IMPLEMENTATION OF BIM TECHNOLOGIES IN INVESTMENT PROJECTS

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АННОТАЦИЯ: Рассмотрен уровень зрелости технологий информационного моделирования объектов недвижимости. Определены основные критерии эффективного внедрения BIM-технологий. Предлагается классифицировать инвестиции на разных стадиях проектов внедрения BIM-технологий.

ABSTRACT: The maturity level of information modeling technologies for real estate objects is considered. The main criteria for the effective introduction of BIM technologies have been determined. It is proposed to classify investments at different stages of BIM technology implementation projects.

Ключевые слова: технологии информационного моделирования, внедрение BIM-технологий, уровень зрелости технологий, инвестиции, реинжиниринг, организационные процессы, изменение организационной структуры, логистическое оборудование, оценка инвестиций.

Key words: information modeling technologies, implementation of BIM technologies, technology maturity level, investments, reengineering, organizational processes, organizational structure change, logistics equipment, investment evaluation.

Introduction: The advantages of information modeling technologies are obvious, but a systematic transition to their implementation requires drastic changes in the field of corporate culture, interaction technologies, and current standards of enterprise activity. Making fundamental changes in the established structure of any organization is indeed a difficult task. It is necessary to completely reorganize work processes and their management system. At the same time, it is very important that the company moves to its goals within the accepted concept of transition to BIM technology.

The level of maturity of the organization's information modeling system is determined by its ability to work with BIM technologies both at the level of individual projects and at the level of the organization. The main indicator of a company's maturity in the use of BIM technologies is the level of technological and organizational changes within the framework of the transition to BIM.

Analysis of the relevant literature. According to the BIM model proposed by Mark Bew and Mervyn Richards, the maturity level of information modeling is evaluated based on the ability to work and share information during the design and construction production process (Figure 1).

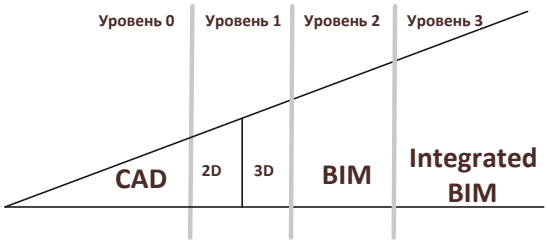


Figure 1. maturity level of information modeling.

Level 1 represents the transition from CAD to BIM. In this transitional stage, BIM standards are formed, the main interaction procedures are defined, while special attention is paid to the data exchange process and their compatibility.

Level 2 increases interaction, data integration and quality. Engineering calculations, previously developed modeling standards cover new types of projects, and engineering data management is added to the collective production process. As a result, more and more attention is paid to the joint use of a single information base, where new types of calculations and analyzes are performed, for example, to calculate estimates and plan work processes, to control the actual execution of the project using virtual-digital modeling of the construction object (4d and 5d). being directed.

When moving to BIM level 3, the organization creates a unified environment for all specialists, which ensures the effective execution of projects, the ability to carry out and check engineering calculations, and manage the operation of objects. This stage is characterized by a high level of control, focusing on the quality of the tasks performed. The widespread use of models and BIM standards is increasing efficiency. The necessary information is available to all process participants thanks to advanced services based on a single digital model. Thus, joint work will rise to a fundamentally new level[1].

Analyzing the transition process of the project organization from CAD technologies to BIM, as well as the depth of BIM introduction into production, we identify the main factors that determine the success of the introduction of new technologies.

1) organization of workflows and their management systems in BIM technology;

2) the existence of information modeling standards and rules that ensure the possibility of using BIM for all types of projects;

3) availability of project design templates and documents;

4) access to the computing base that meets the system requirements of the software;

5) availability of special software that allows to implement the information modeling approach in the unified project management system;

6) formation of administrative and production structures involving qualified personnel. Thus, three directions of investment can be distinguished for the transition of the organization from CAD technologies to BIM (Figure 1).

