

# Organizational schemes for the state expertise process of design documentation depending on the level of implementation of information modeling technologies

S. A. Serbin<sup>1,\*</sup>, N. Yu. Seregina<sup>1</sup>, and N. A. Fomin<sup>2</sup>

<sup>1</sup>State Autonomous Institution "Department of State Expertise", Yekaterinburg, Russia

<sup>2</sup>Federal State Autonomous Educational Institution of Higher Education «Ural Federal University named after the first President of Russia B.N. Yeltsin», Yekaterinburg, Russia

**Abstract.** The implementation of building information modeling (BIM) technologies is actively developing in Russia due to legislative influence. The authors of the article examined the process of the design documentation's examination depending on the level of building information modeling technologies' implementation. A gradation of BIM implementation levels in the examination process was applied: low, medium, high, on the basis of which three schemes of the organizational examination process were described. For each scheme, positive and negative aspects were analyzed. Questions that may arise when trying to implement each organizational scheme were formulated. For the practical implementation of each scheme by all participants in the process the necessary measures were described. The conclusions about the further vector of development in the realities of current legislation and the development of building information modeling technologies were drawn.

## 1 Introduction

Building information modeling (BIM) technologies are the most discussed and developing area in the construction industry around the world. Following the most experienced countries, such as the USA, England and Australia [1,2,3], where implementation is supported by the state, countries developing in the BIM field, such as Indonesia [4], Malaysia [5] and others, also publish their research. The driving factor is the efficiency of using building information modeling technologies [6]: budget reduction due to the elimination of unforeseen changes by 40%; reduction of estimates by 80%; savings in contract costs by 10%; elimination of potential conflicts in interaction with customers; reduction of project implementation time by 7%.

Building information modeling technologies have been actively introduced into the construction industry since their inception [7]. The formation and maintenance of an information model is mandatory for all capital construction projects financed by the state,

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\* Corresponding author: [s.serbin@egov66.ru](mailto:s.serbin@egov66.ru)

and from July 1, 2024 it will become mandatory for capital construction projects that are provided by the developer or technical customer operating in accordance with [8]. At the same time, additions were made to [9] about the information model, but we should not forget that the information model [10] and the building information model [11] are legally different concepts. So, many questions are open now:

Is a three-dimensional model a variant of the design documentation's graphic part or is it an addition to it?

Which of the participants in the process and at what stage checks the compliance of the building information model and drawings, regardless of whether there is such a requirement in employer's information requirements?

How to avoid insufficient or, on the contrary, excessive detail of a three-dimensional model, if in the Regulations, approved by [9], which is the only resolution on the content of sections, does not contain requirements for the building information model? Adaptation of the Regulations is possible, but requires an unambiguous approved interpretation [12].

Until recently, the building information model was subject to a decree [13], which is now being revised by the Government and everyone involved in construction field and BIM processes is waiting for it. The authors of the article examined options for state expertise's organizational schemes of work, depending on the level of development of building information modeling technologies in them. The purpose of the study was to analyze possible organizational schemes for the work of state expertise within the framework of current legislation, depending on the level of implementation of BIM technologies. The following tasks were set: to describe possible organizational schemes for the work of state expertise depending on the level of implementation of information modeling technologies, to evaluate the positive and negative aspects of each scheme in accordance with current legislation, to describe the necessary actions for the transition to each of the schemes, to draw conclusions about the further path of implementation BIM technologies in the process of conducting examination at the stage of design documentation.

