Organizational and Economic Mechanism for Modernization of Water Supply and Sewerage System

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Abstract: The article is devoted to the problem of coordinating the economic interests of the state, the population and resource-supplying enterprises in the process of investing in the modernization of the water supply and sewerage system. The current problems of the water supply and sewerage system have been identified. They are high physical depreciation, exceeding 70%, and insufficient financing of the modernization of the water supply and sewerage system by the state, municipalities and private concessionaires. These problems result in poor quality water supplies and high utility rates. The proposed organizational and economic mechanism for the modernization of the water supply and sewerage system provides for the investment and management activity of the population in this process. At the same time, long-term public investments should receive state financial support and pay off due to savings on tariffs during the period of the modernization project. This promising form of economic cooperation is called social and economic partnership. It will provide the necessary financing for the comprehensive modernization of the water supply and sewerage system using advanced trenchless technologies. As a result, the quality of public services will improve and tariffs will decrease in the interests of the social and economic development of municipalities.

1 INTRODUCTION

The water supply and sewerage system is an important part of the communal complex and is of strategic importance in the life of the population, social and industrial activities of the city, region and country.

As a consequence, the smooth and proper functioning of these economic activities is a priority direction of state policy.

Currently, in the field of water supply and sewerage, there are significant problems associated with increased accidents in the utilities, significant losses and insufficient quality of the supplied resource, as well as a constant increase in service tariffs. The main reason for these problems is the high level of deterioration of the operated water supply and sewerage facilities, which in many regions is more than 70% and continues to increase annually by 2-3%. (Demin, 2010).

The share of water supply and sewerage systems requiring replacement exceeds 44% on average across the country, with a negative trend. The existing treatment facilities do not provide the required degree of wastewater treatment. Only 53% of the total amount of wastewater discharged through the treatment facilities is the normatively treated wastewater. Poor quality water is a direct or indirect cause of 80% of diseases.

Resource-saving measures with the installation of metering devices at worn-out facilities did not improve the quality of public services and its energy efficiency, but they contributed to a rapid reduction in the volume of water resource use for household needs. (Demin, 2010).

This trend has negatively affected the financial position of most resource-supplying enterprises, more than 80% of which are unprofitable and practically cannot make capital investments on their own.

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In the current critical situation, immediate investment is needed in the modernization of the water supply and sewerage system, the volume of which, according to experts from the Ministry of Housing and Construction of Russia, is estimated at 200 billion rubles annually. The accumulated investment deficit is 1.5 trillion rubles.

If there is insufficient state funding for water supply and sanitation, which averages 23.36 billion rubles a year and has significantly decreased since 2018 (more than 6.6 times), the priority direction of public policy is to attract private investors in the field of water supply and sanitation based on the mechanism of concession agreements in a public-private partnership (PPP). (Nikityuk and Timchuk, 2015).

The main advantages of utility concessions are the reduction of budgetary costs for the maintenance of facilities (Yalalieva, 2013), the distribution of project risks between the state and business (Denisov, 2015), improvement of the financial condition of "planned unprofitable" utilities, attraction of highly qualified specialists, preservation of the intended purpose of the object under the terms of the concession agreement. (Zakharova, 2012).

At the same time, some domestic scientists rightly express the opposite point of view in their many years of research. They note the following. Utilities are a public good, and therefore its financial support should be retained primarily in the state responsibilities. (Ryakhovskaya and Tagi-zade, 2005). In their opinion, the state should ensure the construction of such a system of price mechanisms and tariffs so that it can replace the system of competitive prices. (Ryakhovskaya and Tagi-zade, 2016).

Foreign scientists also note serious problems in the implementation of PPP projects in the field of modernization and development of public utilities. (Chou and Pramudawardhani, 2015). These problems are associated with the distribution of risks between the partners of the partnership, the lack of a systematic analysis of the factors for the successful implementation of projects in a particular country, the quality of preparation of the projects themselves. (Osei-Kyei and Chan, 2015).

