

# The study of the contracts of Building Information Model (BIM) and the approach to its contractual framework codification

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## ABSTRACT

Building Information Modeling (BIM) has been created to increase the efficiency and use the abilities of the digital tools in construction projects, and is improving more and more. In addition to the benefits of this technology, some new challenges have been rose most of which are related to the legal and contractual issues. The routine contracts of the construction industry cannot respond well to the special situation of BIM, and various approaches have been proposed in international level to resolve this problem. Some of them are under the investigation and research to reach an appropriate solution. A specific contractual framework has not been codified in Iran, either. The study of these approaches fulfilled separately and scattered all over the world is a necessity which must be analyzed to present an explicit viewpoint for the decision-makers to achieve an appropriate approach for BIM contractual framework codification. This study investigating 21 cases of the proposed approaches in 7 leading countries in this field (BIM) and receiving the domestic industrial professionals' comments, has compared these approaches and categorized their advantages and disadvantages. The results of this research show that providing "the contractual appendix of BIM" and its attachment to the existed contracts can be an acceptable approach for removing the contractual problems of BIM. At the end, some proposals have been presented for the manner of an appropriate contractual framework along with the country situation and requirements.

## KEYWORDS

BIM, Building Information Model, Contract, Construction, Law

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## 1. Introduction

The Building information modeling (BIM) is a modern method of work and a cultural change in the construction industry using the integration approach. Having a shared responsibility in the project and its success is its main goal. The project must be prepared in a strategic guideline, the planning must be fulfilled widely, and all the problems and weaknesses of the involved parties must be completely revealed [1]. These benefits have made it favorite in construction industry and its utilizing is improving day to day.

Although there are so many benefits and possibilities using this modern technology, it has caused new challenges. One of these challenges is the legal framework and the contractual bedding of BIM which must be codified by the project authorities to define their relations, interact with each other, and determine their responsibilities. The building digital model is created by all the parties of the project including the employer, designers, contractors, the providers of the facilities, and all the other individuals. Regarding this model, the new authorities and responsibilities are defined for all these involved parties which were not existed before and are neglected in the routine construction industry contracts. Regarding the newness of this technology, one of its challenges for the users is the framework and the type of the contract which must determine the base of their interactions. Many approaches have been tested for removing the contractual problems and challenges. In 2007, an independent contract was provided in the US to be used instead of the usual contracts. Making the project agents with a new type of the construction contract has become a new obstacle for not-welcome this technology due to the newness of the building information modeling and all the other barriers for its execution. So, the contractual orientation of the building information modeling has been changed, and most of the countries and the researchers found that adding a "BIM appendix" to the existed contracts is a more proper way than the codification an independent contract. Thus, the BIM appendix has been provided for coordinating the existed contracts with the BIM situation since 2007 in the USA, 2012 in Singapore, and 2013 in the Great Britain, and has been updated in the next periods.

## 2. Methodology

The articles and documents regarding the BIM contract provided in the seven pioneer countries in the use of BIM, contracting contracts, and consultant engineers' services in the construction industry in Iran were reviewed. Afterward, several types of solutions presented to address the contractual deficiencies and shortcomings of the construction industry in some

specific BIM conditions. In this context, considering the possibility of reaching an appropriate contractual framework for application in projects that employ BIM, the use of "independent BIM contract" and "BIM contract attachment", which is the major solutions in other countries, was studied and developed by comparing them with the advantages and disadvantages of each. To scrutiny the results and the observation of experts, a questionnaire was developed to get the opinions of experts and industry workers who are also familiar with the issue of building information modeling. In this study, due to the lack of BIM in implementation projects and the lack of access to an accurate statistical sample that the participants have engineering, contractual and legal expertise simultaneously, the "snowball" method was used to collect data. By analyzing the results of the study that were obtained through the review of BIM contracts as well as questionnaires, different solutions were classified and by comparing them, the advantage and disadvantages of each were identified and the results of the research were presented.

## 3. Results and Discussions

BIM inherently depends on data produced and shared by several project performers. Therefore, it requires more cooperation between project members compared to traditional projects. Important requirements and prerequisites for BIM modeling are to determine the assignment of contractual issues and clarify the terms and obligations of the BIM parties. Although there is a general belief among users to develop contract documents for BIM, there is no consistent standard method to verify the number of obligations and requirements as well as where BIM documents should be placed in that part of the contract.