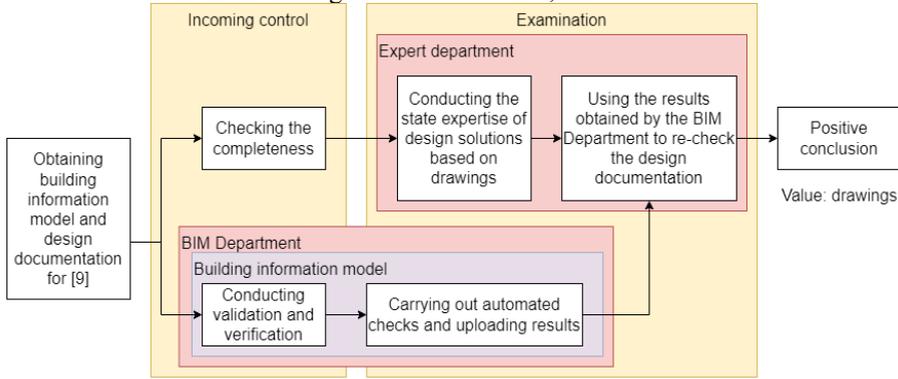
## 2 Methods

Based on the latest current edition [13], the information model of construction object [10] can be supplemented with a building information model [11] if there are a corresponding employer's information requirements. With this formulation, the value of the building information model remains unknown. The value of the building information model was taken as the criterion by which organizational schemes for the work of state examinations were formed. These schemes are obtained from practical experience in implementing building information modeling technologies in the State Autonomous Institution of Sverdlovsk region "Office of State Expertise".

Conducting an examination using BIM technologies is possible according to three organizational schemes, depending on the level of implementation of BIM modeling technologies in state expertise.

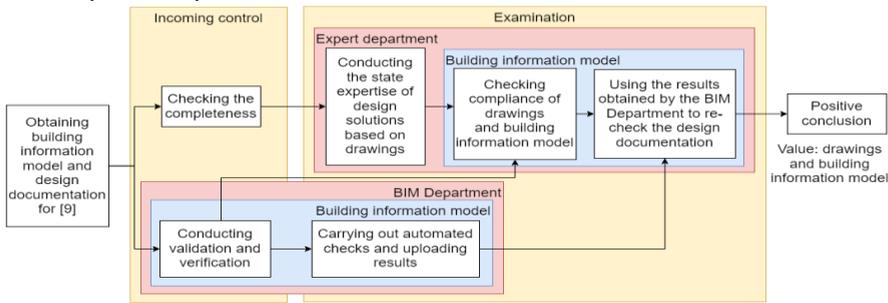
In accordance with the first scheme presented in Figure 1, the building information model is an attachment to the graphic part of the design documentation made according to [9] and does not represent value for the expert even after the examination. This scheme corresponds to a low level of BIM implementation. In this case, the building information model remains under consideration only by the BIM technology department, where automated checks are carried out according to a limited list of legal norms. As a result, reports on automated checks of the BIM model are transferred to the Expertise departments. The obtained data helps draw the attention of experts to problem areas. However, a positive conclusion is issued based on the results of checking the drawings, which means that using the building information model

in the future is incorrect from a legal point of view, since one cannot be sure that the drawings were downloaded from the building information model, and not vice versa.



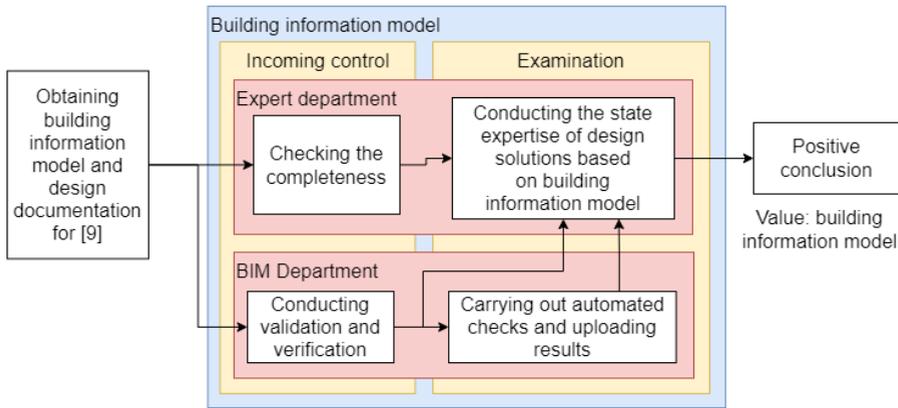
**Fig. 1.** Scheme of work of state examination with a low level of BIM technologies' implementation.

According to the second scheme, presented in Figure 2, the building information model and the graphic part of the design documentation, made according to [9], are equivalent for the expert, which means both have value after the state expertise. This scheme corresponds to the average level of BIM technologies' implementation. With this scheme, firstly, the building information model is accepted by the BIM department, and then goes to the Experts department. As a result, the expert examines the drawings, building information model and issues a positive opinion on the entire set of documentation as a whole.



