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Improving the Methods of Real Estate Operation Based on BIM-Technologies

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***Abstract*–The article describes the possibilities of using BIM technologies, and problems that can be solved using this technology. In addition, the authors analyze the effectiveness of this technology through the example of the experience of other countries. BIM (Building Information Modeling) is a new approach to design, construction and operation. Studies show that the use of BIM technology contributes to increased profits and profitability, lower costs, increase productivity and reduce the overall cost of the project.**

Keywords–BIM-technology, information modeling, design, construction

I.INTRODUCTION

Construction is an independent sector of the country's economy, which is designed to introduce new production and non-production places, as well as their reconstruction, expansion, repair and technical re-equipment. The decisive role of the construction industry is the conditions for the dynamic development of the economy.

One of the features of construction is the territorial fixation of products, and the mobility of the active part of production assets of construction and installation organizations. The construction is characterized by a relative duration of the production cycle (from several months to several years), the production process is conducted outdoors in various climatic conditions.

The finished construction products are building and structure. They have a number of features in comparison with serial production of industrial enterprises. In the process of creating finished construction products, there are several, and sometimes hundreds of independent organizations with different goals and objectives. Under market conditions, a construction organization should focus its activities on the consumer of finished products, on the subordination of all the tasks of organizing and marketing these products.

The implementation of high-tech projects requires innovative methods in the design and construction. The problem of introducing BIM-technologies in Russia is very essential. Since 2019 all the projects for construction and reconstruction of capital construction projects with state participation will have to be handed over to the state expert with an information model.

Purpose of the study – improving the efficiency of operation of real estate.

Object of study - real estate objects at the operation stage.

Subject of study — processes of improving the technologies of real estate facilities using BIM-technologies.

II. BUILDING INFORMATION MODELING

Building Information Modeling (BIM) provides opportunities for designing a future object in a 3D model, which is also the database for this building. All elements of the database contain technical, technological, financial and other parameters and descriptions, the attributes of the elements are interconnected. Thus, all participants in the process have the opportunity to work with the same project at the same time at all stages such as design, construction and operation.

The introduction of information modeling mechanisms allows making effective decisions at all stages of objects' life cycle from investment design to operation and demolition. At the same time, the terms of all stages are reduced and the quality of work is improved, which ultimately improves the management efficiency of the entire construction industry.

Information modeling technology allows visualizing any elements and systems of a building in 3D-format, counting various variants of their layout, analyzing the operational characteristics of future buildings, and simplifying the choice of the optimal solution. The introduction of BIM-technology helps to reduce the construction time, reduce the estimated cost

and further operation of the objects being constructed. BIM allows not only modelling the future building, calculating the risks, the cost of construction, but also predicting its operational and economic characteristics throughout the entire life cycle of the object until the moment of its demolition.

III. Building Information Modeling in Russia

For the first time in Russia, the 3D design system was used in early 2000s. We have been engaged in informatization of the construction industry for a long time [1]. Currently, the information model should accompany the entire life cycle of the construction project.

However, not a single developer in the world would ensure this cycle completely, because here we are talking about the interaction of different solutions - architectural, construction, engineering», the expert explained. In Russia, there is software that is better than the foreign one, but many designers continue to focus on foreign technologies.

The chairman of the temporary commission of the Federation Council for the Development of the Information Society said that a government resolution on imposing restrictions on procurement of foreign software by state agencies in case it has a domestic analog entered into force [2].

The advantages of using BIM-technologies are quite tangible: according to experts, the number of errors at the design stage is reduced by 30%, the design time is significantly reduced, as well as the time and cost of construction. In addition, the three-dimensional model helps architects to find new ideas, because the three-dimensional model is much more informative than a flat drawing.

According to Christoph Ahammer [2], a professor at the Vienna University of Technology, BIM technologies are a very useful thing in modern design and construction. The essence of BIM-technology is that the object is built twice. At the first stage, a turnkey building is built in a virtual mode, where each participant in the design process can look at it and make comments, and at the next stage, when the object is already made in reality, BIM helps to avoid its redesign or rework. The expert notes that the use of BIM will increase the volume of construction in half.

During the restoration of objects using BIM technology, the bulk of information comes through a laser scanning method. The essence of the method is to create a three-dimensional model, presenting it with a set of points with spatial coordinates.

The technology allows obtaining detailed data of objects. Thanks to the created 3D model, you can get drawings in any form and at any time without additional measurements. Such models can be loaded into libraries and replenish "intelligent containers". The experience of using the technologies of information modeling of buildings in the field of restoration of architectural monuments is also applicable to the issue of modernizing mass housing construction due to the fact that the “intelligent container” is universal.

Today, the design solutions of Soviet homes no longer comply with operational standards. Internal systems wear out, nodes lose their strength, facades decay and lose their appearance, houses become outdated morally. Globally, massive housing demolition is costly and unacceptable as a solution for the regions.