In the US, two self-governing organizations have taken some steps to publish the contract and supplement of the BIM contract. The American Institute of Architects (AIA) published an independent contract for BIM in 2007 called <sup>TM</sup> 106AIA Document C, which describes how to use and transmit digital data between project participants. That association further published the appendix of AIA Documents E201 7002 in 2007, which was later substituted by E203, G201, and G202. Ultimately, the AIA introduced a series of supplements called AIA Document E203<sup>TM</sup> and <sup>TM</sup> 201AIA Document G and AIADocument G202. In 2008, the Associated General Contractors of America (AGC) published the BIM supplement in two versions (Employer-Designer) and (Employer-Contractor). This appendix is combined with existing construction industry contracts and sets out specific requirements for BIM. This appendix modifies the terms of the standard contract and the relevant issues to this technology.

which are beyond the original scope of the standard agreement.

Before the publication of its contracting appendix, the UK developed the BIM Standard in 2009 primarily. Later, it published the BIM supplement in 2013 and finalized it in 2018. This appendix could be attached to all co-construction contracts and supports second-level BIM. In the UK, as in many other countries, instead of concluding a comprehensive and independent contract, by attaching a special BIM addendum, it has determined the contractual obligations of the project parties. Singapore drafted the BIM contract in 2012 and revised it in 2015. Australia and China have employed special appendixes to adapt to the new requirements resulting from the application of BIM in construction projects. Other countries have explained guidelines or standards for the application of BIM, in which the contractual aspects of BIM are considered and proper contractual provisions are being employed.

The proposed solutions to resolve the contractual obstacles of BIM are classified into two principal categories. The first category, which was less prosperous, is the development of an independent agreement for BIM. Another method that has been considered by many organizations and countries is the adaptation of a "BIM contract appendix" which is provided according to the features of countries and attached to existing standard contracts to correspond them with the specific conditions of BIM. Due to the complexity and lack of awareness of the project members with relevant issues to the application of BIM and increasing ambiguity in case of using a new and unfamiliar model for project members, the majority of relevant countries and organizations to BIM prefer to existing manufacturing industry contracts. Therefore, the existing contract frameworks should be maintained and the BIM supplements should be included in the contract only by attaching additions. The advantages and disadvantages of each of these contracting BIM solutions are stated in Table (2) and a summary of BIM guidelines in some of the leading countries in BIM is provided in Table (3) of the article in Persian.

#### 4. Conclusions

Project-based contracts, which are united with BIM technology must comply with the terms of this modern technology. Due to the technical and legal novelties in the relation between the employer, contractor, consulting engineer and other project members when using BIM, there is a need to prepare an appropriate contractual framework that defines their authorities, responsibilities, and limitations. To set up contractual relations modeling, most countries are testing and errors. The result of the investigations revealed that in

most cases rather than the preparation of an independent BIM, it is preferable to formulate specific requirements that define the conditions and features that govern the BIM-based project and join the existing agreements. One of the most important reasons for this is to acquaint the factors of the construction industry with standard contracts and lack of the need to control and inspect a new contract and meet the ambiguities and differences in considerations.

Most countries have contributed to the preparation of different construction contracts, such as contracting contracts, consulting services, project management. Given the great familiarity of the various parts of the construction industry to this category of contracts, the provision of a specific type of contract for projects that use BIM technology will cause new confusion and problems. However, it is necessary to develop a particular contract in which the specific requirements of building information are determined and the tasks of any of the project elements are determined. Comparing the contractual solutions, which have been employed in several countries for the use of BIM, and the results obtained from the questionnaire indicate that it provides more advantages over the provision of a new set and a specific format for BIM. In this thesis, we can use the sample of contracts or standard formats used in this regard, and only the specific requirements of building information modeling are added to the original contract in the form special appendix. To develop the proper contract appendix for BIM to add it to the existing agreements of "consulting engineers" and "agreements and general terms of contracting contracts" is a subject which should be placed on the agenda of the researchers and experts in the construction industry and finally the private and governmental sectors. Because of the range and diversity of related topics such as the responsibility of each side of the contract, model ownership, availability and change of model to make this important, contractors, consulting engineers, and cooperation with academic researchers have been involved in the development of a particular BIM strategy that has the ability to respond to legal, contractual, and technology requirements.

#### 5. References

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