**Fig. 2.** Scheme of work of state examination with a medium level of BIM technologies' implementation.

According to the third scheme, the building information model is a graphic part of the design documentation, made according to [9], while two-dimensional drawings are unloaded from the building information model only if it is necessary. This scheme corresponds to a high level of BIM implementation. With this scheme, the building information model is first accepted by the BIM department, then goes to the Experts departments. As a result, the expert evaluates design solutions only based on the building information model and the text part of the section and issues a positive conclusion on the building information model, and only this is of value to the expert.



**Fig. 3.** Scheme of work of state examination with a high level of BIM technologies' implementation.

### 3 Results

Based on the schemes shown in Figures 1,2,3, the positive and negative aspects of the schemes' use in state expertise were analyzed. The results of the analysis of organizational charts are presented in Table 1.

The scheme presented in Figure 1 excludes the expert's consideration of the building information model. This leads to a significant information gap between the drawings and the spatial model, which eliminates the usefulness of using building information modeling technologies in general.

The scheme presented in Figure 2 involves an expert reviewing the drawings and building information model. Since we cannot be sure that the drawings were obtained from a building information model, the expertise must be carried out with double labor costs, which is not provided for by law.

The scheme presented in Figure 3 assumes consideration of a building information model as a graphic part of the design documentation according to [9]. The main problem is the lack of requirements for building information models equivalent to the Regulations approved by [9], which confronts us with the problem of ambiguity in the interpretation of requirements [9] in terms of building information models, which can only be solved by an unambiguous description of the geometric and information detail of the graphic part of the design documentation [12].

**Table 1.** Positive and negative aspects of implementing schemes.

|          | <b>Positive aspects</b>   | <b>Negative aspects</b>   |
|----------|---|---|
| Scheme 1 | There is no need to train experts in BIM technologies.<br>There is no need to check the consistency of the building information model and the drawings.                                       | Building information model has no value after the process of state expertise.<br>There remains an information gap between the building information model and the drawings.<br>Contradicts the Regulations, approved. [9] regarding the compatibility of design solutions.       |
| Scheme 2 | Building information model is valuable after process of state expertise.<br>The drawings are valuable after process of state expertise.<br>Does not contradict the Regulations, approved. [9] | The labor intensity of the examination increases by 1.5-2 times (due to the repeated examination of the building information model).<br>According to the latest edition [13], the detail of the building information model could exceed the detail of the design documentation. |

|          |  |   |
|----------|--|---|
|          | regarding the compatibility of design solutions.<br>There is no information gap between the building information model and the drawings. | Lack of automated validation and verification due to the lack of unified requirements for building information model.   |
| Scheme 3 | Building information model is valuable after the process of state expertise.<br>The examination is carried out once.                     | There is a need for a unified description of the requirements for building information model at the design documentation stage of life cycle, replacing (supplementing) [9].<br>Drawings have no value after the process of state expertise, which requires the competence of all participants in the construction process. |

## 4 Discussion

The authors conducted a comparative analysis of the schemes presented in Figures 1,2,3, taking into account the pluses and minuses taken into account in Table 1. Table 2 presents the main issues that arise when considering each scheme as the main one in the organization of state expertise, as well as the necessary preparatory actions, required for the full implementation and launch of each organizational scheme.

**Table 2.** Emerging questions and necessary measures for the implementation of schemes in the activities of an expert organization.

|          | <b>Unresolved issues regarding legislation and industry readiness that arise during the implementation of the scheme</b>  | <b>Measures to be taken to implement the scheme</b>  |
|----------|---|--|
| Scheme 1 | How can we be sure that drawings match the building information model, if they are submitted for examination as part of the information model of the construction object? If the digital information model is of low quality, then how can we be sure that the inspection reports issued by the BIM department will speed up the work and not slow it down? Is it possible to use a building information model in the future if it has not been reviewed by experts?  | State Expertise: Formation of a list of checks for compliance with standards and attributes necessary for the operation of automatic checks.<br>Ministry of Construction and technical customer: Formation of an employer’s information requirements, including the necessary attributes of the information model.   |
| Scheme 2 | What should we do if the building information model has not passed the acceptance process in the BIM Department (for content), but the expert has already reviewed the drawings and is ready to issue comments/conclusions?<br>Is it possible to issue a negative conclusion on the building information model when it does not comply with the technical specifications (the building information model is tested against the employer’s information requirements for the model established in the technical specifications), and the drawings comply with the technical regulations?<br>How to check the compliance of drawings and building information model if the building information model does not have enough information for analysis, but there are no requirements for the need to provide such information in the task? | State Expertise: Increasing the competencies of experts in the BIM field. Formation of a list of building information model attributes that make it possible to conduct an examination of design documentation based on a building information model.<br>Formation of a list of checks for compliance with standards and attributes, which are necessary for the operation of checks.<br>Formation of validation and verification checks according to employer’s information requirements. |

