: 2146-4138

available at http: www.econjournals.com

International Journal of Economics and Financial Issues, 2017, 7(1), 403-413.

Transaction Costs and Prospects for Public-private Partnership in the Russian Mineral Resourse Sector

Irina Glazyrina[1]*, Sergey Lavlinskii[2]

[1]Department for Ecological Economics, Institute of Natural Resources, Ecology and Cryology of the Siberian Branch of the Russian Academy of Sciences, Transbaikal State University, Chita, 672014 Russia, [2]Institute of Mathematics of the Siberian Branch of the Russian Academy of Sciences, Transbaikal State University, Novosibirsk, 630090, Russia. *Email: iglazyrina@bk.ru

ABSTRACT

An analysis is presented for the current development level of the institution of public-private partnership (PPP) in the mineral resources complex of Russia. The main focus is on the two PPP models that are most widely used in Russia. The first model is production sharing agreement (PSA). An analysis is conducted of the PSA concept. The Sakhalin 2 project is used as an example to show how an inadequate preparation of PSA terms and high transaction costs (TC) can lead to a breach of contract. The second model is applied in production infrastructure development projects financed by the Investment Fund of Russia. This is a Russia-specific model; thus, authors use a special toolkit for its assessment in the paper. Analysis shows that important factor of the project efficiency is an institutional environment. Weakness of institutions and lack of low cost instruments of conflict resolution might be the cause of high TC and environmental damage. The technique applied in the efficiency analysis of concrete partnership arrangements is presented using the examples of the PPP models practiced in Krasnoyarsk Krai and Transbaikal region in Siberia. It can be applied in designing a raw-material base development program involving PPP arrangements. The problem solution generates a cost-sharing arrangement between the state and the private investor, making it possible to optimize the majority of Russian PPP models.

Keywords: Mineral Resources, Public-Private Partnership, Production Sharing Agreement, Transaction Costs
JEL Classifications: Q32, O13, C63

1. INTRODUCTION

High inflation, natural-resource orientation and technological backlog–these are the characteristic features of the Russian economy of recent years. These circumstances largely define the strategy of natural resource use on most of the vast and low-developed territories of Russia. The major challenge here is to design a mechanism to coordinate the long-term interests of the state and the private investor. Such a mechanism should ensure the investment appeal of the region, the inflow of government money, and the observance of environmental constraints in territorial socioeconomic development.

Public-private partnerships (PPPs) are widely used throughout the world and are an effective way to achieve a compromise of interests in various spheres of economy. There are diverse forms of PPP arrangements whereby a private company builds a state-owned object and transfers it to the state either directly upon the completion of the works or after a certain period of operation. World experience shows that PPPs can be a successful means, primarily, of creating new and maintaining the existing public sector infrastructure. In the mineral complex, PPPs help to considerably expand project financing and encourage subsoil users to develop new fields in remote areas.

How broadly is the PPP institution implemented in the mineral resources complex of Russia? It is quite often that the investor cannot implement an investment project due to a lack of the necessary infrastructure, and the state officials are unwilling to invest in infrastructure until they are sure it is used efficiently. What steps are taken to break this vicious circle? What economic and mathematical tools for designing an efficient PPP model can be used in the Russian context? These questions are the focus of this paper. The authors propose a PPP model-building methodology based on finding of a compromise of economic interests. This approach would ensure long-term efficiency for the state as well as the private investor.

2. HISTORY OF RUSSIAN PPPS

The original form of the PPP model is traditionally termed BOT (Built, Own, Transfer) and is known worldwide as concession. Its core idea is the transfer of activities from the state to the private sector. This PPP model was broadly used in Europe since the 19th century in the development of transport infrastructure (Reznichenko, 2010). The next step in the development of PPPs—the BOOT model (Built, Own, Operate, Transfer)—was taken in Australia (Quiggin, 2004). In this model, the private investor builds, finances, manages, and operates an infrastructure object. In this case, the ownership of the created object belongs to a private partner until the end of the contract, after which it passes to the state (Grimsey and Levis, 2004). This model played a dominant role in the implementation of infrastructure projects in the 1990s.

The next stage in the development of PPPs is associated with the DBFO (Design, Built, Finance, Operate) model (Mayston, 1999) and the adoption of a new strategy for government projects in the UK, i.e., the Private Finance Initiative (Groute, 1997; Owen and Merna, 1997). In this model, the private investor sets up a management company for a long term (30-60 years) to build, finance, and manage the object and provide the services specified in the government contract (Broadbent and Laughlin, 2003; Bennett and Iossa, 2006). This is a general outline of the two-centuries long evolution of the PPP institution in the world. As a result, now the state is changing the strategies and formats of its participation in infrastructure development. The state is anxious about the search for an optimum proportion between directive and market management, heading toward large-scale attraction of private resources to development of industries that used to be in state ownership and constituted a state monopoly. Attracting private capital on a partnership basis, the state divests itself of a substantial part of its administrative and economic functions to release resources for other socially important functions (Varnavsky, 2009).

The history of the PPP institution in Russia is much less eventful. In 1836, the emperor Nicholas I granted a concession to build a railway line from St. Petersburg to Tsarskoe Selo. The state provided land for free and gave guarantees for the project (Westwood, 1964). Further on, there were attempts at using PPPs in Russia, but those were isolated instances of an experimental nature. The situation has changed only in the last decades. Private capital began to flow to the infrastructure sector, but on a lower scale compared with developed nations. A particularly complex situation is observed in the mineral resource sector, which has traditionally been in focus of the state. Here the state is most interested in the development of PPP tools capable of attracting the resources of the various financial and credit institutions to the implementation of major investment programs.

Historically, two PPP models have been most widely used in the Russian mineral resources complex. The first one is production sharing agreement (PSA), which is commonly used for oil and gas projects. The second model is applied in production infrastructure development projects financed by the Investment Fund of Russia. Both of the models are based on international experience, but their original form has undergone serious change in the process of adaptation to the Russian conditions.

