A Review on Contractual issues And Aspects Regarding Building information Modelling (BIM)

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Abstract- BIM permits complete cooperation between project parties to imagine the future built in a simulated environment by determining any potential design and construction problems through the projects life cycle. Despite BIM is technically mature, until now its legal and contractual methods are not standardized. The construction industry in several countries is suffering from many challenges and insufficient productivity, so BIM is consider the future of the construction industry, it is the way to address these challenges. Although the BIM have huge benefits, there are various risks and problems impact in this technology, legal problems and contractual issues are minimizing and hindering the better adoption of BIM. So, the main aim of this study is to highlight an understanding about some concepts and issues, which lead to successful implementation of BIM, the major issues include: BIM definition, Benefits of BIM, understanding the construction contract, overview of contractual BIM adoption (theoretical frameworks) and Legal issues surrounding BIM adoption. The importance of this research is to determine the popular contractual issues and aspects that affect and impedes the applying of BIM in many countries, and to remedy them and reduce their disadvantageous effects in the construction projects.
Keywords – Contractual issues, BIM, contract, legal risks

I. INTRODUCTION

Usually, the construction industry in several countries is described as fragmented; it is suffering from massive challenges, conflicts and lower grade of productivity [1]. In these days BIM is applying through the construction projects phases, it is provides many benefits for parties [2]. The majority of big firms employing BIM are in support of this technology, it presents a better quality to the projects at minimum cost and lower time among the design and construction stages [3] . In spite of benefits with BIM for construction sector there are many problems and risks which are limiting the perfect adoption of BIM [4]. BIM legal problems are the major risks and challenges that need to be managed and addressed. A contractual arrangement is the main issues that are need to establish for achieving BIM positive results [5]. The present contractual regulations and the shortage pertinent provisions for the incorporated design and the input versions of all parties cooperated in the construction project could not collaborate extensively [6].

II. LITERATURE REVIEW

2.1 BIM definition

The simplest definitions of Building Information Model define as "simulation of a facility" [7]. Also, BIM model can be definition as "a digital representation of physical and functional characteristics of a facility" [8] .

2.2 Benefits of BIM

A large number of researchers have studied the benefits of BIM for the AEC/FM industry. For instance, most of them talk about the benefits at each of the four construction phases [3]:
Pre-construction, design, construction, fabrication and post-construction. Eight kinds of benefits were abstracted as following [9]. : Faster and more effective processes, accurate geometrical representation, better design, better production quality, controlled whole-life costs , environmental data, automated assembly, better customer service and lifecycle data.
Jernigan, in his study [10] clarifies that some case studies of construction projects that apply BIM indicate that there are 8–15% savings on new projects and up to 35% savings on repeat projects, these savings are the result of reusing information, having more (and better) decision-making information earlier, and better early-phase analysis.

2.3 Understanding the construction contract-

The definition of a contract can be explained as: "A contract represents an obligatory document through which parties perform their duty and supply deliverables" [11].

According to Alfaifi [12], the contract is the agreement between two or more parts for the compliment of the objective of a project they are taking part in. Also, it can define a construction contract as [13] :
"Any contract where one person or corporation, agrees for a valuable consideration to carry out construction works which may include building or engineering works for another".
It is very necessary for construction project stakeholders to have a contractual relationship. If not, their partnership will miss legal responsibility, as well as lead to pure economic loss. A contract between the key stakeholders will help to control the required liabilities or functions in the BIM project [14].
In many countries usually the construction projects include contracts, often a portfolio of contracts, and almost every main contract is simultaneously a project. Contracts must be controlled and managed effectively to be successful. As organizations both in the public and in the private sector continue to streamline and outsource operations, most people need contracting skills, and contract managers and lawyers need project management skills. The relations between contract management and project management blur. Obvious connection and a working knowledge of each discipline's core elements and competencies are important to the success of contracts and projects [15].

2.4 Overview of contractual BIM adoption (theoretical frameworks) –
Nowadays, there are various discussions about the legal implications of BIM, none of the studies provides a comprehensive review of the legal issues associated with BIM or their solutions. Also, BIM is very efficient computing tools for establishing and controlling digital information among a project life cycle. BIM will not achieve reasonable improvement in current procurement practices unless the issues surrounding its legal frameworks have been determined clearly and have been made more usable for procurement and contract management [16].
- The case of United Kingdom
United Kingdom is a leader in BIM utilization and implementation in the construction area. They have a clear image of BIM implementation at both public and private's levels [17]. . Correspondingly, they have demonstrated best practice samples of BIM adoption and implementation. Figure 1 show the development of a BIM governance framework (G-BIM) in UK.