Due to the seriality and prevalence of mass housing, the system of "intelligent container" allows you to lay in the database the typology of houses and tools for their modernization. Since the BIM system affects all stages of “design - construction - operation - demolition” and in its work allows you to simultaneously involve specialists in different directions, it is possible to create a specific catalog of solutions for a series of houses, designed by several specialists simultaneously to modernize mass housing.

In the future, data from the library can be supplemented and used in work with other projects throughout the country.

Such a directory may include 3 key sections: architecture, construction and building technology. Each section contains a selection of decisions by specialized experts. BIM will allow you to track down problems at the project development stage and find a compromise solution.

So, for example, in the architectural section it is advisable to consider such modernization methods as facade reconstruction, changing the roof condition, expanding the area in the building, terracing and modernizing balconies, as well as creating comfortable entrance groups. In the construction sections are meant technical methods for the modernization of the engineering networks of the object and constructive methods, appropriate to the state of the house at the time of its modernization.

Of course, each house should be considered individually in the modernization. However, such a system will greatly facilitate and accelerate the work on the modernization will allow you to choose the best option.

Based on Talapov’s reflections in the work “BIM Technology and its Linking Role for Architectures of Different Eras,” [3] we can single out new opportunities considered in the context of modernizing mass housing:

1. New features of monitoring and research: the model allows you to analyze the object in whole or in parts. Point cloud is also applicable for pipeline inspection, communications, analysis of their condition and creation of three-dimensional models of engineering networks for subsequent inventory and modernization.

2. "Electronic passport" of object upgrading. Let's apply at all stages of work with the building.

3. The possibility of creating a global information system of monuments of architecture: “internal” information about the monument becomes publicly available for electronic search and accounting.

With the advent of such a powerful and convenient tool as BIM, the modernization of mass housing is greatly simplified. It is possible to achieve an important architectural task with a limited budget, such as the massive modernization of neighborhoods while maintaining the unity and identity of the territory. At the same time, BIM assumes high-tech solution methods in combination with high-quality and modern design.

BIM is experiencing active development in Russia and abroad. This was influenced by two circumstances: the popularization of new technologies and the state's policy aimed at digitizing the economy. Today, BIM technologies are becoming a reality and a necessity for many companies.

The importance of using new technologies was stressed at the international investment forum PROEstate by the Minister of Construction and Housing of Russia Mikhail Men. In his opinion [4], it is necessary to take into account the British experience in the introduction of BIM-technologies, where, since May 2016, all construction sites under the state order have been designed using information modeling of buildings. The first estimates have already confirmed the effectiveness of this decision. The cost of construction has decreased by 30%. "Their experience has shown that Russia is moving in the right direction," the minister said.

For a successful transition to the new design format, a "road map" was developed for the implementation of BIM technologies in construction, which was signed by the Deputy Prime Minister of the Russian Government Dmitry Kozak and approved by the government of the country [4]. The document provides with the development of national standards for information modeling in design, construction (reconstruction, overhaul) processes, operation and demolition of capital construction objects, bringing the regulatory and technical documents and estimated standards used in construction in line with the classifier of construction resources. The road map also spells out the expansion of the functional purpose of the federal state pricing information system in construction in the direction of operation and demolition of objects.

Russia turned to a three-dimensional design system at the beginning of the two thousandth, says Maxim Nechiporenko, deputy director of Renga Software [4], a software company for information modeling of construction objects. "We have long been engaged in the informatization of the construction industry. Today, an information model must accompany the entire life cycle of a construction object. However, there is no developer in the world who would provide this cycle completely, because here we are talking about the interaction of different solutions - architectural, construction, engineering"».

IV. Building Information Modeling in the World

Today, in many countries of the world (the USA, the UK, France, Nordic countries, Singapore, South Korea, China, etc.), information modeling technologies are being actively implemented in the construction industry [1]. The scale of BIM implementation in these countries depends on the benefits. They can be obtained at various stages of project implementation or at various levels (both at the level of an individual enterprise and the industry or the state as a whole).

The result of the use of BIM-technologies is expressed in the form of high quality of the created project documentation, cost reduction at the construction stage, establishing information exchange, storing information in a single place and simplifying the interaction of the participants who are part of construction projects, etc. All this in turn leads to an improvement in economic efficiency from the implementation of the project for the construction of buildings and structures, and most importantly, to a reduction in cost. Such a positive effect in the form of increasing the level of profit and profitability is manifested both at the level of a single building organization and at the state level by reducing the cost of facilities built under the state order, which allows saving and efficiently using state budget funds.