2.1. PSA

In a transition economy, the main challenge for an investor evaluating a field is the uncertainty of the project's external conditions in terms of tax burden. The use of a special PSA regime is an effective way to solve this problem. Developing a field under a standard license agreement, the investor pays, in addition to royalties, a full spectrum of general (labor, property, value-added, and profit) taxes, whose rates are formed outside the natural resource sector and reflect the general tendencies in the economy. In a transition economy, such a tax environment puts a mineral resource project on a par with regular goods and services, the investment horizon of which is an order of magnitude smaller, leading to an adverse effect on the project economics.

The economic nature of a large-scale mineral resource production project—a long period of capital investments, high specific transportation costs, and fluctuating prices—leads to a high investor's discount in Russia. The current tax system ignores the key role of the internal rate of return (IRR) in the investor's value system: The investor is "stunned" by a sizable tax burden as soon as the first item is produced. The project costs cannot be compensated within a reasonably short period to achieve a satisfactory performance. That is why in many cases a license agreement does not give the investor an IRR that would justify the risks associated with the implementation of a serious project in Russia.

The PSA contractual mechanism, which was designed specifically for unstable economies, is more sensitive to the costs in the initial project period; tax payments begin to grow gradually only when the investor has reached a certain profitability level. This scheme pulls the investor beyond their discount threshold while ensuring that the state receives the larger part of the rent in the form of taxes. That is why PSA helps harmonize a PPP and achieve a compromise between the interests of the PPP participants.

Unfortunately, the PSA model that has proven effective in the global economy has undergone serious change in Russia. In this context, noteworthy is the example of the Sakhalin 2 project on the development of the Lunskoe and Piltun-Astokhskoe fields on the Sakhalin shelf with the total geological reserves of 600 million tons of oil and condensate and 700 billion cubic meters of gas. The Sakhalin 2 PSA includes both value-added and labor taxes, showing the inertia of the fiscal approach and the failure to understand that the PSA ideology is based on the concept of a "protective dome" covering the investor. This dome guarantees the existence of unchanging "rules of the game" for the investor to minimize political and economic risks regardless of the situation outside the field.

The Sakhalin 2 PSA, which was signed in the 1990s, was beneficial to the Russian government because the domestic oil companies had neither the technology nor sufficient working capital to develop the field. The economic conditions have changed seriously over time: The national economy has stabilized; the role of the oil-and-gas sector has increased dramatically, and so has the financial capacity of Russian companies. The terms under which the foreign party concluded the PSA began to seem unprofitable for Russia, and the government decided to change the terms of the agreement, undermining the very foundations of the PPP institution. Russian state-owned companies became part of the Sakhalin 2 project; the strategic investor's protective dome was destroyed.

2.2. PPP Projects Financed by the Investment Fund of Russia

The production infrastructure projects financed by the Investment Fund use a non-classical PPP model evolved due to the specific features of the Russian economy. (Varnavsky, 2009) Methodologically, investment projects become PPP projects only when a private company finances the construction and (or) operation of state-owned objects (Groute, 1997). Within Russian projects, production infrastructure is built under the principle that each participant finances their own objects only. In practice this means that the government finances only public properties such as roads, bridges, power lines, etc., whereas businesses build their own objects, i.e., plants, factories, etc. In this situation, the main problem is to share the project costs between the participants.

Here we can draw a historical parallel. During the Great Depression, in France the classical model of concession was modernized. Two systems appeared: A PPP-based concession system and a system whereby the infrastructure was created directly by the government. At that time, in France a large number of infrastructure objects were developed under concession agreements between the government and a public corporation specifically created for the construction and operation of infrastructure facilities (Grimsey and Levis, 2005). However, the outwardly similar PPP types had evolved under different circumstances. In France the government struggled with the economic crisis and pursued a proactive industrial policy. In Russia the government is looking for effective partnership arrangements for the economic development of low-developed areas with a promising mineral resource base; however, Russian businesses do not trust the government and do not work unless they own the assets. They do not understand how and on what terms they can finance properties owned by the state. The best that they have agreed to is the participation in large production infrastructure projects whereby private companies build private properties and the government builds public facilities.

The major infrastructure projects supported by the Investment Fund are implemented according to the above scheme. The federal investment project on the integrated development of the lower Angara region includes infrastructure projects and the construction of the Boguchansk hydroelectric power plant (HPP), an aluminum smelter, and a pulp and paper plant. The support of the Investment Fund is to come in the form of co-financing of the investment project on negotiated terms through construction of the HPP and infrastructure facilities that will become the property of the Russian Federation (where the state unreasonably took a lion share of environmental costs connected with the construction of the reservoir).

Another such project is the one to create the transport infrastructure for the development of mineral resources in the southeast of the Transbaikal region in Siberia. In this project, the government builds the Naryn–Lugokan railway line to provide access to a cluster of prospective fields to be developed by a private investor (OAO Norilsk Nickel). Both of these projects are being implemented at different pace and with different degrees of success.

In the Lower Angara region, the HPP construction is almost complete, but the projects financed by the private investor lag behind the planned schedule (aluminum smelter and pulp and paper plant). In Transbaikal, 3 years after the project was launched, the private investor—OAO Norilsk Nickel—declared its intention not to fulfill its obligations under the project statement. So, both the company's competence and the need for further budget funding of the railway construction were called into question. Indeed, why build a road if there is nothing to carry? As a result, the government builds only a part of the railway up to the station Gazimursky Zavod (223 km instead of 425). This infrastructure provides access to two fields only (Bystrinskoe and Bugdainskoe polymetallic deposits) out of those originally planned under the project.

3. DECISION-MAKING TOOLS

The above examples suggest that the first experience of Russian PPPs in the production infrastructure sector with the support of the Investment Fund was not very successful. This result is due not only to the transition nature of the economy and the lack of the necessary market institutions.

Specific transaction costs (TC), (Wallis and North, 1986) incurred in:

1. Identification and establishment of property rights on constructed facilities;
2. Finding compromise solutions acceptable to both parties: The investor and the state;
3. Unforeseen challenges due to inadequately developed and often ineffective institutions regulating the relations between private and public interests;
4. Unforeseen challenges due to uncertainty.

How can be taken into account costs this kind of? Practical experience suggests that for this decision-making process, a comprehensive evaluation of the PPP project and used schemes of project financing.