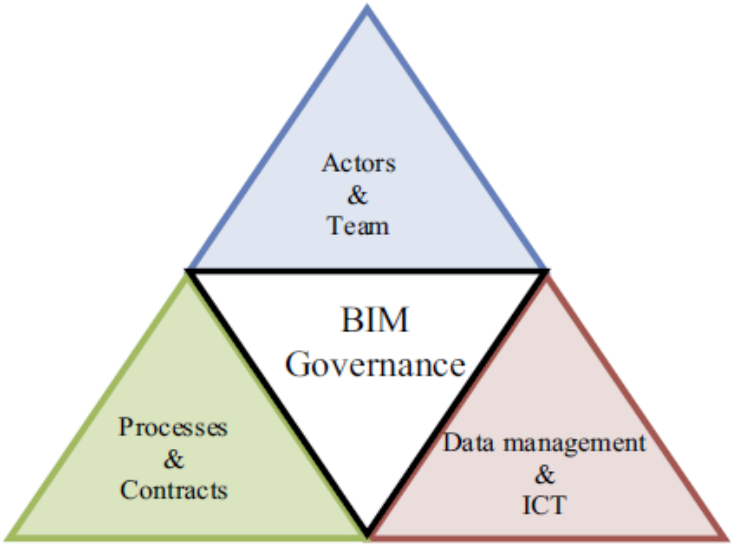

Figure 1 Prerequisite components of BIM governance (Alreshidi et al., 2017)

2.5 Legal issues surrounding BIM adoption
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A systematic review was conducted to identify the legal issues arising from using BIM. Fifty-five (55) journal articles and conference papers that discussed the legal issues were selected and scanned [18].Among the 55 papers,

27 papers were identified as journal articles. Figure 2 shows that the number of papers that discussed the legal issues from 2007 to 2017 increased unevenly, with the highest number (11) recorded in 2013.

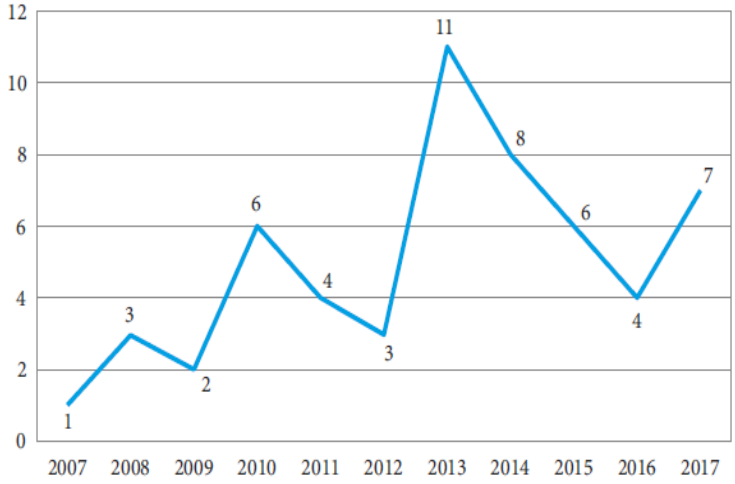

Figure 2 Number of papers that discussed the BIM legal issues from 2007 to 2017 [18]

The legal issues were classified into four categories: (1) incompatibility of procurement systems with BIM, (2) liabilities, (3) model ownership and IPR and (4) unclear rights and responsibilities.

2.6 Contractual issues relating to BIM 0

There are several specific contractual issues appear through adopting BIM in many countries, the main of these issues include:

- BIM model ownership

The owner who is the main paymaster hopes to own the model after the completion of project construction for the aim of operation and facilities management [19].

- Rights of Intellectual Property

BIM accelerates project design stages, permitting fast, virtual prototypes. Those stakeholders might consider, like Architects, Structural Engineers, Mechanical and Electrical Engineers (M&E), etc., who supply data and input in the BIM form, protect their copyrights and intellectual property rights of Intellectual Property [20].

- LOD of BIM model

Stakeholders are required to perform a "duty of care" in order to ensure the model is improved throughout the design time]. Therefore, as the model develops, problems may appear between the two parties. Owners can increasingly order forms with more information and request to be submit to the contractor in a more accurate way and obtain manufacturing details. One of the major challenges is that in the absence of mechanisms to control and draw the LOD line, this will have a main effect on the project's professional service agreements [21].

III. CONCLUSION

Literature summarizes that BIM contractual and legal issues are seem to be very essential and need priority for discus. Contractual risks are considered as critical challenges linked with the applying of BIM in many countries. This study illustrate that as to date , contractual issues are under studied and there is lack of framework addressing legal and contractual problems. The major contractual and legal issues that were discussed in this research are ownership of BIM model, intellectual property rights, level of development of the model. The findings of study will help to indicate the major legal and contractual issues, and then take the suitable decisions to minimize or avoid it in construction projects.

IV. REFERENCES

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