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Digital methods of managing investment and construction projects as a factor of sustainable territorial development

A N Dmitriev[1], G Yu Kallaur[1] and L M Papikian[1]

[1] Plekhanov Russian University of Economics, Moscow, 117997, Russia

E-mail: kaf-stroy@yandex.ru

Abstract. Currently, the documents of strategic planning in Russia prescribe the innovative economic development based on digital technologies. In construction, which is a material and technical basis for the development of other industries, the question of introducing and using information-modeling technology is of paramount importance. This fact determined the subject of this study. The relevance of the topic is dictated by the search for ways of sustainable economic development with regard to the sectoral and territorial aspects based on the effective implementation of investment-and-construction projects in the emerging digital environment. The authors use analytical and comparative methods to summarize the present international experience in the development of construction in the context of application of information modeling technologies. Based on that, they also consider the basic principles of economic development in the context of using digital methods as the main factor of sustainable territorial development. As a result, proposals were formulated for integrating the information modeling of capital construction facilities into the project management system at various levels of economic decision making: federal, regional, municipal, and business. Through the example of Moscow, the territorial-sectoral structure of managing investment and construction projects was considered. The authors substantiated their conclusions on the priority measures for the development of the innovation system in construction for the sustainable territorial development.

1. Introduction

Currently, the strategic development of the nation is ascertained at the federal level with the help of 12 national projects approved by Decree of the President of Russia No. 204 of May 7, 2018 “On National Goals and Strategic Tasks of Development of the Russian Federation for the Period up to 2024”, with a total amount of funding of 25.7 trillion rubles. In accordance with these documents, the authorities of the constituent entities of the Russian Federation are implementing regional priority projects with due regard to the documents of territorial planning and local development tasks of the regions.

Industry-wise, construction in Russia makes up about 7% of GDP, and capital investments in national projects are estimated at more than 8 trillion rubles, which constitutes 1/3 of the total amount of their funding. Thus, the construction industry, which is the material and technical basis for other industries, can be viewed as the main driver in the development of the national economy, which, in accordance with relevant documents of strategic planning, should be based on the principles of project management, innovation and sustainable development.

Investment and construction activity is, by nature, a project design activity, and the transition to a new technological economy must be ensured by the search for an innovative development path.

At the same time, information modeling of capital construction facilities, or building informational modeling (BIM), is a modern effective tool for managing investment and construction projects on the basis of digital methods. The development of information modeling in Russia is furthered by the Codes of Practice (CP) and national standards (GOST) from the "Information Modeling in Construction" [1] series developed at the request of the Ministry of Construction of Russia.

According to "Global Construction 2030", in 2013-2014, full-scale digitization of the construction industry in the UK ensured cost savings of GBP 800 million. Globally, in the next 10 years, digitization may lead to a reduction in costs at the stage of real estate design and construction by 1.2 trillion dollars, and at the operational stage, cost reduction can amount to 0.5 trillion dollars [2].

In addition, the international experience of promoting "green" standards in the economy determines the vector of innovative development of the construction industry, based on the choice of energy and resource saving technologies for environmental management and sustainable development. By Presidential Decree No. 899 of July 7, 2011 "On establishing priority directions for development of science, technology and equipment in the Russian Federation and the list of crucial technologies in the Russian Federation," energy saving, energy efficiency and rational nature resources management were defined as priority directions of economic development in sectoral and territorial aspects.

Thus, the task of ensuring the integration of innovation development processes in the management system of investment-and-construction projects in the light of digital environment and green economy requirements becomes urgent.

2. Models and Methods

To this end, this article, using analytical and comparative methods, summarizes the current international experience in the development of construction under the conditions of the application of information modeling technologies with the aim of identifying the factors of sustainable territorial development.

Research methods include a review of scientific papers, government strategies and programmes, regulatory documents, including international and national standards in the fields of project management, information modeling technologies, green economy, and innovation policy in construction.