.The most important problem of using concessions in public utilities has emerged in domestic practice. Concessions do not ensure the provision of public services of the required quality at acceptable rates in the public interest in conditions of high depreciation of public facilities and insufficient public funding. (Svistunov, Kurkina, 2019).

As a result, if something is repaired or even modernized by the concessionaire, then it is done in a pointwise manner, for a long time and ineffectively in relation to payments from the population and is accompanied by a constant increase in tariffs in order to accumulate funds for the concessionaire to implement the investment program.

It contradicts the goal of transferring water supply and sewerage facilities to a concession, the essence of which is the need to attract funds from outside the concessionaire. As a result, an ineffective unitary enterprise operating water supply and sewerage facilities is replaced by an ineffective commercial organization.

At the same time, the modernization and reconstruction of communal facilities are carried out mainly in an open way, which leads to an increase in the cost and timing of capital-intensive work, the forced destruction of road surfaces, blocking of traffic, and a deterioration in the environmental situation.

Meanwhile, abroad, 95% of the reconstruction of utilities is carried out using trenchless technologies (pipe rehabilitation) by applying protective coatings (linings), which reduces the cost of work by 10-40%.

One of the most effective methods of trenchless technologies is the method of pulling a polymer pipe in the form of a flexible and stretchable polymer sleeve inside the old pipe. This method can significantly improve the reliability and durability of pipes. It reduces the cross-section of the pipeline, but at the same time it can provide energy savings of up to 68 kWh per one linear meter of pipeline length per year, according to expert estimates. (Orlov V. et al., 2011).

As a result, the use of sanitation of utilities makes it possible to achieve a reduction in tariffs for the services provided by practically eliminating subsequent costs for major and current repairs for a long time and an increase in water consumption.

However, the cost of remediation increases significantly and becomes unaffordable for most municipalities, when concessionaires carry out individual spot repairs with insufficient investment.

The average annual investment in the modernization of water supply and sewerage is 88.0 billion rubles and does not allow to increase the rate of modernization of public utility facilities (on average 1.4% and 0.4% of the total length of water supply and sewerage pipes) compared to the annual growth rate their wear (on average 2-3%) and the established replacement standard – at least 5% per year.

Thus, the existing investment mechanism in the utilities sector consists in attracting private investors through concession agreements and inadequate state

and municipal funding with an annual indexation of utility tariffs, which does not cover the growth of current costs of resource supplying enterprises. This mechanism does not allow providing the necessary volumes of investments in the complex resource-saving modernization of water supply and sanitation facilities. Insufficient volumes of investments, directed mainly into backward technologies and conducting spot maintenance, are accompanied by an annual increase in the wear and tear of water supply and sanitation facilities, which further accelerates the rate of inflation and poses a threat to the national security of the state.

Under these conditions, the population does not have the official status of an investor, but in fact pays for the repair work and the concessionaire's profit through increasing tariffs. The public interests of the main customer and consumer of utilities are not sufficiently protected.

2 RESEARCH METHODOLOGY

To solve this problem, it is necessary to form a mechanism for effective interaction between the population, state and municipal authorities and an economic entity - a resource-supplying enterprise for investing in projects for the modernization of communal facilities using advanced resource-saving technologies in the public interest.

This investment mechanism presupposes a new form of investment and economic interaction - social and economic partnership (SEP).

The public interest is to improve the quality of utilities and reduce service tariffs. That is why, in the conditions of a centralized water supply and sanitation system with a high level of wear and tear, it is necessary to comprehensively modernize it while preserving the public character of a public utility service with a socially significant focus.

To achieve this goal, the population should become the main customer and consumer of utilities with the status of an official investor and, in their own interests, invest in projects for the comprehensive modernization of utilities together with the state and with the possible involvement of third-party investors, including business.

The proposed investment mechanism is based on simple and economically sound indicators determined for specific municipalities according to the reporting data of local governments. Therefore, it can be implemented in practice.

