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Features of the Application of Information Modeling in the Construction Industry

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Abstract. The article deals with the issues of improving the quality of products by design organizations contributing to improving the efficiency of the organization in terms of dynamism of the environment. The application of BIM technologies in the work of organizations is discussed in detail.

1. Introduction

The market situation analysis and evaluation of financial and economic activities of companies conducting design activities in the field of construction made it possible to identify several anti-crisis management alternatives as part of the company's development strategy that contribute to improving the efficiency of the organization's activities in the context of the dynamism of the external environment.

Based on the pair-wise ranking of scenarios for the development of the external environment and comparative judgments about pairs of goals and management alternatives, it is possible to quantify the probability of these scenarios, the weight of goals and the priorities of management alternatives. In order to maintain its competitive position in the market, the enterprise needs to make a managerial decision to improve the efficiency of the organization's operations in changed conditions of the external environment.

2. Discussion

2.1. The concept of information modeling in the development of project documentation

Based on the current situation in the market, the most effective behavior can be called the introduction of BIM-technologies in the design (see Fig. 1) [1].

When designing any buildings and structures at present, it is impossible to do without the use of a computer virtually at all stages of design. Due to the wide spread of the computer technology, its relative availability, and the emergence of many graphic programs, designers have been able to see various solutions on the computer screen, both at the design stage, and at stages of working out design solutions, production documentation and project presentation. The use of information technology has significantly changed the traditional design and scope of services. Along with pre-project research and the creation of traditional 2D drawings, it becomes necessary to design 3D, i.e. creation of a virtual model of the object on the basis of which it is possible to verify the geometric consistency of solutions



(collision detection) and create any necessary views and sections, i.e. generate basic drawings, get the initial data for calculations and related tasks, obtain the necessary specifications, statements, etc.

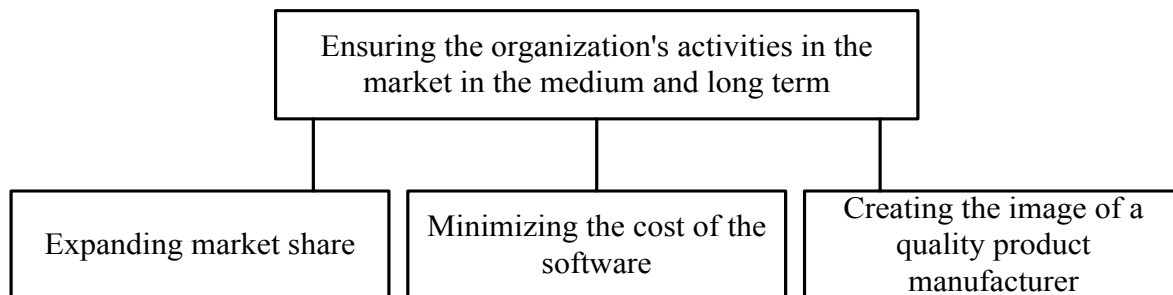


Figure 1. The hierarchical structure of the process of adoption of anti-crisis management decisions.

Computer models of different types require different approaches and solutions depending on the complexity and size of buildings, as well as the available software and hardware. There are several types of computer models used in everyday architectural practice, namely: conceptual models; models used for visualization; BIM / Team model (see below); models for project coordination; structural models, models of vertical and landscape design, and so on.

2.2. Principles of information modeling

Throughout the world, the automated design is carried out with the help of CAD-applications. Due to the rapid development of software and computer programming, a few years later only, after 2D CAD applications, 3D CAD applications began to appear. By the end of the eighties, CAD developers had come to the conclusion that different software products were required for different segments of the industry.

The so-called BIM-design has become more widespread recently.

Most often, BIM is defined as a process, a model, a database describing the structure or software.

BIM technology combines:

- objects describing the building (functional objects, physical objects, logical objects, abstract objects)
- objects describing the process (schedules, resources, prices, quality, tasks, work, solutions, document flow, etc.)