The methodological basis of the study is an analysis of the basic principles of economic development: project management, innovation and sustainable development (Table 1), which will be further considered in the context of digital transformation of the construction industry as a driver of the national economy.

Table 1. Basic principles of economy.

Basic principles of economy		
Project Management [3]	**Focus on Innovation [4]**	**Sustainable Development [5]**
1. Focus on a specific result 2. Limited resources 3. Teamwork 4. Proactivity 5. Planning and control 6. Integrated approach 7. Continuity at each stage of the life cycle 8. Flexible process settings	1. Evaluation of competitiveness 2. Development of education, science and technology 3. Increasing cognitive capital 4. Innovative entrepreneurship 5. Dependence on production and new knowledge 6. Advance development	1. *Economic responsibility:* high productivity, development of production and technological complexes 2. *Social responsibility:* development of education, protection of the interests of the population 3. *Environmental responsibility:* ensuring safety, minimizing the impact on the environment, saving natural resources

3. Results and Discussion

Implementation of BIM in the management of investment-and-construction projects with due regard to the Decree of the Government of the Russian Federation of July 28, 2017 No. 1632-r "On approval of the programme Digital Economy of the Russian Federation" and the Government Order of the Russian Federation of April 11, 2017 No. 2468p "Plan of action for introduction of assessment of the economic effectiveness of justifying investments and information modeling technologies at all stages of the "life cycle" of a capital construction facility," is a logical stage in the digital transformation of the investment and construction sector. Information modeling in construction makes it possible to expand the possibilities of optimizing resources and management decisions, searching, substantiating and introducing innovations within the life cycle of capital construction facilities, and also contributes to the effective planning and solution of tasks of sustainable territorial development.

Information modeling of a capital construction facility makes it possible to use various digital economy tools at different stages of its life cycle: blockchain, smart contracts, automation of engineering surveys, laser scanning of terrain and structures, cloud technologies, computers and mobile devices at the construction site, big data information storage centers, stress-strain state sensors and resource consumption at different stages of the investment-and-construction project [6,7]. At the same time, BIM should be viewed as an efficient up-to-date tool of innovation diffusion [8,9] on a single digital platform.

Thus, the integrated application of these digital methods in the management of investment and construction projects ensures a more efficient implementation of the above-mentioned basic principles for the development of the economy in general, and the construction industry in particular.

At the same time, the integration of information modeling processes of the capital construction facility into the project management system at various levels of economic decision-making (federal, regional, municipal, and also at the business level) is of paramount importance. For effective coordination of work in a single information space between all participants of the investment-and-construction cycle (investors, customers, designers, contractors, government agencies of different levels, future consumers and operating organizations), it is necessary to create an innovative multi-level project management system in the form of project management offices.