In the international practice, there are tools allowing enterprises created within PPP arrangements to raise finance and take out loans for major investment programs. These tools use sophisticated schemes of financing, cross-guarantees, and risk redistribution. World experience shows that the project financing scheme is the most effective form of long-term funding of major PPP projects.

The most important feature of project funding is that the project itself, its working capital, (Lavlinskii, 2010) and investment is guaranteed only by the economic effect of the project. That is why commercial banks have recently started to withdraw from net lending for infrastructure projects and prefer project financing schemes, which allow them to share risks with other institutional investors. The government performs various functions in PPP projects, which often determine the project success. The government itself finances them in part, provides an organizational framework, and reduces the risks by guaranteeing the repayment of loans, procurement, and supplies at negotiated prices.

How to create an effective PPP arrangement? The involvement of a large number of stakeholders in the development of a PPP project places high demands on project organization and management. It is already at the project development stage that an *a priori* assessment is required for the PPP model by forecasting the implications of the project. This assessment is not possible without a comprehensive analysis of all the details of project financing and interactions between the government, banks, and private investors.

An analysis of the feasibility studies submitted to the Investment Fund for the PPP projects in the lower Angara region and Transbaikal reveals insufficient project preparation (Lavlinskii, 2010; Glazyrina et al., 2013; Glazyrina et al., 2014). In these materials the main focus is on the subprojects implemented by private investors. There are independent economic assessments for these subprojects, but no comprehensive assessment for the entire project, which would take into account the contribution of the Investment Fund to the infrastructure development.

The quality of preparation of PSA projects is roughly the same. Although in the 1990s a PSA support department was established within the Russian Economic Ministry, the quality of the Sakhalin-2 PSA leaves much to be desired. An analysis of the main PSA parameters forming the ratio between “cost oil” and “profit oil” suggests that no comprehensive expert assessment of the project implications was carried out at the time of signing the agreement. However, a PSA, like any fiscal scheme, is a fairly complex algorithm with a set of parameters whose roles and effective ranges depend primarily on the features of the economic environment. The PSA efficiency indicators fundamentally depend on a specific combination of key parameters, i.e., the project financing scheme, costs eligible for recovery, depreciation, bonus program, and royalty and uplift rates. However, the materials on the Sakhalin 2 PSA contain no economic and mathematical analysis. Neither there are any forecasts regarding the project outcomes at a particular combination of the PSA parameters.

The above excursion to the modern history of the Russian PPP models in the mineral resource sector indicates that political arguments tend to dominate in the decision-making process. The socioeconomic and environmental implications of this approach initially fade into the background; however, it is these implications that eventually lead to the breach of partnership relations and project suspension. The available experience shows that designing an efficient PPP model for the Russian mineral resource sector would require specialized economic and mathematical tools for the development, assessment, and support of PPP projects. It is only these tools that can provide a comprehensive socioeconomic and environmental assessment of a PPP project and its funding scheme.

For the first of the above PPP models, i.e., PSA, the problem has largely been solved. There is a series of works on economic and mathematical modeling of PSA projects (David, 1996; Johnston, 1994). The Russia-specific modeling tools and techniques to develop the terms of PSAs for oil and gas projects are described in (Lavlinskii, 2007). This is sufficient to support the decision-making process in designing and evaluating a specific PSA model.

For the second form of the PPP (Russian industrial and infrastructure projects financed from the Investment Fund of the Russian Federation) modern world experiences are virtually absent. It is difficult to find international counterparts for the production infrastructure PPP projects financed by the Investment Fund of Russia. This circumstance necessitates the creation of special modeling tools for decision-making in the development, assessment, and support of these projects the subsequent sections of this paper are devoted mainly to the description of one of the possible approaches to this problem. This approach, which has been tested in real-life conditions, may provide *ex ante* evaluation of TC and therefore be useful for natural resource-based regions that consider the use of PPP mechanisms in designing a program for the development of their raw material base.

4. PPP MODEL ASSESSMENT

4.1. General Concept

In the majority of natural resource-based regions of Russia, most of the economic potential is concentrated in the natural resource sector. Industrial development can be achieved by dealing with the “infrastructure bottlenecks,” i.e., electricity shortage and the lack of roads and transport communications.

The project economics of a private investor is, as a rule, very sensitive to the availability of roads, bridges, power lines, etc. in the region and, in some cases, cannot allow for extra costs other than those planned at the beginning. So, here comes the government, which helps the private investor out by taking responsibility for a part of the general-purpose infrastructure projects. The thus created infrastructure can be used not only during the implementation of the private investor’s projects but also in the future. It facilitates economic development through new investment projects that will come to the region in the future as a result of its serious competitive advantages over the other areas, primarily in terms of infrastructure development and reduced project costs.

Large investment projects in the natural resource sector, which are most typical of the Siberian and Eastern regions of Russia, should take into account not only the global economic efficiency considerations but also the environmental impacts of the project activities. That is why the search for a long-term compromise between economy and environment should be used as a way of managing large-scale projects with the participation of private investors and the state. Being part of a partnership, the state can take over a part of the costs related to the environmental losses caused by the implementation of investment projects.

This is the general idea underlying the coordination of interests within the conceptual PPP model, which should be transformed into economic and mathematical tools of regional planning. These tools are essentially a forecasting model used to assess the consequences of a regional development program based on a particular PPP model.

The procedure for an assessment of a PPP model is as follows. Considering a mineral resource base development program as a set of long-term investment projects, the state seeks to achieve a compromise between the interests of all the stakeholders. The assessment of a field in terms of economic rent plays an important role in the selection of projects by the investor. It characterizes the project profitability and is based on the net present value NPV of the project:

$$NPV=\sum_{t=1}^{T}(D^t-R^t)/(1+E)^t, \quad (1)$$

Where, D^t and R^t are the sales revenues and the technological costs of the project (capital investment, operational costs, and labor remuneration) in comparable prices in year t; E is the discount rate; and T is the field development period.

The investor's tax payments are not included into the technological costs R^t, since they are considered as part of the project's positive cash flow. NPV reflects the general efficiency of the project and corresponds to the discounted cash flow of the state and the investor taken together whereby the state plays a passive role of resource owner and recipient of fiscal revenues according to a particular tax system. A proactive position of the state, which is associated with the use of PPPs, has a profound effect on the situation. Being part of a PPP, the state is involved in the financing of capital investment by building a part of the infrastructure needed for the technological project and implementing a range of environmental activities.