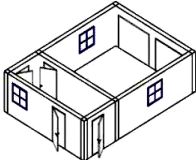
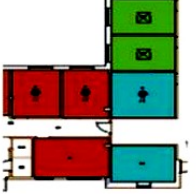
For the effective work of all participants of the BIM process, the information should not depend on any specific tools and software, that is, the following principles should be observed:

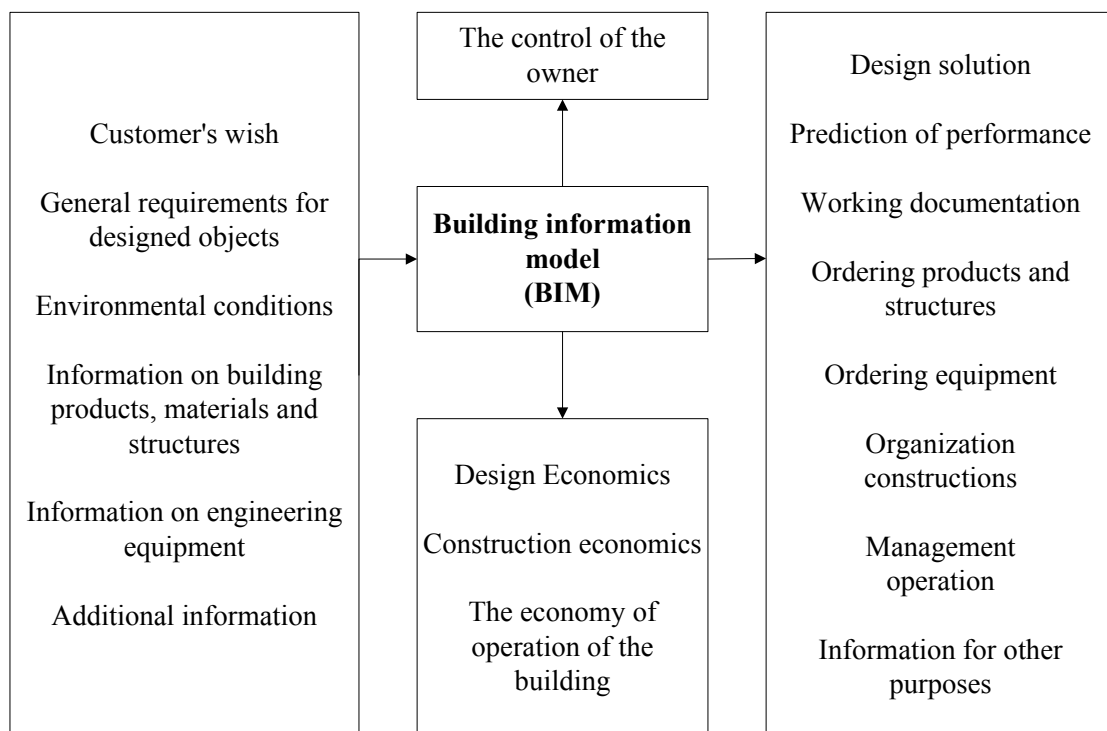
- freedom to choose tools that meet one or another of the needs;
- freedom to transfer information from one participant to another;
- freedom to create specific tools, regardless of any platform solutions.

The developers of this concept believe that "BIM is associated with the creation and use of coordinate-based, coordinated, verifiable information on the projected building – the information used to make decisions, create high-quality project documentation, predict performance, compile estimates and construction plans, and, finally, for the management and operation of technical equipment"[4, 5]. The pattern of optimization of working processes in the construction industry based on the information model of the building is shown in Fig. 2.

In accordance with the BIM concept, the design of buildings is reduced to the creation of a three-dimensional virtual model, on the basis of which various types of project documentation are created. Being different forms of presentation of the same information model, all kinds and documents are inextricably linked with each other, so that any changes to the project on any kind of changes will be automatically displayed in all other types and documents.

Table 1. Information modeling objects.

	Model type	External display
1	Functional object	
2	Physical object	
3	Logical object	
4	Logical object	

**Figure 2.** The scheme of optimization of business processes on the basis of the building information model (BIM).

2.3. The practical application of information modelling

Today it was with the help of BIM-technologies that a number of unique construction projects were developed, requiring the relevant work of specialists in various fields. Examples of objects are shown in Fig. 3-4.