|                 |  |  |
|-----------------|--|--|
|                 | <p>What should we do if the building information model is developed in a volume corresponding to the life cycle stage of the working documentation and does not correspond to the content of the sections of the design documentation according to the [9] (excessive elaboration has errors)?</p> <p>Is it possible to keep the duration of the state expertise the same if there are actually 2 times more examinations: according to drawings and according to the building information model?</p>  | <p>Ministry of Construction and technical customer: generation of an employer’s information requirements, including the necessary attributes of the building information model for conducting the examination.</p> <p>Allocating additional labor to compare the graphic part in the form of drawings and in the form of a building information model.</p>   |
| <p>Scheme 3</p> | <p>It is impossible to carry out the building information model according to the current Regulations, approved. [9], the standard needs to be adapted.</p> <p>What should we do if the building information model is developed in a volume corresponding to the life cycle stage of the working documentation and does not correspond to the content of the sections of the design documentation according to the [9] (excessive elaboration has errors)?</p> <p>Is the industry ready for a 3D model approved by an expert organization rather than drawings? Will coordinating organizations be able to work with building information model (network specialists, city administrations, etc.). Is construction supervision ready to supervise the object and issue a “conclusion on the conformity of the construction project”? Most importantly, are the operating organizations ready?</p> | <p>State Expertise: Increasing the competencies of experts in the BIM field. Formation of a list of building information model attributes that make it possible to conduct an examination of design documentation based on a building information model.</p> <p>Formation of a list of checks for compliance with standards and attributes, which are necessary for the operation of checks.</p> <p>Formation of validation and verification checks according to employer’s information requirements.</p> <p>Ministry of Construction and technical customer: generation of an employer’s information requirements, including the necessary attributes of the building information model for conducting the examination.</p> <p>Organization of work processes involving the use of building information models.</p> <p>Construction supervision, operating organizations: Increasing competencies in the application of BIM technologies. Changing organizational schemes for working with approved design documentation.</p> <p>Legislation: Changing the graphic part format of the design documentation.</p> |

Summarizing the results presented in Table 2, it can be noted that to implement any of the presented schemes it is necessary to make changes to the legislation. The first scheme is transitional, since if the low level of the value of a building information model, it must either be increased or the process of implementing BIM technologies into the examination process

must be stopped. At this stage, BIM technologies are developing towards the average level of BIM implementation, namely scheme 2. However, the problem of increasing the labor intensity of conducting an examination remains behind the scenes. As a consequence, this problem can lead to a discrepancy between the drawings and the building information model, which means the building information model will never begin to be of value from the point of view of conducting an examination. There are two ways out of this situation: either recalculating the labor intensity of conducting an examination (for expert organizations), as well as maintaining an information model (for the customer), or developing the level of implementation of BIM technologies to Scheme 3, which requires legislative support. It should also be noted that the design documentation stage is currently not adapted for the use of BIM technologies, which means that for further application of Scheme 2 or Scheme 3, a description of the geometric and information elaboration of the design documentation stage is necessary to unify the method of information transfer and create the possibility of automating the acceptance of a building information model.

## 5 Conclusion

As a result of the analysis carried out by the authors, organizational schemes for the state expertise of design documentation were described depending on the level of implementation of BIM technologies. The positive and negative aspects of each scheme have been identified, as well as the measures required to be taken in implementing each scheme. Conclusions were drawn about the importance of amending legislation for any level of implementation of BIM technologies, and several possible ways to increase the level of implementation of information modeling technologies in the examination process at the stage of design documentation were described.

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