1) redesign of the organization's work processes and their management system;

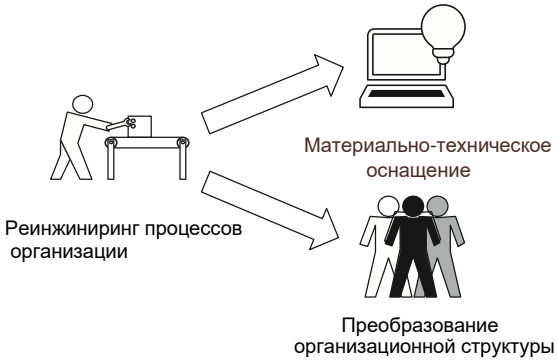
2) change the organizational structure (in terms of personnel composition and qualifications);

3) material and technical equipment of the company.

The main stage that determines the vector of all subsequent changes for BIM is the change of processes in the organization. At this stage, the main requirements for the material and technical base of the organization and the composition and qualifications of the employees are formed. In this regard, the main costs in the initial stages of BIM implementation are the reconstruction of specific processes (Figure 1).

Figure 1. Investment directions for the transition to BIM.

Redesigning processes in the organization should begin with defining the conditions



and requirements for the formation of new administrative and production processes and information models. At the same time, the decisions made should be related to the goals of the organization, take into account the available resources and possible risks. Using information modeling technology, maps of BIM processes are created, reflecting the order of performing the main work tasks, as well as the forms of data transfer. At this stage, the BIM standards used by production processes in the implementation of projects in the organization are determined. In addition, it should be remembered that the main part of the model is created at the initial stage, all participants in the process spend more time, as a result of which the resource intensity of this stage increases[2].

As a rule, the main share of investments in the restructuring of organizational processes is made at the stage of transition from CAD to BIM. At the same time, this type of investment is unique, because the main part consists of temporary and intellectual costs, which are difficult to evaluate with money, but nevertheless, they should be considered and planned when moving to BIM.

Change the organizational structure. A fundamental change in work processes leads to a rethinking of the company's structure and the skills of employees. In order to increase the effectiveness of using the potential of BIM technologies, it is recommended to include three new types of specialists in the organization: BIM-manager; BIM-master; BIM coordinator.

The BIM manager should be at the beginning of the BIM implementation process. The BiM manager actively participates in the development of company workflows, standards and templates. In the future, he will support the information model, update it, and also develop programs for training and professional development of employees.

The main task of the BIM master is the technical support of the information model, from the creation of infographic tools to the implementation of expert support for users of BIM content libraries.

The main task of the BIM coordinator is to ensure the integrity of the information model by combining the results of the work of specialists of relevant specialties in accordance with approved rules and standards. The full effect of BIM implementation will be achieved only if all specialists of the organization switch to the new technology. Now, since we are not

talking about modernization or improvement of existing programs, but about changing concepts and the emergence of radically new software, it is necessary to train specialists to the level of reliable users.

At the same time, it is natural for labor productivity to decrease in the first stages. A significant part of BIM implementation costs are investments in infrastructure development. these include the purchase of office equipment, software and other costs associated with maintaining and developing the business. It is important to keep in mind the implementation features for a company that has entered the bim path. in order to successfully install the technology in production processes, it is necessary to go through all the main stages and correctly form the expectations of all participants of the project.

Estimating investments in the development of material and technical components is probably the simplest of those listed. it is enough to calculate the cost of purchasing the necessary funds, taking into account their average market value. the biggest difficulties in this aspect, as a rule, is choosing the right software. often, there are no difficulties in preparing individual components of the information model. Problems arise when trying to combine separate parts into a whole. the main requirement when choosing software should be the compatibility of file formats for input and output at each stage of model development. to avoid such conflicts and the appearance of unexpected costs, it is recommended to choose software on a single platform, which allows you to model all stages of the object's life cycle from end to end[3].

In order to evaluate the investment in the implementation of the project, all costs must be presented in monetary terms. This process is complicated by the need to convert quality data and time indicators, so it is often recommended to turn to expert data evaluation at this stage.

The transition to BIM is a set of interrelated processes, therefore, investments in a BIM implementation project are a set of investments in all three areas:

$$I_{BIM} = I_{PR} + I_{OC} + I_{TE},$$

Here: Investments in the Ibim-BIM implementation project; Costs of restructuring IPR-organizational processes; IOC — costs of changing the organizational structure, including personnel training; ITE is the cost of providing the material and technical base [4].

Conclusion: Thus, only a systematic analysis of the three investment components of the BIM technology implementation project allows for a full cost assessment and to determine the effectiveness of the introduction of information modeling technologies in the company's activities in the future.

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