Application of public-private partnership in smart city projects implementation considering environmental management

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Abstract. The paper presents the "Smart City" pilot project from the point of view of the benefits of public-private partnership for each participant in the joint activity aimed at optimizing urban infrastructure. The role of the state and the private sector in the transformation of the city into a single "smart" system is defined. Indicators of the state's expectations from the implementation of the pilot project are given. The forms of public-private partnership contracts and the degree of their applicability on the example of a concession agreement are considered. The possibility of realization of public-private partnership in certain areas of concession agreements is examined. The probable future of the Smart City project activities after its completion from the point of view of the development of public-private partnership principles is determined. The strategic importance of the Smart City project implementation and, separately, of the PPP principle for the optimization of public relations is revealed.

1 Introduction

The concept of "smart city" has become increasingly popular around the world in recent years. This is due to the desire to improve the quality of life of citizens through the introduction of innovative technologies in urban infrastructure, efficient resource management, enhanced public services and sustainable development of urban areas. However, the implementation of smart city projects requires significant investments, including financing, development of innovative solutions and their integration into the existing urban environment. In this context, public-private partnership (PPP) is a promising model that can provide an effective combination of public and private resources for the successful implementation and scaling of smart city projects [1, 456]. The relevance of the research topic stems from the need to develop effective mechanisms for public-private cooperation to accelerate and optimize the process of urban transformation into smart cities.

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Thus, the purpose of this research is to assess the opportunities and study the practice of using public-private partnership in the implementation of smart city projects.

2 Materials and Methods

The implementation of the pilot project "Smart City" in the Russian Federation was designed to make the participating cities change the trajectory of territorial development in accordance with the set Standards. The roadmaps developed by the participating cities so far contain often unique urban planning technologies that can transform the city into a single "smart" system.

As early as 2019, the participating cities had to introduce special digital platforms in social policy to establish communication with residents [2, 101]. This communication involves joint discussions with citizens about changes that significantly transform the city as a territory. For construction organizations and other structures engaged in urban transformation, joint discussion with citizens provides an opportunity to form foreseeable benchmarks that are both consistent with the Standards and potentially important to the city residents.

For the authorities, such discussion acts as a tool for establishing relations with the population and forming a positive image in the minds of the city residents. Directly for the residents of the city, joint coordination provides ample opportunities to influence the transformation of the city and the preservation of urban objects, including cultural heritage, in accordance with the latest modern standards [1, 455].

The pilot project "Smart City" is implemented by the participating cities according to the provisions of a specific Standard. The uniqueness and integrity of the document is that it covers eight areas that form the urban system. Thus, the participating cities in their roadmaps provide for activities related to the optimization of urban management. The designated direction implies not only the introduction and use of technologies in accordance with the Register of the Ministry of Finance of the Russian Federation, but also the implementation of management decisions taking into account the criteria of quality management [3, 304].

The second direction affects the "smart" housing and communal services, which is a tangible direction for the city residents in view of the many problems related to the quality of housing and communal services. The third direction refers to innovations for the urban environment. In addition to technology and innovative management solutions, the urban environment is gradually incorporating elements of urbanism, including design solutions to ensure the convenience and comfort of residents.

The next direction is "smart" urban transportation. The practice in other cities implementing technological approaches shows the commitment of city residents to the predictability of the transportation system and the variability of route construction to the destination within the city, taking into account time saving. Another direction concerns intelligent systems of public and environmental safety. Like the housing and utilities system, public and environmental safety is also among the tangible directions for the city residents due to the location of industrial enterprises and industrial zones on their territory, potentially increasing the degree of danger to the society.

The seventh direction is the infrastructure of communication networks, which implies a set of engineering and telecommunication solutions for data exchange and ensuring effective communication within the city. The last direction is tourism and service, which together form an essential component and subject of interest mainly for the authorities. The accordance with the world standards and technological sophistication of tourist locations, as well as the service sector contributes to the increase of the city's income, and therefore, the
formation of additional opportunities for the development of activities within the framework of the "Smart City" project.