In this case, a relationship similar to (1) may also be constructed for the state (NPV_{st}). It uses a longer time horizon TS and a discount rate E_{st} that is considerably smaller than that of the investor:

$$NPV_{st}=\sum_{t=1}^{TS}\frac{VDI_{st}^t-R_{st}^t+tax^t}{(1+E_{st})^t} \quad (2)$$

Here the costs of the state R_{st}^t are the capital investments in the infrastructure and environmental activities; the state revenues include not only the tax payments tax^t arising from the project but also the non-project revenues VD_{st}^t generated by the development of local infrastructure.

The key efficiency indicator for the investor is NPV_{inv}, an analog of (1), which is characterized by reduced capital costs due to the state participation and by additional costs, i.e., tax payments:

$$NPV_{inv}=\sum_{t=1}^{T}\frac{D^t(R^t-R_{st}^t)-tax^t}{(1+E_{inv})^t}, \quad (3)$$

The investor is interested in a project if $NPV_{inv}\geq 0$.

The state implements the raw-material base development program as an integrated project consisting of a set of investment subprojects within a PPP model. Within this project, the state builds infrastructure facilities and finances environmental activities. It receives tax revenues from all the investment subprojects and non-project revenues as a result of the development of local infrastructure. For such an integrated project, we can derive the state's integral NPV_{st}^{int}, which is defined by the selected PPP model (cost-sharing arrangement) and is similar to (2). A compromise between the interests of all the stakeholders (the state and investors) is achieved if

$$\{\text{for each investor } NPV_{inv}\geq 0\} \text{ and } \{NPV_{st}^{int}\geq 0\}. \quad (4)$$

Thus, to choose of an effective raw-material base development strategy, one needs to take the following steps:

1. Conduct an efficiency assessment of the projects.
2. Define the range of objects with $NPV\geq 0$.
3. Develop a state infrastructure and environmental construction program implementing the selected PPP model and ensuring the fulfillment of condition (4).

4.2. Tools for PPP Model Assessment

The key role in designing the tools to assess a raw-material base development program using a specific PPP mechanism is played by a model describing the implementation of an investment project. This model makes it possible to assess the profitability of a project and its implications for the region within a given scenario of external conditions, a part of which are determined by the chosen PPP model and project financing scheme.

The core idea is to use a computer model describing the operation of an enterprise created by the investor to implement the project. The model helps generate a forecast for the trajectory of the key economic indicators depending on a variety of factors. The formal scheme of the model is given by a system of recurrence equations:

$$X(t)=F(X(t-1),P,E(t),PPPM), \qquad \text{на } t=1.,T, \quad (5)$$

Where, P is the original technological project; $E(t)$ is the forecast for the external operational conditions; and $X(t)$ is the vector describing the state of the enterprise at the end of year t. The components of $X(t)$ determine the production capacity and output, the mining of ore, oil, and gas, the results of their processing, the loans and interest paid under the chosen project financing scheme, tax payments by category, and financial and economic indicators showing the performance of the enterprise in year t.

The applied PPP model $PPPM$ directly affects the project configuration because a part of the production infrastructure and necessary environmental projects are implemented by the state. The system's operator F is formalized as a set of simulation algorithms describing the functioning of individual units within the investor's enterprise. The model describes the interactions between the units and the decision-making routines to generate a forecast for the dynamics of the resulting material and financial flows of all kinds. An example showing the interactions for a typical mineral resource project such as the development of a polymetallic ore field can be found in (Lavlinskii, 2008).

Once a PPP model $PPPM$ is chosen (exogenously) by an expert and the initial state of the investor's enterprise $X(0)$ is described, the recurrence equations in model (5) are used to derive the enterprise development trajectory $\{X(t),\ t = 0,\ldots,\ T\}$ for each scenario $\{E(t),\ t = 1,\ldots,\ T\}$. For field development projects that are most typical of the natural resource sector, model (5) allows the construction of annual charts of revenues and expenses for the state and the investor and the assessment of the economic rent from the field NPV and the corresponding NPV_{inv} and NPV_{st}. The rent sharing proportions between the participants are analyzed to determine the degree of compromise between their interests and evaluate of the chosen PPP model.

In a mineral resource region, the state generally deals with a set of fields and a group of potential investors, each of which having a specific technological project that can be implemented under specific conditions. In this context, the PPP mechanism is a basic element in a raw-material base development program. The development of such a program involves the use of special tools based on territorial planning and forecasting models with a strong emphasis on the issues related to raw-material base development. Thus, the decision-maker cannot do without field development models, which are the core of the procedures to assess a specific partnership mechanism as part of the overall development strategy.

How can such an assessment be made? The proposed technology is based on understanding the regional development process as a set of investment projects and a particular PPP model used to harmonize the participants' intentions. Hence, a raw-material base development program can be treated as a bunch of investment projects (BIP), i.e. a set of projects "bundled" by a given PPP model. A general scheme of the model is shown in Figure 1.

The basic element of the bunch model is the investment project model (5) within a given PPP mechanism. For field development projects, one can use the standard models for an oil-and-gas complex and a mining factory (Lavlinskii, 2008).

The road, power line, HPP, etc. construction projects are standard infrastructure projects (Figure 1). An HPP is the most complex object in the group; it requires a special model with a dedicated environmental block describing the preparation, construction, and operation processes. In the general case, the environmental block contains a set of environmental project models to implement a range of compensatory actions such as resettlement from the flooding zone, protection from flash flooding, protective measures against ice weakening, etc. The road and power line models describe the construction and operation (maintenance and service) processes. They use the general investment project model (5) supplemented by a detailed project financing scheme.

The input data of the BIP model are as follows:
1. A set of investment projects implemented by the private investor; the investor's choice depends on what the state offers in terms of infrastructure construction.
2. A set of infrastructure projects implemented by the state; the state's choice depends on efficiency estimates based on the long-term prospects of regional development.
3. A list of environmental projects necessary to offset the environmental losses caused by the implementation of the investment projects; the sharing of commitments for environmental projects between the private investor and the state is not specified and has to be derived from the PPP cost-sharing arrangement.
4. The cost-sharing arrangement defining the PPP model.