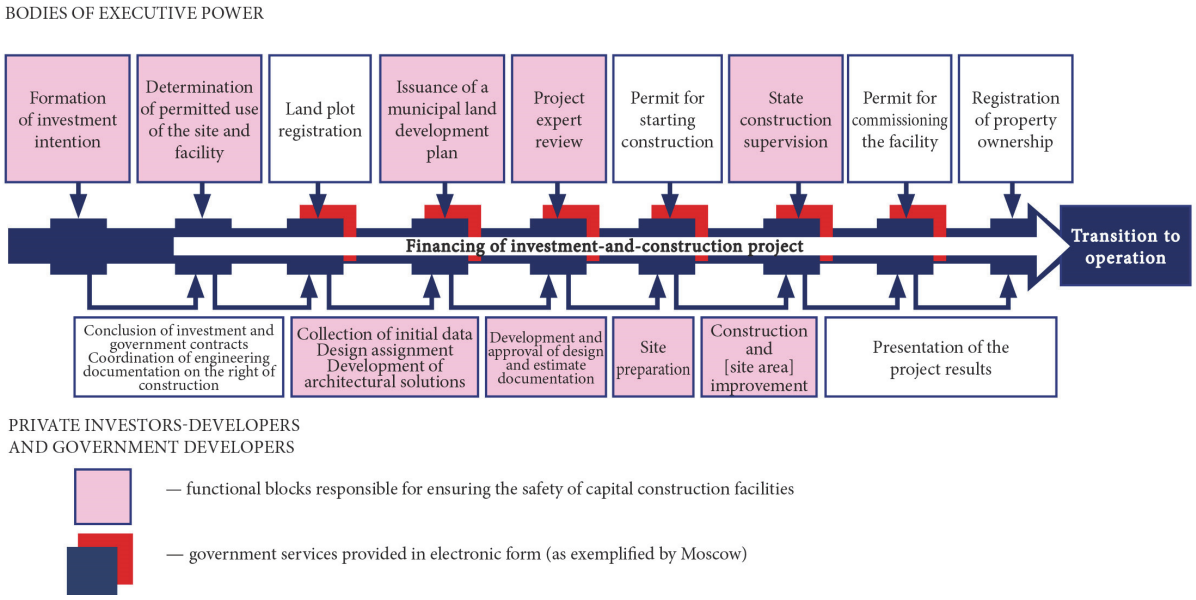

Figure 1. Scheme of communication in the preparation and implementation of investment-and-construction projects in Moscow.

At the federal level of management, project offices have already been established to coordinate activities within the framework of national projects, which makes it possible to effectively interact with regional authorities and individual departments responsible for the implementation of various tasks.

To solve the problems of managing regional projects in the investment and construction sphere, project offices operating with the use of digital technologies are also needed. Figure 1 shows a typical communication scheme for the preparation and implementation of investment-and-construction projects in Moscow, which reflects the extent of use of digital methods at various stages of the life cycle.

Presently, the Moscow State Expertise [expert review panel] is drawing up a list of requirements for digital models of capital construction facilities at the stage of expert review of design and estimate documentation and is becoming one of the participants in the digital modeling of a future capital construction facility.

At the same time in Moscow, experience has been amassed of creating a territorial construction catalogue in which, with its further development in the direction of digitalization, it will be possible to include libraries and classifiers of innovative design and technological solutions tested at pilot sites with the use of BIM for mainstream use. Thus, regional authorities shape the policy of digital modeling of urban space and aim at solving the problem of optimizing resources and sustainable territorial development.

Rosenergoatom Concern is an illustrative example of the active and effective use of integrated construction project management systems based on digital methods at the business level. The package of projects implemented by the company includes more than 20 power units being simultaneously built and designed in Russia and abroad. The company is also a developer and actively implements an innovative project management system for the construction of complex engineering structures, Multi-D [10]. This is currently the most advanced technology system for managing the design and construction of capital construction facilities, which makes it possible to effectively manage such parameters as budget, time and quality. On the basis of Multi-D, the Neolant Group of companies, in close cooperation with Rosenergoatom, developed a system of real-time monitoring of capital construction facilities. It forms a single digital space created by integrating information systems used by all the specialists involved in the creation of a facility - from research and design to construction. Thus, a unique coverage for practically the entire life cycle of a capital construction facility with model-oriented systems is provided.

4. Conclusion

Documents of strategic planning implemented in the form of national projects and state strategies in Russia determine the vector of innovative economic development in the sectoral and territorial aspects, which is based on the integrated application of project management methods with due regard for the requirements of digital environment and the principles of sustainable development.

Information modeling of capital construction facilities, as an element of digital technologies, makes it possible to move up to a new technological level in construction, change the design processes and those of organization of work, improve their quality by reducing the number of errors and conflicts.

At the same time, significant effects are manifested in the project management system for project participants at all stages of the life cycle, including through alternative modeling of management and technological processes, improved control over supplies and costs, all of which leads to a reduction in the cost and in the duration of construction work, as well as to enhancing the performance characteristics of the facility being erected.

To form an effective territorial management system for investment and construction projects, it is necessary to create an innovative multi-level project management system in the form of project offices, ensuring comprehensive coordination of all participants in the investment and construction cycle on single digital platforms.

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