The interest of the state in the development of smart cities is explained by the fact that this project acts as a way to increase the level of digitalization of an individual entity and in the aggregate provides intensive development of the digital economy. The "Smart City" project is planned until the end of 2024 and involves the active participation not only of the state, city authorities and city residents, but also a number of state corporations [4, 143].

The participants of the project under consideration include such cities as Yekaterinburg, Voronezh, Veliky Novgorod, Novouralsk, Elabuga, Sosnovy Bor and others [5]. In general, the state plans to spend 12.5 billion rubles for the implementation of this project, of which 2.9 billion rubles were allocated only in 2019, when this project started [6].

The papers of state support expenditures include the introduction of innovative solutions and technologies mainly in the sphere of urban economy. An example is the installation of "smart meters" in the entrances of apartment buildings as a solution within the housing and utilities sector.

Money flows are carried out within the procedure established for the control of budgetary funds in the Federal Law No. 44-FZ dated 05.04.2013 [1, 455]. At the same time, public-private partnership (PPP) is also envisaged in the form of realization of economic relations within the PPP contract, which implies the attraction of private sector resources for the purpose of effective performance of public sector tasks. The conditions of PPP contract are the sharing of risks between the contract participants, ensuring the compensation of costs, defining the obligations for each party of the participant, as well as the competencies within which the contract party can participate in the implementation of tasks.

3 Results

There can be many varieties of PPP activities [2, 102] but all contracts must comply with the following organizational and legal forms presented in Fig.1.

Based on Fig.1, it should be noted that the above types of agreements within the framework of the legislation consider the subject of the contract as an object of information technology [1, 456]. Thus, in the framework of the above types of PPP contracts the parties agree on obligations and competencies not in relation to, for example, an apartment building, but in relation to the elements of this construction object related to manufacturability. It is worth noting that under the technology in PPP contracts is meant not only information technologies but also any other technologies that improve the safety and quality of the "smart city".

All the forms of relationships between the participants shown in Figure 1 are practically applicable within the framework of the Smart City project. For example, within the framework of the concession agreement the public-private partnership is realized as follows: the subject of the agreement is a certain software with the ability to process the database on the basis of paragraph 2 of Article 1260 of the Civil Code of the Russian Federation [1, 455]. The party to the agreement as a representative of the private sector can develop, implement or maintain software that belongs to the city. Such software can be an information system for management of urban public transportation or control over the quality of housing and communal services provision [3, 305].
Table 1 presents the key indicators of the Ministry of Economic Development of the Russian Federation on concession agreements for 2021 and 2022.

**Table 1.** Key indicators of the Ministry of Economic Development of the Russian Federation for concession agreements under the Smart City project for 2021 and 2022 [7]

<table>
<thead>
<tr>
<th>no.</th>
<th>Indicator</th>
<th>Numerical values by areas of implementation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>social</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2021</td>
</tr>
<tr>
<td>1</td>
<td>Number of agreements signed, pcs.</td>
<td>44</td>
</tr>
<tr>
<td>2</td>
<td>Average duration of agreements, years</td>
<td>22</td>
</tr>
<tr>
<td>3</td>
<td>Amount of financing under agreements from extrabudgetary sources, bln. rub.</td>
<td>57</td>
</tr>
<tr>
<td>4</td>
<td>Amount of financing under agreements from budget sources, bln. rub.</td>
<td>19</td>
</tr>
</tbody>
</table>

Thus, the data in Table 1 show that the social sphere within the framework of public-private partnership gradually increases the areas of applicability, which is reflected in the increase in concession agreements for the optimization of the relevant components of the "smart city". With a high probability, for objective reasons, the applicability of public-private partnership in the sphere of housing and communal services is not possible in all directions. Another probable reason is that in the segment of housing and communal services there are fewer organizations that are technically and organizationally ready to cooperate with the authorities within the framework of the "Smart City" project.

