BIM technologies in customer service business processes. Commercial pricing classifier

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Abstract. In the construction industry, implementing the information modeling technologies directly in the business processes of the Customer’s Department will allow improving the following procedures on a deeper scale: designing buildings and structures with the parameters that enable to receive consolidated cost estimates in an automated mode at various stages; monitoring and control over construction and installation works at any stage of the process; and creating a federated model.

Keywords: construction company, construction, BIM technologies, effectiveness, implementation, pricing, calendar planning.

1. Introduction
Currently the BIM technologies are used worldwide more and more, which, in its turn, allows to substantially increase the quality of construction project execution, shorten the time frame, and reduce the estimated construction cost that provides the customer with the opportunity to improve the effectiveness of a company’s activity within the construction industry. In this paper, the authors describe the process of implementing the BIM technologies in the activity of the Customer’s Department of a construction company and study the possibility of using the classifier with commercial rates for a qualitative transformation of the business processes using the BIM approach [1].

The subject of the study is a commercial pricing classifier. The purpose of the study is to decide on the estimated and engineering calculations for information models of buildings. The methodology of the study is:

- theoretical: a theoretical analysis of literary sources;
- experimental and theoretical: modelling, analysis, deduction.

2. Methods
The construction industry’s problems of ensuring the effectiveness of capital investments in the Russian Federation are constantly discussed by the top-level state authorities, including the Main Department of State Expertise. Conferences and round tables are held, and the enormous amount of work is being done in order to solve the problem [2]. The key stages of this are the following two –
taking a decision on investments with detailed justification of the amount of the capital investments in a project and the design activities that also include obtaining the project’s expert review.

This study was conducted using methods:
- Theoretical: a theoretical analysis of literary sources;
- Experimental and theoretical: modelling, analysis, deduction.

On the basis of the available literary sources, the authors processed and analyzed research data on information technologies in construction. Simulated the work of customer service departments to identify the need to create a classifier of commercial rates. According to the results of the simulation, an analysis was made of the existing needs and suggestions for a specific solution to a particular task [3].

The objectives of the work is to resolve the difficulties of the customer service. This issue is being actively developed by Glavgosexpertise and various project committees [4].

Currently, the main mechanisms aimed at ensuring the effectiveness of capital investments in construction are the examination of the state investment construction projects carried out by the Ministry of Economic Development of the Russian Federation with regard to the effectiveness of using the federal budgetary funds, and the comprehensive technology and price audit of the largest investment construction projects and verification of the correct determination of the estimated construction cost carried out by experts. Actual mechanisms that are widely used nowadays have several drawbacks, which substantially reduce the possibility of taking weighed decisions in investing in construction of this or that object.

On the other hand, constant redistribution of powers among the competent authorities, the possibility to obtain a non-state expert review, and other approaches to evaluating the investment construction projects and their effectiveness do not undergo any significant changes. In practice, the increased focus is on the compliance assessment of the documents, while choosing essentially correct and profit-making decisions and their suitability for modern engineering solutions and technologies are left aside.

Besides, various experts note that the de facto project evaluation is usually started at the last preparation stage and the assignment is almost never evaluated in regard to the correctness of design and other input data. This is with the exception of such situations when the technology and price audit of the largest investment construction projects is performed. Currently, the obsolete base and index method is used for evaluating the cost of investment construction projects, as well as outdated itemized construction estimates [5]. The Main Department of State Expertise determines the project cost taking into account only the design and construction costs and does not consider further costs on operating the property, though sometimes such costs exceed the investments in project construction.

In order to ensure implementing the principle of effective usage and investment of budgetary funds, currently the regulatory documents of the construction industry are being amended [6].

“So increasing the effectiveness of investing budgetary funds is planned to be achieved by creating a database with similar projects, implementing the investment justification, fixing the economic effectiveness criteria and evaluating the planned marginal cost of construction taking into account the construction price norms and the cost of similar projects, updating the cost standards and using the input cost assessment method instead of the base and index method, and developing the consolidated construction cost standards” [7].

However, the transition to accounting the operation costs and costs on construction object demolition using the information modeling technologies is in progress. Experience has proven that quite often the substantial reduction of construction costs for this or that object by using available materials, products, structures, and works leads to the necessity of large investments in maintenance and minor repairs of a building or a structure in future [8]. The increased construction costs due to using high-quality materials, process, and engineering equipment, as well as performing works with better quality will allow reducing the operation costs and extend the service life of a construction object [5].
3. Results
Within the current business environment a comprehensive solution is needed that provides for creating a standard framework for developing the mechanisms of evaluating all costs and creating new methods, standards, and classifiers. It is important to pass over to a new level of organizing works and to actively use the existing information regarding the projects that have already passed the state expert review - that is, to pass over to informatization and creating new information environment where an information model of an object can be created. The information model should include all the data required to take a decision on capital investments, the materials and the information about the objects. [9]

Transforming the business processes using the BIM approach will allow designing buildings and structures with any characteristics, forming various types of costs estimates by various methods, monitoring and controlling the construction and installation works at any process stage, and creating a federated model [10].