A distinctive advantage of using BIM tools is the fact that the model of the construction object is dynamic (changeable). After adding changes to the geometry or data of the BIM-model, all the interrelated types, data, parameters and documents are automatically updated. Also, the information model allows all participants of the investment and construction process (customer, designer, builder, contractors, suppliers, etc.) to be involved in the team process of creating an object, have the opportunity to discuss, comment and coordinate their actions, track changes, which also increases project performance.

Dedicated advantages of BIM-technology lead to its wide distribution and widespread introduction into the global design practice and construction management practice. In Russia at the moment, there is some lagging behind the developed countries, where BIM-technologies are already widespread, which affects the increase in volumes, the improvement in the quality of construction, combined with the increase in economic efficiency.

Due to the advantages of using BIM-technologies in a number of countries at the state level, the conditions for the mandatory use of technology in the design and construction of facilities at the expense of the state budget have been adopted. Such requirements were introduced by state customers in the USA since 2003 and in 2007 in a number of countries in Europe and Asia.

In 2011, the UK announced a new program in the field of construction focused on achieving competitive advantages on the world stage [3]. Based on this strategy, a consistent program of transition to information modeling technologies was developed. This solution provided an accelerated pace of BIM implementation.

In 2012 in the USA, about 70% of the construction market participants announced the use of BIM-technologies in their projects; in the UK in 2016, it is 54%. In Singapore, since 2015, more than 80% of all construction projects are carried out only with the use of BIM technologies.

Nowadays, all design organizations and about 70% of Singapore's building contractors use BIM on their projects. Today, BIM-technologies successfully exists and receives funding from the European Commission working group on BIM (EU BIM Task Group). It includes representatives of government customers of countries in the European Union. The main objective of the work is to create uniform for all EU countries rules for planning and implementing government orders for design and construction contracts.

Consider the approaches used by researchers in various countries to assess the effectiveness of the implementation of investment and construction projects using *BIM*.

In the UK, the need to introduce BIM technologies was realized and implemented at the state level to increase the competitiveness of construction enterprises in the international arena and the possible achievement of global leadership in the field of digital construction.

In 2014, an updated version of the strategy for the development of the construction industry in the UK until 2025 was adopted [4]. The main goal of this strategy was to reduce the cost of implementing investment projects by 33% and reduce the duration of the construction process by 50%.

Singapore is now one of the leaders in the use of information technology not only in Asia, but throughout the world. The Singapore government very quickly realized the benefits of using BIM-technologies in construction, therefore, it promptly launched a government policy to support its implementation, including financial support for industry organizations implementing *BIM*.

In 2010, *the Building and Construction Authority* of Singapore, which is responsible for managing the construction industry and performing the functions of the ministry, developed a BIM roadmap (*Singapore BIM Roadmap*).

It is planned to reduce the number of low-skilled workers (migrants) at construction sites with the help of innovative technologies. Another special goal of Singapore is to become the world leader in the speed of project expertise and issuing building permits.

According to a study [5] conducted in Europe among engineers, architects and other representatives of related specialties, 41% of respondents believe that after BIM introduction, their profits increased; 55% talk about reducing the cost of the project; 21% report an increase in labor productivity, which leads to a decrease in the number of personnel involved.

V. CONCLUSION

Studies show that using *BIM* approaches contributes to increased profits and profitability, reduced costs at the design stage, increased productivity and reduced total project costs.

One of the positive aspects of the introduction of information modeling is the emerging trend of reducing the number of changes in the project and information requests, as well as rework on the object, which leads to a decrease in costs.

In addition, the use of *BIM*-technologies leads to the emergence of many qualitative benefits that affect the growth of competitiveness of the enterprise:

− process automation;

− project risk reduction;

− increased safety at the facility;

− project quality improvement;

− increasing the effectiveness of communication between project participants.

The achievement of such highly positive results of the introduction of BIM-technologies and their wide distribution in the leading countries is obliged, first of all, to state support and public policy with clearly defined goals and developed measures to achieve them.

BIM technologies are used not only at design and construction stages, but also throughout the life cycle of the project. According to DealFM, which provides services for the general management of real estate and technical maintenance of buildings, the operational phase is the most expensive and lasting stage in the life of the facility.

To reduce the cost of maintenance, systematic data collection and its structuring are required. Modern BIM models allow this to be realized, ensuring the permanent access of the service organization to various building systems that ensure its functioning.

Practical significance lies in the fact that practical recommendations will be developed on the implementation of BIM-technologies in the operation of real estate objects. Materials will be used in the educational process.

Thus, the main advantage of BIM is to integrate processes and ensure accurate and timely transfer of information between key project stakeholders. Many countries in the world are already enjoying the benefits that information modeling offers.

The task of Russia is to ensure the systematic implementation of BIM both at the legislative and practical levels in order to minimize the costs of construction and operation of facilities, reduce errors, and shorten the project implementation time.

1. Organizational and technical preparation of construction;

2. Material support system;

3. Acceptance certificate;

4. Qualification requirements.

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