The output of the BIP model is a forecast of the revenues and expenses of the private investor and the state during the implementation of the entire set of projects within the assessed cost-sharing arrangement. These data allow one to assess the efficiency of the selected PPP model and the degree of compromise of interests provided by positive NPV_{st}^{int} and NPV_{inv}.

Thus, the core of the proposed PPP assessment technology is a forecasting model allowing the expert to evaluate the *PPP* mechanism and uncover its internal imbalances (negative NPV of some of the participants). A "manual" adjustment of the cost-sharing arrangement and repeated application of the model procedure make it possible to find a partnership mechanism ensuring a compromise of interests[1].

4.3. Examples of PPP Model Assessment

The possibilities of the proposed approach are illustrated using the above described infrastructure projects implemented with the participation of the Investment Fund of Russia. The central object of the Lower Angara development program is the Boguchansk HPP investment project. The planned capital investment in construction is 70 billion rubles, most of which is to be covered by debt financing. The 10-year construction period is planned to provide 3000 MW of capacity by 2016. Financing the infrastructure projects and, in part, the HPP construction, the state needs to know the long-term efficiency of the projects.

In this case, environmental considerations and adequate TC evaluation play a major role; it is here that the problem of finding an efficient PPP mechanism comes to the fore. Thus, the HPP construction and operation entails costs due to the population resettlement from the flooding zone, compensation for agricultural production losses, implementation of socioeconomic programs, etc. These costs are estimated to be at least 18 billion rubles, but are beyond the scope of the activities financed by the investor within the HPP construction project. Who has to cover these costs?

Figure 2 shows estimates for the implications of the various strategies for sharing the above-mentioned environmental costs for the Boguchansk HPP project from the standpoint of the participants' return on investment. The estimates were derived using the BIP model; they show that positive estimates overlooking the environmental costs change substantially as soon as the costs of compensatory measures are factored in.

If the private investor bears all the environmental costs, the investor's economic incentives for implementing the project are undermined. In this case, the state is required to provide partnership assistance, e.g., through an equal cost-sharing strategy.

1 The basic mathematical models described in (Lavlinskii, 2008; Glazyrina et al, 2014).

Figure 1: General scheme of the bunch of investment projects model

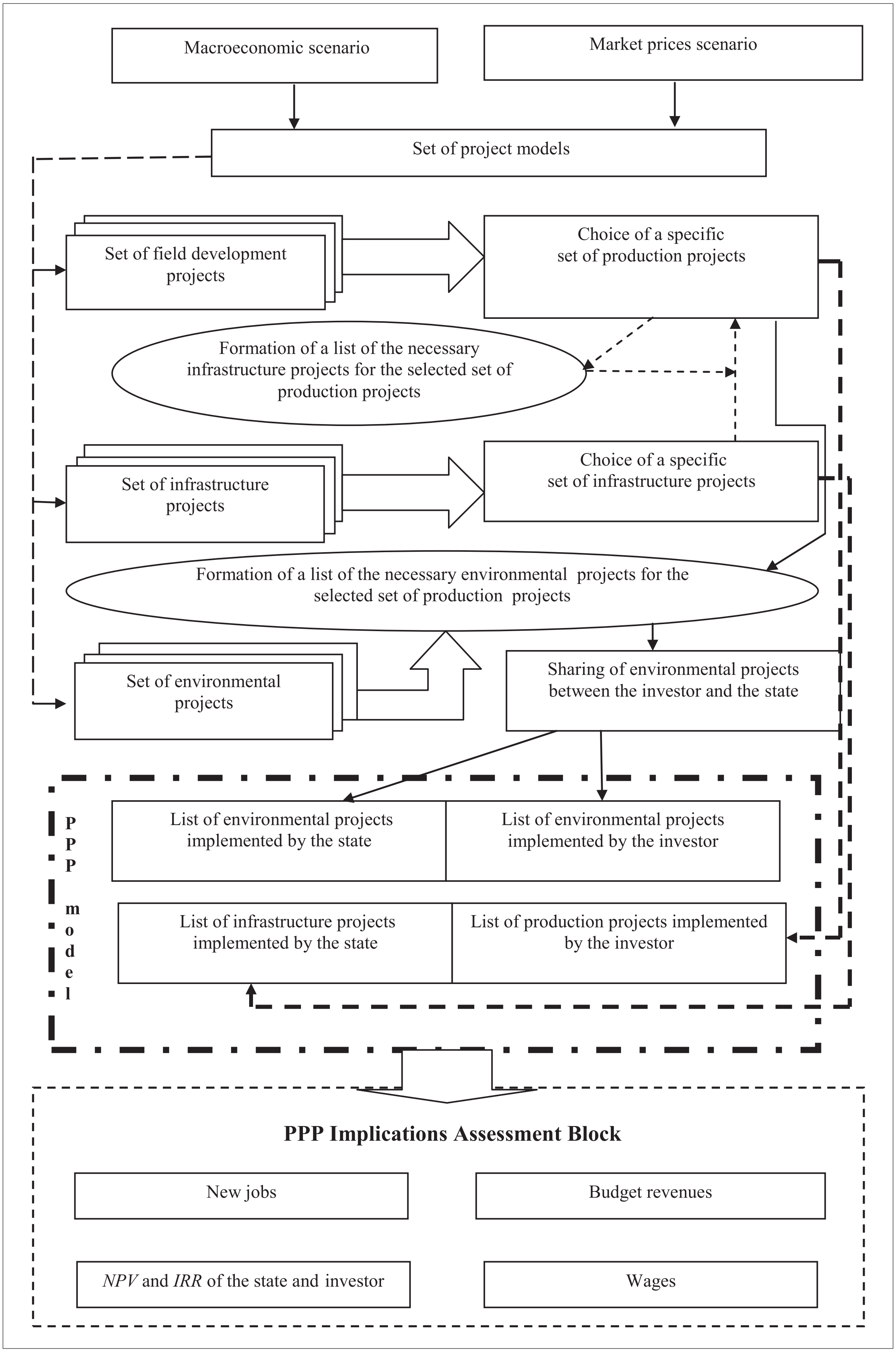
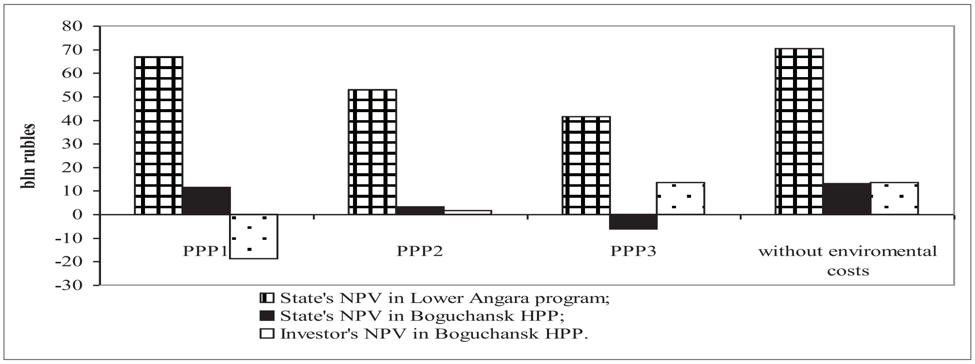