In a narrower sense, this will lead to the following [11]:
• Eliminating discrepancies and errors in detailed design documents directly at the design stage;
• Creating a method to transfer a part of the works from the Detailed Design Documents stage to the Basic Design stage, as well as from the Basic Design stage to the Sketch Design stage;
• Expediting the generation of the planned cost of a construction object;
• Improving the accuracy of budget planning and control over spending of the funds allocated for construction;
• The possibility to monitor the performance of construction and installation works online;
• Drawing up and updating the as-built project documents.

Developing the information modeling technology for the above-mentioned business processes requires an item-by-item analysis of the requirements thereto.

The Design block in the created software allows:
• Facilitating the process of making any changes to the design documents;
• Computerizing the process of calculating volumes and areas of the designed objects;
• Eliminating discrepancies in the detailed design documents in a timely manner.

The following data sources are required for the operation of this system:
• The developed and adapted classifier of standard design solutions of a construction company;
• The technical assignment for a project and a model;
• The comprehensive classifier of all structural elements used and types of works performed.

According to the results of using the improved Design block a customer receives the following:
• Calculated data on the volumes and cost of materials used;
• The complete cost calculation for construction and installation works;
• Technical and economical parameters of an object and the effectiveness of project implementation;
• The design at the Sketch stage;
• The design at the Basic Design stage;
• The detailed design documents.

Further on, Classifier of Structural Elements and Cost Estimate Creation blocks allow to obtain the following:
• The possibility of prompt interaction of all departments involved;
• Computerized collection of volumes and rate setting;
• A works and materials reference book that is standardized for a construction company;
• All the data from the project’s technical and economic parameters are used;
• The bill of quantities is drawn up;
• According to the results of the design works, it is possible to download the bill of quantities taking into account the volume of the required materials;
• Automatic generation of the bill of quantities;
• Creating various templates of contracts with cost estimates.

The Construction and Installation Work Control and Federated Model block allows to carry out the following:

• Technical supervision and operative control over the construction process;
• Comparing the object model with actual built structures;
• Making prompt changes in the sections of detailed design documents and creating a federated model of the construction object;
• Preparing data for controlling the use of a building;
• Working model;
• The construction schedule;
• The current federated model and documents are created during the process in a real-time mode;
• The bill of quantities is constantly downloaded and the budget is reviewed in order to control the expenditure. [12]

The statutory regulation in the sphere of information modeling are developed quite actively. On March 6, 2018, Order No. 410 of the Federal Agency on Technical Regulation and Metrology established the Project Technical Committee PTC 705 “The Information Modeling Technologies at All the Stages of the Construction Object Life Cycle”, “pursuant to several provisions of the Action Plan to implement the evaluation of the economic effectiveness of investment justification and information modeling technologies at all the stages of the construction object “life cycle”, composed of many organizations, including the Main Department of State Expertise.

Currently, according to the proposal by the Project Technical Committee 705, the “National Standardization Program” for 2018-2019 includes 27 topics, among them the issue of developing of set of basic standards; proposals regarding the documents contributing to the development of the concept are accepted.

“The PTC 705 Medium-Term Standardization Program provides for the standards that ensure the information security of the information modeling technologies (ISO 19650-5), the standards that detail the requirements to an information model at all stages of the life cycle of buildings and structures, and the standards that establish the methodology of using the information modeling by specific participants of the construction process (“role” standards)” [13].

4. Discussion

The information model of a building includes a large amount of various information. It is quite important that all this information is classified correctly. Consequently, when developing information modeling software classifiers must be created correctly as well. Correct classification provides the possibility to use the information model of an object in other software packages.

Standards for the methodology of forming the information on construction resources as a whole are planned to be developed for creating the construction resources classifier.

Currently, the following areas of using the classifiers in information modeling are identified conventionally:

• Creating various specifications;
• Analysis of the information model in other programs.

There may be several applied tasks and programs that can work with the information model of an object, but for the transformation of business processes the following developing areas are a priority:

• The calculation of the construction cost of a building or a structure;
• Thermophysical and acoustic reports according to the information model of a building.

The calculation of the construction cost of a building or a structure is necessary for:

• Construction companies, contractor and subcontractor companies;
• Design institutes and organizations;
• Developer;
• Technical customer that is the top lieutenant of the developer.