The sphere of urban transport, as Table 1 shows, is the most defined area of public-private partnership, which may indicate both the limited degree of applicability of the...
partnership under consideration and the limited number of private sector representatives to implement activities within the framework of the Smart City project. Despite the insignificant number of concession agreements in other areas of public-private partnership, there is still a positive dynamics and there is a possibility to assume that there may be an increase in the degree of applicability of public-private partnership in other areas of urban development [8-10].

4 Discussion

Considering the indicator of the average duration of concession agreements it should be noted that PPP contracts in the sphere of urban transportation system management are the most pronounced in time intervals. The development of transport infrastructure implies a longer time period, as the purchase of the new models of public transport for example, requires lengthy maintenance of the information system, as well as the need for their repair service. In addition, the construction of roads taking into account "smart" technologies implies long production cycles at each stage of such activities [11].

It should be noted that the most significant participation of the private sector under PPP contracts is in the implementation of investments in the housing and utilities sector, social policy and transportation system. This may indicate that the private sector understands the importance of urban infrastructure development and economic feasibility within the framework of private sector participation as a party to the PPP contract. In many contracts, one of the conditions is the mandatory investment of own funds by representatives of the private sector, which in the aspect of partnership represents an economic profit for all parties to the contract [4, 141].

The participation of the state in public-private partnership, based on the spheres of implementation of activities under the project "Smart City" through municipal authorities, is different. In the sphere of transport infrastructure, the state gradually reduces the share of its participation, as representatives of private partnership implement activities under PPP contracts on the basis of greater feasibility in economic terms for their development. In other areas, the process of correlation of financial participation between the state and the private sector is currently going through the stage of determining the spheres of responsibility in relation to each party depending on the specific activities required for the development of the smart city [12, 38].

Thus, it should be noted that public-private partnership is now gradually developing. Both the state and the private sector determine the boundaries of their participation and opportunities within the framework of economic feasibility and resource capacity to contribute to the "Smart City" project. It becomes obvious that the most progressive sphere of applicability of public-private partnership will be urban transportation and its maintenance.

It is highly likely to assume the emergence of new areas of the considered partnership, for example, in the field of tourism and service. Currently, the areas of the Standard, which are not yet involved in the PPP contracts being implemented, are being developed with the support of other government programs in the field of entrepreneurship and information technology. The difference between such support and the projects realized within its framework is the target purpose, affecting certain areas of the national economy. At the same time, these areas do not always affect the process of digitalization. Nevertheless, the implementation of the Smart City project will be continued after its completion through the dissemination of successful urban development practices to the sectors of the national economy that are subject to digitalization.

The Smart City pilot project shows that the application of public-private partnership is not only possible, but also advisable [13-15]. One of the tools that strengthen the indicated
opportunity is the division of competence between the state and the private sector within the framework of the realization of a particular event or project. The second tool is the attributes of contractual relations, in which each party declares its contribution, proposes a mechanism for the realization of joint activities and agrees on the expected results of such a partnership [16-17].

5 Conclusions

In conclusion, it should be noted that the form of public-private partnership initiated within the framework of the pilot project "Smart City" is potentially subject to widespread dissemination, as such cooperation is a type of social relations. Unlike other types of social relations, public-private partnership is aimed at the well-being of society, economic development of the city and ensuring satisfaction of all parties of social relations from interaction with each other. Given the importance of directions within PPP contracts, public-private partnership as a resource to influence change, is able to transform the livelihood of the city, which will subsequently have a positive impact on the livelihood of the subject, according to the expectations of the state.

References

1. A. A. Peshkova, Russian Regions in Focus of Change, 10, 455-457 (2020).
5. The Ministry of Construction announced the list of pilot "smart cities". https://clck.ru/38W7Sf (access date: 02.02.2024).
12. I. M. Shor, Bulletin of Moscow City Pedagogical University, 4 (34), 37-46 (2022) doi.org/10.25688/2312-6647.2022.34.4.03