

The Role of Using Database of Materials and Equipment in The Building Information Modeling Implementation

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ABSTRACT

One of the new processes and technologies that solve many problems of construction projects is Building Information Modeling (BIM). BIM is not widely used in Iran, while in other countries, its culture is settling at a more favorable pace. Ideal modeling so that the micro-models are realistic and have information such as construction time and cost, construction companies, quality, etc, is a time-consuming and costly task, this issue reduces the tendency of stakeholders to implement BIM. What is the role and effect of using databases of materials and equipment in each of the stages of BIM implementation in construction projects? if there is a comprehensive database in the field of BIM, which BIM functions will be facilitated and which stakeholders benefit most from this database, are the questions that this paper seeks to answer. In the present study, after reviewing the literature related to the subject and recognizing the generalities and definitions of the database of materials and equipment, as well as its benefits and effects, semi-structured interviews were conducted with 16 experts in this field, using a qualitative method and then a content analysis. The results show that the use of materials and equipment database is the most used in the detailed design stage and it's most used in cost estimation, Quantity Take Off and clash detection and also the consultant and employer benefit the most from this database.

KEYWORDS

Materials and equipment database, building information modeling, project stages, BIM applications, BIM models.

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1. Introduction

BIM started in the 1970s, and in 1974, during reports, BIM was considered a suitable solution for problems and dilemmas faced by industries such as architecture, engineering, construction, and operation. Then the concept of "BUILDING DEVELOPMENT SYSTEM - BDS" was brought up, and its importance was expressed in reducing the costs that usually happen in building design, construction and operation.

BDS is a combination of software and hardware that can be useful for saving and manipulating building design information with details that enable design, construction, and implementation analysis. Various industries developed integrated analysis and parametric modeling tools when BDS was introduced.

BIM is a digital representation of the functional characteristics of a building, as a common source of information for decision-making throughout the life of a project, from concept to completion [1]. BIM is the development and use of a multidimensional computer information model designed not only for structural documents but also for simulating the construction and operation of capital facilities [2]. As a result, BIM is a digital, parametric, intelligent, data-rich, object-oriented display. So that all users' views can be extracted and analyzed based on their needs from this model. [3].

The BIM database is an important platform that facilitates communication between building components, related services, multiple stakeholders, and BIM software. The number of BIM databases and their components in databases worldwide is booming. For example, the "BIMobject" database contains 13,371 product families and 50,760 parametric BIM objects. The Autodesk Seek in the US database consists of 65,000 building objects.

Many efforts have been made to use BIM to implement construction projects successfully. However, in practice, a database system has not yet been developed because an extensive database structure is required for time/cost analysis for a specific project. Also, one of the important obstacles to implementing BIM is the lack of a database of equipment and materials.

Until now, academic researchers and organizations have published numerous kinds of research and articles on BIM success factors, methods of implementation and exploitation of BIM, and its advantages and obstacles. Over the past 20 years, there have been extensive studies on BIM in large and small dimensions, in which

the success factors of BIM have been classified in different ways and from different perspectives.

Many studies have been conducted regarding the obstacles to BIM implementation, but with the research that was done, it was found that one of the main obstacles to not using BIM is the lack of a comprehensive database of materials and equipment, also in Iran; there is not a comprehensive database in this regard. The research review indicates that valuable studies have been conducted in BIM databases. However, no research focuses on the effects of the existence of the database of materials and equipment in the BIM implementation, and this gap is felt; for this reason, this research seeks to identify these effects.

2. Methodology

The strategy of this research to collect information is to use appropriate methods and tools for the research. Data collection methods include those that determine how to collect data, such as questionnaire methods, interviews, literature review, a document study, observation, and experiments. Since the main goal of this research is to investigate the effect of using the database of materials and equipment in the BIM implementation process, a qualitative method should be used.

In this study, which was conducted to investigate the impact of using the materials and equipment database in the BIM implementation process, a qualitative survey strategy and semi-structured interviews were used to collect data. The participants of this research are suppliers, employers, contractors, and consultants. The number of interviewees is determined based on the data obtained from the interviews. It means that we continue interviewing new people until new opinions are received from the research participants, and whenever we see duplicate data, the number of research participants is determined, and we refuse to refer to the next interviewee. However, we chose the participants in the research based on their work background and experience. Experts with at least 2 years of work experience are included in the list and are randomly selected.

In order to collect qualitative information to identify and investigate the impact of using the materials and equipment database in the BIM implementation process, experts in this field were on the agenda. In order to select the research participants, the snowball sampling method, a non-random method, was chosen. The researcher used this method to interview people with experience in building and using BIM. After

interviewing 16 people, all of whom were managers and experts in the field of construction projects.

Semi-structured interviews are used in this research to identify the impact of using the materials and equipment database in the BIM implementation process. First, specific and informative questions are presented to inform the interviewee about BIM. During the interview, we may learn new points by receiving experts' opinions, which need to ask other questions to connect their opinions with the research topic.

Simultaneously, with gathering information, classification, and listening to audio files began using coding and identifying repeated codes in response to research questions.

3. Discussion and Results

The interviews of this research include three parts. The first part was getting to know the person participating in the research and reviewing the materials and equipment database concept. The second part of the interviews of this research has been structured interviews in which the stages of a project and the functions of BIM have been discussed with people, and then the question was raised as to which functions the database of materials and equipment is used the most and which beneficiary will benefit from it.

The third part of the interviews of this research was the additional points and explanations of the participants regarding the previous answers, and the information of this part of the interview was used as a summary.

4. Conclusions

The materials and equipment database definitely impact the BIM implementation process, but this impact is in different stages of the project. Such databases add much value to projects and cause more work transparency and productivity. Also, the existence of a database of materials can have a great impact on the quality of the project. Therefore, according to experts, the database of materials and equipment in the project establishment stage impacts cost estimation and Existing Conditions Modelling. The employer gets the most benefit from using the database of materials and equipment at this stage. In the conceptual design stage, the materials and equipment database is effective for cost estimation, Design Review, and spatial analysis, and the consultant gets the most benefit from using the materials and equipment database at this stage. In the detailed design stage, the material and equipment database is effective for cost estimation, Quantity Take Off, Clash detection, Record Modelling, product library, engineering analysis, and Sustainability Evaluation. The consultant gets the most benefit from using the material

and equipment database at this stage. In the construction stage, the database of materials and equipment is effective for cost estimation, modeling of technical details of components, manufacturing outside the workshop, design, and preparation of reports, and QA/QC, and the contractor gets the most benefit from using the database of materials and equipment at this stage. In the operation phase, the database of materials and equipment is effective for cost estimation, Record Modelling, Space Management, and Tracking, Building (Preventative) Maintenance Scheduling, and asset management, and the user gets the most benefit from using the database of materials and equipment at this stage.

The effects of the database of materials and equipment are different in each stage of the project. So, it has the least impact in the initial stages, such as project establishment and conceptual design, because the use of BIM in these stages is currently low, and the existence of a database cannot have a great impact.

However, the higher effect of using the database of materials and equipment is in the detailed design and operation. Because the main stage of BIM implementation is detailed design and BIM models evolve in this stage, the use of materials and equipment database facilitates path-breaking in this stage. Because the stakeholders of the BIM models are the consultant, and the use of the database can greatly help the consultant in terms of cost, time, and quality, the greatest benefit of using the database of materials and equipment will go to the consultant. Also, the research participants believed that because materials and equipment databases create a comprehensive and reliable database, it can be effective in operation as an as-built plan without mistake.

5. References:

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