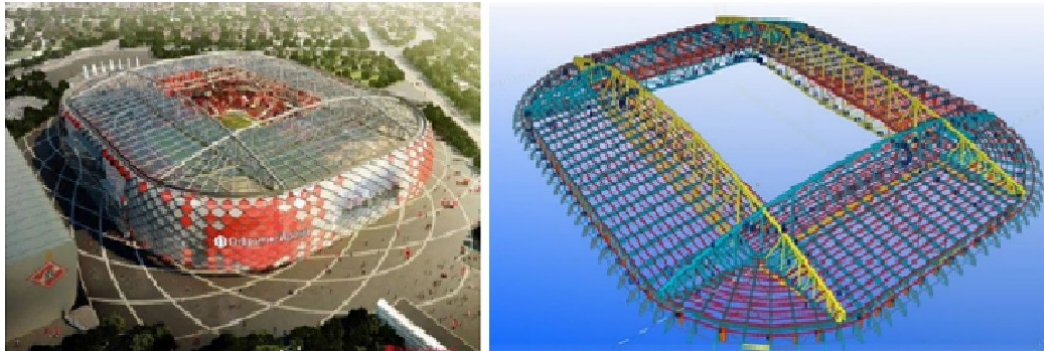


Figure 3. Spartak stadium, Moscow (Facade, BIM model).

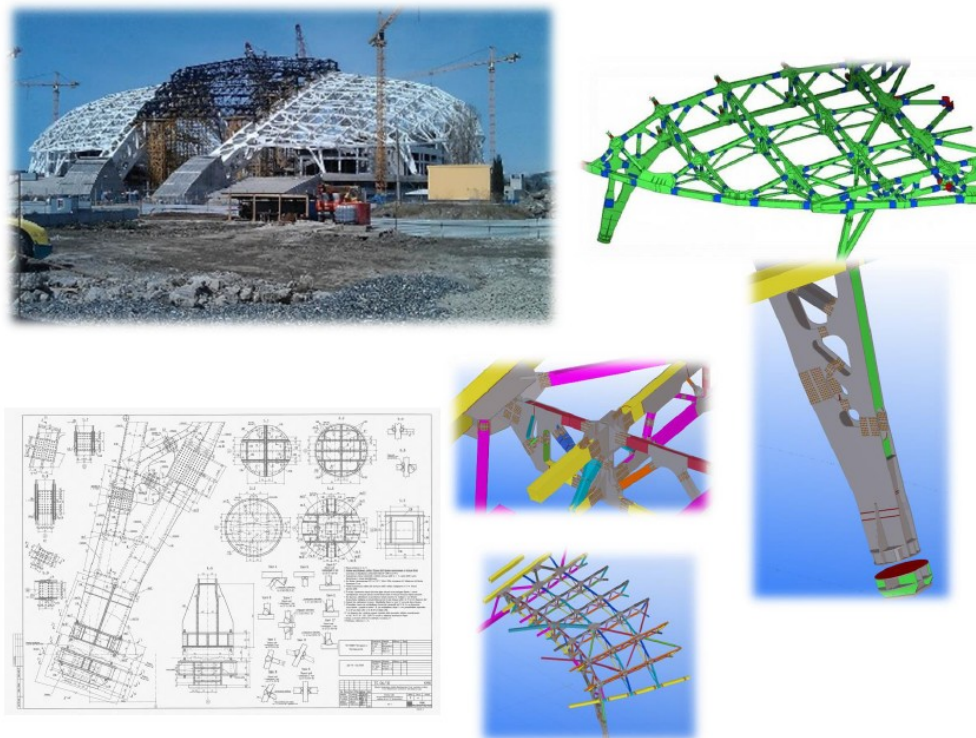


Figure 4. Main stadium (Olympic games 2014, Sochi). Photos of the construction works. Drawings, sites, obtained on the basis of the model in Tekla Structures.

With the use of BIM-technologies in the design of small construction sites, the efficiency of the entire working group was increased [7], including due to the use of a multi-user model, as well as savings in building materials.

In a number of programs of information modeling, import and export of files to and from manufacturing equipment have been realized. This accelerates the process of production of building structures and a building object in whole.

3. Summary

Advantages of the BIM-technology consist in the visual representation of the design intent with any possible detail at any stage of the project development. Accuracy increases during design and construction. Consequently, against the background of cost reduction, the terms for the implementation of investment and construction projects are being reduced.

Summarizing the above, we conclude that the most common application of computer technology in the design is:

- creation of a full package of the project documentation (drawings, explanatory notes, etc.);
- creation of three-dimensional models of objects and structures;
- creation of photorealistic presentation of the project;
- strength calculation of applied building structures;
- engineering calculations of the plumbing and electrical engineering parts of the project.

4. References

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