State of Building Information Modelling (BIM) adoption in Iraq

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Abstract. Building Information Modelling (BIM) is one of the most promising technologies in the Architecture, Engineering and Construction (AEC) industry. However, while a number of studies have shown the benefits of BIM, especially in infrastructure projects, barriers exist to actualising these benefits through implementation. In Iraq, there is a lack of BIM adoption among construction firms because industry practitioners are not interested in BIM and the firms do not have the adequate experience in this technology. The focus of this study is to investigate the current state of BIM adoption in construction industry in Iraq and determine the barriers that prevent its widespread. The key findings of this study are; first habitual resistance to change has the most adverse effect to BIM implementation in the country, second AutoCAD, STAAD Pro and Revit are the most common BIM tools used by BIM adopters in Iraq and finally the results indicate that BIM adoption is not satisfactory because the majority of respondents had only 3 to 6 years’ experience working with BIM.

1. Introduction

Building Information Modelling (BIM) is one of the most advanced technologies in the Architecture, Engineering and Construction (AEC) industry. Many researchers have assessed the efficiency of BIM applications within industrial or educational purposes [1]. In addition, many researches have approved the benefits of BIM adoption during all stages of construction process from the pre-design stage to the end of building lifecycle such as Jung and Lee [2], Talebi [3] and others [4-6]. It has been identified that BIM technology will increase the efficiency and effectiveness of construction delivery systems because BIM will provide better understanding of BIM capabilities to resolve some of the construction issues, especially conflict deduction in the early design stage[7]. A number of case studies have been published to show the benefits of applying BIM applications on actual construction projects to show how BIM can be applied to resolve issues of the construction industry.

Building and Information Modelling (BIM) is considered as one of increasingly important techniques that is widely used these days in many construction projects. Recently, a considerable literature has grown up around the theme of its adoption in the Architecture, Engineering and Construction (AEC) industry and its significant benefits were emphasised by numerous researchers. Wan, Platten [8] suggested that BIM can empower safety systems in construction organizations. Bennett and Mahdjoubi [9] focused on the advantage of combining BIM with other technologies by their study by using BIM software with cloud technology in order to maintain construction health and safety purposes. The use of BIM for safety checks systems based on existing standards was suggested
Safety training is another substantial use of BIM in construction field. It can be used for safety training by identifying hazards in virtual reality environments. Chen et al., 2013 established a System for Augmented Virtuality Environment Safety (SAVES) which was explained in Chen and Luo (2014) [13]. The researchers investigated many aspects that BIM have been applied for in construction industry. One of these aspects was safety. The advantage of BIM employment and its significant role in safety, health, and environmental protection was investigated by testing the model used in their study. Another benefit of combining BIM with other technologies was highlighted by Alsaeedi [14] study when the researchers used BIM software with cloud technology for maintaining construction health and safety purposes.

The crucial roles of BIM in AEC industry were investigated by Yalcinkaya and Singh (2015) [15]. Their study showed that there is a rapid growth in the use of BIM applications in safety management.

Wetzel and Thabet (2015) [12] investigated the role of BIM as a virtual design and construction medium to decrease uncertainty, recognise problems, analyse potential impacts and improve safety. In their study, a framework to support safety during the facility administration stage through BIM model was proposed.

A model input to substitute partnership and social collaboration, direct handling for user system interaction and simulation element formation for real-time network transmission was proposed by Kang et al. (2014) [16]. Additional improvement in the approach including BIM adoption, more effective Product Breakdown Structure (PBS) PBS collection, and further dependable mechanisms for conflict exposure and exclusion in the simulation were proposed by the findings of this study. Zhang et al., [17] developed a strategy to avert fall in construction site by applying BIM-based safety model. This model simulates construction methods and envisions safety in construction schedules. The study demonstrates the importance of BIM technology in construction safety. Though, the model that is used in this study requires further enhancement since it does not offer the essential data for the examination purposes, particularly between wall and slab sections.

Many researchers provided insights into the benefits from owner’s perspective that can be gained by adopting BIM in the construction projects such as; increase the reliability of cost estimation, improve project management, decrease financial risks, optimise building performance, enhance facility maintenance and tighten the project schedule [18].

Many methods have been applied to measure the level of BIM implementation used by many studies. For instance, Jung and Lee [2] determine the status of BIM implementation by measuring; level of proficiency, experience respondents, BIM’s future importance, frequently used BIM software applications, BIM’s benefits, the rate of BIM adoption, BIM investments and implementation depth in the project or organisation. Many researchers have been using one of the following data collection methods like surveys (including interviews) or case studies also. Some researchers used a combination of these methods to evaluate and measure the level of BIM implementation in the construction industry. One example is the Azhar et al.[19] study, the researchers evaluate BIM through a case study to determine the benefits of using BIM to firms not currently using BIM applications, the savings in time and cost, future challenges and possible risks. Also, the researchers used the case study to minimise design errors by running a detect clashes in the design stage and develop management and safety planning by using BIM. Another use of case study is to develop a framework to identify the current BIM barriers in four developed countries in using BIM technology which were USA, UK, Australia and Hong Kong [20].
2. Research Methodology
Recently, there has been a significant attention in BIM technology shown in Iraq, however it was a challenge to find an expert in BIM in the country. The findings of this study will help to spread BIM implementation in Iraq by providing a clear understanding of the nature of BIM adoption level and its challenges. In addition, this study will allow BIM adopters to develop a strategy to overcome these challenges. The best method to collate a large amount of data in short time was to develop a questionnaire to achieve the research aims. In order to obtain more accurate results, the researchers sent the questionnaire to both the public and the private sector.