Figure 2: Environmental cost sharing strategies for the Boguchansk hydroelectric power plant project and the participants' return: Environmental costs are paid by the investor (PPP1); environmental costs are shared equally between (PPP2); and environmental costs paid by the state (PPP3)



This would adversely affect the state's efficiency indicators both for the HPP project and the Lower Angara program as a whole, but would provide a positive NPV for the private investor. Within the third scenario, the PPP model whereby the state finances a part of the construction of the Boguchansk HPP and half of the environmental costs yields a satisfactory compromise between the participants' interests.

Thus, with a reasonable distribution of costs, it was possible to find an economically viable solution. In reality, however, during the construction of the HPP the investor and the state was made not all environmental and social obligations. The construction of the reservoir was constructed with significant environmental violations. Accumulated damage (Glazyrina et al., 2006) had not been taken into account. Property losses of the population was not fully refunded. Although the Russian laws provide for the rights of citizens in such conflicts, the relevant institutions in Russia are weak and inefficient. So the public TC for these purposes are extremely high. Rural residents could not afford such costs. As a result, their interests were sacrificed to the interests of the owner of HPP.

Another case illustrating the PPP practices in Russia is that of Transbaikal region. Here, construction works are being completed on the Naryn–Lugokan railway line (up to the Gazimursky Zavod station) for a total cost of about 32 billion rubles; the project is financed by the Investment Fund of Russia. This opens up prospects for launching the first phase of the project to create the transport infrastructure for the development of mineral resources in the southeast of the Transbaikal region and develop the Bystrinskoe and Bugdainskoe fields. The chosen PPP model allowed OAO Norilsk Nickel to build the key transport infrastructure element mainly through the federal budget and create an economic background to launch the field development projects. Environmental issues associated with the project would involve substantial additional costs (Zabelina and Klevakina, 2012). How good was the choice of a PPP model for the Bugdainskoe and Bystrinskoe fields?

This question can be answered by applying the BIP model, which allows one to assess the two projects from the point of view of the investor as well as the regional and federal budgets under different PPP arrangements. In the model experiments, the state's participates in the infrastructure project by sharing with the investor the construction costs of the railway line. The state's participation in these costs can range from 0 to 100%. The zero level corresponds to a situation whereby the investor independently finances the infrastructure project (the target object of the PPP). The 100% level means that the construction is financed from the federal budget. In the subsequent numerical experiments, we consider 11 levels of state participation with a step of 10%.

We consider three product price scenarios: Optimistic (market 1), inertial (market 2), and pessimistic (market 3). The scenarios are based on a retrospective analysis and retain the general upward trends in the raw materials sector, which have been observed for the last decade. Our calculations show that the minimum number of process stages in the field development projects predetermines the maximum level of sensitivity of performance indicators to a change in the market conditions.

An analysis of Figure 3 suggests that the IRR for the federal budget financing of the railway construction falls sharply with the increase in the main PPP parameter, i.e., the state's share in the capital investments for this infrastructure. The state is in general much less sensitive; nevertheless, its IRR becomes less than the modeled 5% discount for adverse market conditions if the state participation is more than 75%. But this IRR is enough to provide positive *NPV*[2]. within scenarios (market 1) and (market 2). For adverse market conditions when the level of state costs exceeds 75%, State's NPV becomes negative and leads to a violation of conditions of balance of interests (4).

The calculations show that even under the most favorable price conditions, at least 80% state participation is required for an investor with a discount of 15% to invest in the Bystrinskoe and Bugdainskoe fields. Any other market situation pushes the investor into the domain of negative *NPVs* (Figure 4). Any other situation puts the investor in negative NPV; inertial scenario of market prices does not provide the required level of profitability (Figure 4), and in pessimistic scenarios the IRR does not even exist. Any other situation puts the investor in negative NPV – inertial scenario of market prices does not provide the required level of profitability

2 5% adopted in Russia the discount rate of the state.

Figure 3: State's internal rate of return for the public-private partnership project in the construction of the railway line Naryn – Gazimursky Zavod