The target indicators for the functioning of the mechanism should be the payback period of capital investments and a phased reduction in utility tariffs in the form of the economic effect of modernization.

Eliminating water leaks, reducing current repairs and saving electricity during public utilities will achieve the necessary economic effect following the completion of a comprehensive modernization project.

According to the requirements of a systematic approach to the formation of the investment mechanism, the individual goals and interests of investors must strictly correspond to the general strategic goal (mission) of the integration socio-economic partnership.

This mission is to ensure uninterrupted provision of the population and other consumers of the municipality with high-quality and competitive water supply and sanitation services. Managing effective influences and structured decisions should be focused on the criterion of optimality and constraints that represent the interests of investors and, above all, public interests.

That is why, in contrast to the mechanism of concession agreements, the indicator of obtaining a target profit should be absent in the proposed mechanism. The targeted attraction of the required volume of investments should be provided at the expense of public capital investments and state funding, but the attraction of extra-budgetary sources is not excluded.

An integrated approach to the functioning of the investment mechanism is focused on achieving socially significant results and ensuring mutually beneficial joint organizational and economic cooperation between the state and municipalities, resource-supplying enterprises and the population with a priority of public interests.

3 RESEARCH RESULTS

The organizational and economic mechanism of social and economic partnership between the state and the population is shown in Figure 1.

The organizational and economic mechanism of social and economic partnership must be formed under the following conditions:

- To create an investment fund, monthly investment payments of the population and budgetary funds of the state and the municipality are deposited into a special account of a resource supplying enterprise that must perform capital-intensive work;
- The amount of a separate investment payment should be calculated per one payer per month

based on the economically justified amount of investment, the population of the municipality that consumes public services, and the planned modernization period with an average duration of 15 years; (Svistunov, 2019);

- Budget financing should be carried out in the form of special projects and programs for the modernization of communal facilities. Its share should make the individual investment payment not burdensome for the population;
- Budgetary funds should be invested at the initial stages of modernization, when significant one-time investments are needed. These investments will be directed primarily to the modernization of pumping stations, treatment facilities and the purchase of special equipment;
- It is possible to attract financing from private business, which is also a consumer of utilities, special funds of financial institutions and development banks on a fully or partially repayable basis;
- The amount of the investment payment must be set separately from the utility tariffs. Due to the high level of wear and tear of utility facilities, the current tariffs mainly include the costs of routine maintenance and emergency recovery work. The annual growth of tariffs at the maximum permissible level excludes the possibility of their additional increase due to the inclusion of an investment payment in the tariff;
- The formation of an individual investment payment should be interconnected with the establishment of tariffs for water supply and sanitation services. The income component in the form of profit should be excluded from the tariff. In addition, the tariff should include an annual reduction in the cost component as a result of the modernization of the water supply and sewerage system by eliminating water leaks (up to 20%), reducing current repairs (up to 10%), saving electricity during maintenance (by 10%);
- The annual reduction of tariffs as the modernization of utility facilities will reduce the payment burden for the population and will serve as a source of return on investment and obtaining economic effect in the planning period;
- The amount of investment should be interconnected with a phased plan for carrying out capital-intensive work. They should be divided into investments required for the modernization of water supply and sewerage facilities (stations, structures), including for the purchase of special equipment and motor transport equipment, and into investments necessary for the modernization of water supply and sewer pipes and associated with the elimination of technological losses, accidents and damages;
- To control the targeted spending of investments, it is necessary to form plans of financial flows by years in accordance with the plan for the modernization of the water supply and sewerage system in the territory of a particular municipality;
- The annual reduction of tariffs as the modernization of utility facilities will reduce the payment burden for the population and will serve as a source of return on investment and obtaining economic effect in the planning period.