According to the respondents, the easiest method to share their opinion was the online questionnaire, therefore, the authors designed an online questionnaire using google forms and shared it via Email or direct link to google forms. However, there was a small number of respondents who still preferred the paper questionnaire because their lack of computer skills. The questionnaire consisted of nineteen questions focused on respondent location, years of experience in BIM technology, software used in BIM, project life cycle and BIM, BIM training, project delivery methods, challenges of implementing BIM. The scale of the questionnaire involved following five choices 1. Strongly Disagree 2. Disagree 3. Neutral 4. Agree 5. Strongly Agree and there is an additional option for some questions called (please specify) if the answer needed more details. Consulting firms (Engineers, BIM managers, planners, architects, draftsmen, BIM coordinators and project managers), site engineers and construction managers were recruited to answer the survey. The number of sent invitations was 315 with response rate of 69.52% which means that 219 survey was completed successfully in 45 days.

3. Study Results
It was observed from the survey (Figure 1) that the highest number of participants in the survey were the Architects (62 participant), the second highest number of participants were the Structural Engineers (51 participant) followed by the Electrical Engineers (30 participant). However, the lowest number of participants were the Quantity Surveyors (only three) then the Site Supervisors (5), followed by Mechanical Engineers (11). There are other construction industry professionals who also participated in the survey such as planning engineers, BIM coordinators and BIM managers. The questionnaire was sent to equal number of the Architects and Structural Engineers and less number for the other specialization.

![Figure 1. Respondents’ profession](image-url)
As it is clear in figure 2, which represent the respondents years of experience in construction industry, only 20.55% (45 participants) had more than 20 years’ experience in construction industry, while 67 participants (30.59%) had between 5 to 10 year working experience, however, the highest numbers of years were between 10 to 15 years of 87 participants (39.73%) and the lowest were 20 who had less than 2 years of experience in construction industry.

![Figure 2 Years of respondent’s experience in the Industry](image)

Furthermore, figure 3 illustrate the BIM experience in Iraq, the result shows that BIM technology adoption process is still in its nascent stage in the country. 107 of the respondents had 3 to 6 year experience, 87 had 3 to 15 years experience, 25 had less than 3 years experience and 45 had more than 20 years experience.

![Figure 3 BIM experience in Iraq](image)
experience in BIM which represent the majority of respondents, followed by the respondents who had under 3 years working with BIM software (87 participant), only 25 had worked for more than 6 years in BIM projects.

The next set of questions was designed to find which BIM tool had the most use in construction projects in Iraq. It can also be seen clearly from figure 4 that AutoCAD is the most common BIM tool used in Iraq with 62 participants, which represent (29.67%), followed by STAAD Pro which was used by 42 participant and the ranked 3rd in the survey was Revit which is used by 39 participants. There are other BIM tools used by few numbers of participants such as Sketchup, Tekla Structure, ArchiCAD, Navisworks and others.

![Figure 4. Most common BIM tool used by respondents](image)

To achieve study aim, barriers and obstacles of BIM adoption in Iraq must be investigated. Respondents can select three choices to answer the question about what barriers had the most significant impact on widespread BIM adoption in Iraq and that making a total number of 627 responses (see Figure 5). Habitual resistance to change has the most adverse effect on the spread of BIM implementation in Iraq according to 112 responses (17.86%) which ranked 1st barrier. The second barrier was lack of incentive to adopt BIM because there is no standard force for the construction firms to use BIM applications in their projects, 107 responses have chosen this barrier which represent 17.07%. Lack of government lead is the third most common barrier mentioned in the responses. Iraqi government has to take steps to consider making BIM as a requirement in the projects, especially in the infrastructure projects. Another barrier is that top managers are not supportive to adopt BIM technology which was highlighted by 94 responses (15%). There are other obstacles mentioned in survey responses which was lack of training/education, cost of technology change and ability of firms to adapt the change and costs of hardware and software were mentioned 78, 75 and 62, respectively.
Figure 5. Obstacles and barriers of BIM adoption in Iraq

4. Conclusions
Building Information Modelling (BIM) is one of the most advance technologies in the Architecture, Engineering and Construction (AEC) industry. It can be stated that BIM technology is widely used in design stage in the country because the highest number of participants were working as Architects and Structural Engineers.

This research provided insights into the current level of BIM adoption in Iraq. This study found that AutoCAD, STAAD Pro and Revit are the most common BIM tools used by BIM adopters in Iraq. In addition, the results indicate that BIM adoption is not satisfactory because the majority, 88.6% of respondents had not more than 6 years’ experience working with BIM applications (194 participants). Another evidence of slow progress of BIM implementation is that only 25 participants had more than 6 years BIM experience. The construction firms in Iraq did not gain the full benefits of BIM implementation, especially its capability in early conflicts detection among different design teams of the same building prior to the beginning of construction process, which has a significant effect on reducing the overall construction costs, construction delays and loss of productivities. According to the participants’ response, habitual resistance to change has the most adverse effect to BIM implementation in this country followed by lack of incentive to adopt BIM, lack of government lead and top managers not being supportive, respectively. The nature of these barriers refers to the lack of support from top authorities whether in public or private sector, which have a great role in spreading BIM implementation among Iraqi construction firms.

BIM implementation requires many changes in the existing projects procedures to obtain full BIM benefits, therefore, a different approach to integrate BIM with the current construction systems is needed in public sector particularly to lead the Iraqi effort to widespread BIM in the country and to encourage the private sector to invest in BIM tools. This study aimed to determine the current level of BIM adoption in Iraq. Future studies should investigate in depth the strategies and solutions that can
The result shows that many engineers are satisfied with the traditional methods for projects design and with no government lead and lack of top manager support, the Iraqi construction industry is not prepared to invest in BIM, the investment in BIM will be increased when a real case study is introduced with evidence of BIM financial benefit to the AEC industry in Iraq.

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