The construction cost calculation within the information model can be divided into several stages as follows:

• All volumes are calculated by the information model
• The volumes are then linked to the rates and types of works, thus carrying out the item-to-item calculation;
• Further, the item-to-item calculation is recalculated as a cost estimate using the rates, volumes, and types of works to be performed;
• The item-to-item calculation is used to draw up a work schedule that details the types of works and can be broken down by floors, sections etc.

From the technical perspective, the object construction cost can be obtained at any stage of information modeling. Yet, as is proven by the experience, no exact calculations can be made at the Basic Design stage as the model’s level of detail for the first calculations should be sufficient, that is, the model should include exact geometric reference, form, and orientation, the connection should be described, and the non-graphic information presented. Because of this, the construction cost calculation will be performed in a more accurate manner when the information model’s level of detail is higher [14].

On the other hand, it is quite often that the cost calculation allows verifying the information model for the degree of information filling and the flaws. When making calculations, several errors can be noted that were made in creating the information model.

In order to make estimate and engineering calculations according to a building’s information model the approved geometric parameters of a building are required, as well as the identification and classification of all structures. When obtaining the information on the composition of the object’s structures the exact classification of the construction materials used is of great importance, as are the types of rooms and a type of works.

Adopting the above-mentioned complex measures provides the possibility to pass on to a new level of taking decisions on capital investments in construction, correct planning, coordination, and further use of a construction object [15].

In order to reform the construction industry and assist in carrying out business processes in a reasonable manner, unified information environment should be created, a takeoff in developing information systems should be performed, and the formats of electronic documents should be improved for all investment construction projects.

5. Conclusions
1. The introduction of classifiers gives effect to the company, an effective BIM-approach for planning and evaluating investment and construction projects;
2. This simple solution reduces the routine burden on employees;
3. The classifier of commercial rates is the property of the company and the cost of its creation will be disposable

References
[1] Mamaev A E et al 2016 Applied application of BIMbuilding model to control investment and construction project of a construction project Vestnik SanktPeterburgskogo politekhnicheskogo universiteta im. Petra Velikogo – Bulletin of St. Petersburg Polytechnic University. Peter the Great, I (3)
[2] Brainard S L 1997 An Empirical Assessment of the Proximity Concentration Tradeoff between Multinational Sales and Trade American Economic Review 87(4)
[3] Astaf’eva N S, Kibireva Yu A, Vasil’eva I L 2018 The advantages of using and problems of implementation of building Construction of unique buildings and structures 8 (59)
[4] Lipsits I V, Kosov V V 2014 Investment project: methods of preparation and analysis (Moscow: BEK Publ)
[5] Kozhevnikov K I, Pridvizhkin S V, Bazhenov O V, Kozhevnikova M K, Zasukhina Y A 2017 Advances in Economics, Business and Management Research 38
[6] Zolotov V A and Semenov V A 2014 Perspektivnye sxemy prostranstvenno-vremennoj indeksaci dlya vizualnogo modelirovaniya mashtabnyx industrialnyx proektov Trudy Instituta sistemnogo programmirovaniya RAN. 26 (2)
[7] Lukashova A, Chumachev D 2013 London is a city of contrasts, rains and fogs Respublikanskaya stroitel' naya gazeta − Republican construction newspaper 12 (513)
[8] Zakrevskaya L V, Lubin P A, Avdeev S N, Gandelsman I A, Filippov S V 2017 Zhurnal grazhdanskogo stroitelstva 75 pp 123-128
[9] Voronin I A, Izatov V A 2014 About the possibility of determining the estimated cost of construction projects using the BIM design methods Proc. of the All-Russia conf. “Economic, organizational and management problems of construction complex development in Russia”
[10] Astashov A M and Oshkina L M 2014 Rol informacionnyx texnologij proektirovaniya v reformirovanii inzhenerno-stroitelnogo obrazovaniya Integraciya obrazovaniya. 18 no 4 (77)
[11] Talapov V V 2011 Foundations of BIM, introduction to building information modeling (Moscow, DMK Press Publ)
[12] Barabanova T A 2017 Using of BIM technology in the technical operation of buildings Proc. of the international scientific conference “Integration, partnership and innovation in construction science and education”
[13] Malakhova V V Cluster approach to development of region construction complex Economics and management 1
[14] Drapkin I M, Mariyev O C, Chukavina K V 2015 A Quantitative Evaluation of Import And Export Potential of the Foreign Direct Investment in the Russian Economy with a Gravity Approach Journal of New Economic Association 4
[15] Pridvizhkin S V, Bazhenov O V, Vyguzova M A 2017 Materials Science and Engineering, 262 012165