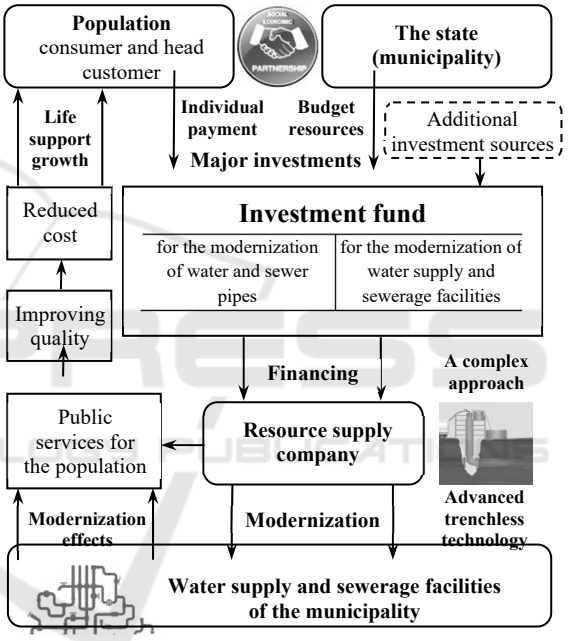

Figure 1: Functioning of the organizational and economic mechanism for the modernization of the water supply and sewerage system.

An integrated approach to the formation of a modernization investment fund will allow investing in advanced trenchless technologies with a reduction in cost and an increase in the quality of capital-intensive work.

4 DISCUSSION

The mechanism for the formation of an individual investment payment is fundamentally different from the current practice of setting tariffs based on the income approach in concessions.

Now the tariff includes the investor's profit and the return on the invested capital. The current approach ensures the interests of the concessionaire, but also cannot provide the necessary volume of investments for the implementation of comprehensive modernization within a certain period. As a result, tariffs for utilities are growing annually, and the wear and tear of utilities is constantly increasing.

Social and economic partnership (SEP) is aimed at creating mutually beneficial economic cooperation and effective financing of innovative activities in the utilities sector.

Practical application of the proposed mechanism will allow achieving the following results:

- Maintain public and socially important signs of public service in the public interest. The investment payment will be calculated for a specific payback period and a specific strategic goal to improve the quality of utilities and reduce tariffs. Now it is not known what the population pays for according to the established tariffs. In fact, the population should have a clear idea of their investments. Social and economic partnerships will enable such rules to be enforced.
- Provide targeted investment in resource-saving trenchless technologies for the comprehensive modernization of water supply and sewerage facilities. Effective use of pipe rehabilitation will improve the quality of utilities and reduce their costs;
- Achieve complete restoration and renovation of water supply and sewerage facilities in the planning period (estimated within 15 years);
- Improve the quality of drinking water and public services;
- Reduce tariffs and slow down the rate of inflation that is provoked by the current monetary government policy;
- Reduce the payment burden of the population for utilities;
- Increase state responsibility and strengthen control over the activities of resource-supplying enterprises by local authorities responsible for life support systems;
- To finance in full the economic activities of resource-supplying enterprises both during the modernization and after its completion due to the full functioning of the depreciation mechanism. As a result, municipal unitary enterprises will be able to free themselves from the financial and economic crisis and provide uninterrupted quality water supply and sanitation services.

5 CONCLUSION

The research results will make it possible to develop practical recommendations for the implementation of the idea of economic cooperation in investing in public utilities with a predominance of public interests.

Thus, the population will become a customer and an active investor in the modernization of communal services. The mechanism of long-term public investment should provide for state financial support and payback of public investments due to savings on tariffs.

The use of the organizational and economic mechanism of investment in conjunction with the tariff setting system will make it possible to increase the social and economic efficiency of reforming the communal services at the state, regional and municipal levels.

State authorities and local governments and specialists of resource-supplying enterprises will be able to develop socially oriented investment projects for the comprehensive modernization of the water supply and sewerage system. These projects will be aimed at improving the quality of public services and reducing tariffs in the interests of social and economic development of municipalities.

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