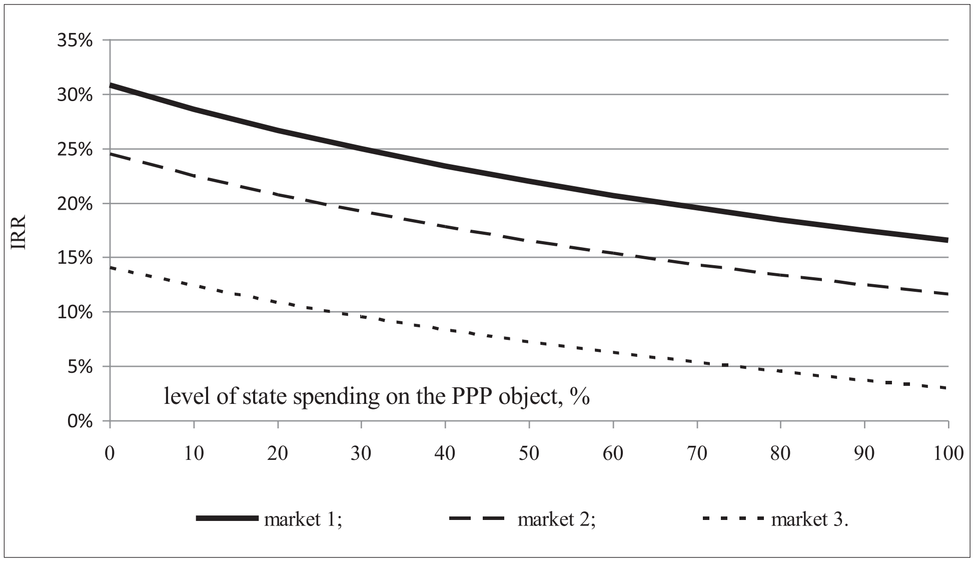
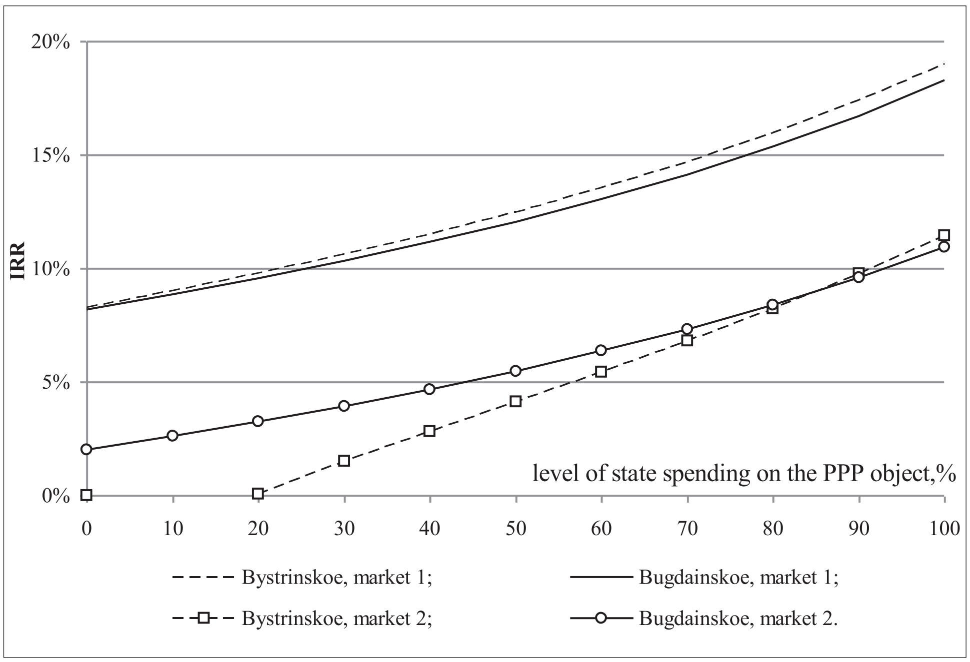


Figure 4: Investor's internal rate of return for the Bystrinskoe and Bugdainskoe fields



(Figure 4), and in pessimistic scenarios, realized in practice, the IRR does not even exist.

Thus, the evaluated fragment of the Transbaikal mineral resource base development program using a PPP whereby the state builds the Naryn–Gazimursky Zavod railway line ensures a positive return for the state in a wide range of market conditions. Within the initial technological projects for the development of the Bystrinskoe and Bugdainskoe fields, the chosen PPP gives a sufficient return for the investor under favorable market conditions only. To achieve greater price stability for the field development projects, they should plan a greater number of technological process stages.

How the project has been implemented in practice? The decision, which was adopted in the construction of the railway line, was the fact that 75% of the costs would be provided by the state. The calculations show that in this case, under favorable market conditions, the investor's IRR for both projects is greater than 15%, which can be considered acceptable. Under conditions of the inertial scenario of market prices, the PPP project becomes marginally profitable for the state and for the investor. Under the most adverse conditions of the pessimistic scenario, realized in practice, the investor loses interest in the project, and the state still may consider the level of IRR is acceptable because it is the beneficiary of the project not only in connection with mining. New Railways can significantly improve business conditions and quality of life of the local population.

The decision to launch the project was made in 2007 and by 2012 the railway was built. However, the global crisis of 2008-2009 and subsequent fall in metal prices has made changes in the plans of the investor. The timing of construction of enterprises was postponed for a few years. Built road was unclaimed.

The current situation is an apparent result of underestimation of TC. In the design and construction of the road basic TC has been paid from the Investment Fund of Russia. But after construction it was necessary to determine ownership rights to the constructed object and the right to use it. However, the costs for this purpose was not provided for in the project budget, and the railroad more than 2 years was "no one's object." State institutions in Russia are not aimed at achieving long-term goals, so no one government agency was interested in spending the budget until the start of field development.

The cost of maintaining the railroad was not needed and the investor company, as the construction of mining and processing has not started yet. Local people were interested in the work of the road but they did not have to her any rights[3]. As a result, the railroad became a focus for local criminal groups, which have destroyed it in order to sell the metal on the black market. Such a market exists in the border regions for more than 20 years. Its stability is related to the ability to export the metal in neighboring China. The high level of corruption makes the process of legalization of this product is relatively simple, and TC that legalization is insignificant compared with criminal income.

The decision about transfer of rights on the use of the railway to the investor company was adopted only in 2015. According to expert estimates, the additional costs in connection with the need to restore damaged areas are roughly 16% of the total expenses of the investor on the construction of the road.

5. CONCLUSION

It can be concluded from the retrospective analysis of the development of the PPP institution in Russia that it is only beginning to shape. Although the government pays much attention to the development of the mineral resources complex, its attempts to stimulate the use of the various PPP models are not reinforced by economically sound administrative decisions. The political losses due to the failure of the PSA and PPP projects financed by the Investment Fund of Russia are big enough for the government to become seriously concerned about decision- making in this sphere.

The proposed approach to the development of economic and mathematical tools to design and evaluate PPP models (with all relevant TC) may address a substantial part of these issues. The BIP model takes into account all the features of the mineral resources complex and project financing details when evaluating a particular PPP arrangement. Having been tested in real-life contexts, the model can be used already at the decision-making stage to predict situations involving the risk of partnership termination and project suspension.

3 Financial resources for the railway construction were provided from the Federal State Budget. There is a "budget trichotomy" in Russia: strict division between budget levels (federal, regional and local).

The assessment of the institutional environment at all stages of implementation of projects and related TC deserves a special attention. Our examples show that the quality of institutions can have a significant impact on the overall result: In the context of economic efficiency and in terms of implications for the welfare of the local population.

Existing Russian institutions of environmental control was powerless under the pressure of large economic agent who performs the project development of the Lower Angara region, with the state support. Social and environmental rights of local residents are protected by the Constitution of the Russian Federation, but in the absence of low cost instruments of conflict resolution (Ostrom, 1999; 2009) the level necessary for the judicial protection of the rights of TC is irresistible to relatively poor rural population. Only a few people of the thousands appealed to the court. An important factor was the distrust of the judiciary because of the reputation of the courts. People don't want to waste time, money, health, understanding that win in court against the powerful companies and the state is unlikely.

In the case of the mineral cluster in the South-East of the Transbaikal region in Siberia institutional gap was the reason for the untimely specifications of the rights of ownership and management, which led to additional costs and an overall efficiency reduction of the project.

The results of the analysis of the development of the PPP institute in the Russian mineral complex say about the important role of TC. We offer modeling tools that allow to analyze the expected results of the project under various exogenous scenarios (macroeconomic and market conditions, external shocks etc.), for practical purposes needs to be supplemented with the forecast estimates dynamics of the institutional environment.

The transformation of institutions is necessary for decreasing TC, although it is not always feasible in the short term (McCann, 2013). However, changes at the level of legal rules and management practices, that is, the second and third level in Williamson's classification (Williamson, 1998), can be implemented in a reasonable period of time and require relatively little TC. Overcoming "budget trichotomy in Russia" is one of priorities for institutional development. It is important that the necessity of these institutional reforms to be recognized, and the corresponding TC to be provided in the budget: "Institutions do not come for free" (Marshall, 2013).

6. ACKNOWLEDGMENTS

The article presents the research results in the framework of the Russian Scientific Foundation project #16-18-00073.

REFERENCES

Bennett, J., Iossa, E. (2006), Delegation of contracting in the private provision of public services. Review of Industrial Organization, 29(1-2), 75-92.

Broadbent, J., Laughlin, R. (2003), Public private partnerships: An introduction. Accounting, Auditing and Accountability Journal, 16(3), 332-341.

David, M.R. (1996), Upstream Oil and Gas Agreements. London: Sweet & Maxwell.

Glazyrina, I.P., Kalgina, I.S., Lavlinskii, S.M. (2013), Problems in the development of the mineral and raw-material base of Russia's far east and prospects for the modernization of the region's economy in the framework of Russian–Chinese Cooperation. Regional Research of Russia, 3(4), 21-29.

Glazyrina, I.P., Lavlinskii, S.M., Kalgina, I.S. (2014), Public-private partnership in the mineral resources complex of Zabaikalskii Krai: Problems and prospects. Geography and Natural Resources, 35(4), 359-364.

Glazyrina, I.P., Glazyrin, V.V., Vinnichenko, S.V. (2006), The polluter pays principle and potential conflict in society. Ecological Economics, 59(3), 324-330.

Grimsey, D., Levis, M.K. (2004), Public Private Partnerships: The Worldwide Revolution in Infraastructure Provision and Project Finance. Cheltenham, UK, Northampton, MA: Edward Elgar.

Grimsey, D., Levis, M.K. (2005), The Economics of the Public Private Partnerships. Cheltenham, UK, Northampton, MA: Edward Elgar.

Groute, P.A. (1997), The economics of the private finance initiative. Oxford Review of Economic Policy, 13(4), 53-66.

Johnston, D. (1994), International Petroleum Fiscal Regimes and Production Sharing Contracts. Tulsa, Oklahoma: Penn Well.

Lavlinskii, S.M. (2007), Techniques of developing the economic clauses of a production sharing agreement for oil and gas projects. Studies on Russian Economic Development, 18(1), 68-74.

Lavlinskii, S.M. (2008), Models for Indicative Planning of the Social and Economic Development of a Mineral Resource Region. Novosibirsk: Siberian Branch, Russian Academy of Sciences.

Lavlinskii, S.M. (2010), Public–private partnership in a natural resource region: Ecological problems, models, and prospects. Studies on Russian Economic Development, 21(1), 71-79.

Marshall, G. (2013), Transaction costs, collective action and adaptation in managing complex social-ecological systems. Ecological Economics, 88, 185-194.

Mayston, D.J. (1999), The private finance initiative in the national health service: An unhealthy development in new public management. Financial Accounting and Management, 15(3), 249-274.

McCann, L. (2013), Transaction costs and environmental policy design. Ecological Economics, 88, 253-262.

Ostrom, E. (1999), Coping with tragedies of the commons. Annual Review of Political Science, 2, 493-535.

Ostrom, E. (2009), A general framework for analyzing sustainability of social-ecological systems. Science, 325, 419-422.

Owen, G., Merna, A. (1997), The private finance initiative. Engineering, Construction and Archaitectural Management, 4(3), 163-177.

Quiggin, J. (2004), Risk, PPPs and the public sector comparator. Australian Accounting Review, 14(33), 51-61.

Reznichenko, N.V. (2010), Public-private partnership models. Bulletin of St. Petersburg University Management, 4, 58-83.

Varnavsky, V.G. (2009), Public-Private Partnership. Vol. 1, 2. Moscow: Institute of World Economy and International Relations.

Wallis, J.J., North, D.C. (1986), Measuring the transaction sector in the American economy, 1870-1970. In: Engerman, S.L., Gallman, R.E., editors. Long-Term Factors in American Economic Growth. Chicago: University of Chicago Press. p95-161.

Westwood, J.N. (1964), A History of Russian Railways. London: G. Allen and Unvin.

Williamson, O.E. (1998), Transaction cost economics: How it works; Where it is headed. The Economist, 146(3), 23-58.

Zabelina, I., Klevakina, E. (2012), Environmental and economic aspects of natural resource use and problems of cross-border cooperation in regions of Siberia. Problems of Economic Transition, 55(7), 39-48.