Adopting Building Information Modelling in Small and Medium Enterprises of Iraq's Construction Industry

Abdussalam Shibani
Assistant Professor in Construction and Project Management
School of Energy, Construction and Environment
Coventry University, UK
ab1732@coventry.ac.uk

Khaled Abu Awwad & Michel Ghostin
PhD researchers
School of Energy, Construction and Environment
Coventry University, UK
abuawwa2@uni.coventry.ac.yuk
ghostinm@uni.coventry.ac.uk

Kalim Siddiqui
Senior lecturer in Economics
Department of Accounting, finance and Economics
Huddersfield Business School
K.U.Siddiqui@hud.ac.uk

Omar Farji
Master student
School of Energy, Construction and Environment
Coventry University, UK
farjio@uni.coventry.ac.uk

Abstract

The main problem facing the construction industry in Iraq is the absence of proper management techniques during the project execution stages. Over the past decade, a new concept, known as Building Information Modelling (BIM), has been rising and developing as a new construction management tool in the AEC industry. Building Information Modelling is considered as modern technological advancement and referred to as a new revolutionary tool in the construction industry, due to its platform of collaborative working techniques and its growing computer software which can be involved among all the project tasks to increase the level of performance during the project life cycle as well as reduce the project's complexities and conflicts. BIM has many benefits that play a significant role in the project execution such as visualisation of the project by creating 3D models, reduce the project's cost, duration, and many other benefits will be investigated through this research paper. Recently, BIM is used and implemented in most of the developed countries such as the USA, UK, and EU, where it became an essential part of the construction projects to achieve the planned and anticipated project delivery. As of today, BIM is not applied in the Iraqi Architecture, Engineering, and Construction (AEC) industry and the companies are struggling in its implementation. Therefore, the purpose of this research is to explore the process of BIM adoption in the small and medium enterprise (SMEs) in the Iraqi construction sector. The validity for selecting SMEs comes from the fact that 80% of the projects executed by these companies do not involve the use of BIM, in addition to their limited knowledge about the subject. Moreover, to achieve the research aim and objectives a mixed method of data collection was adopted and consists of questionnaires and semi-structured interviews with experts in Iraqi construction companies with different specialities such as architecture, engineers, construction projects managers, etc. out of 90 participants in the questionnaire 38

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responded and only 24 responses were valid and considered in the data of this research. As well as 5 interviews were conducted to support the results produced by this research. The findings indicated that there are many barriers facing the adoption of BIM in the Iraqi construction companies despite the benefits of this technology.

Keywords
Building Information Modelling (BIM), Architecture Engineering and Construction (AEC), Iraqi construction, Small and Medium Enterprise (SME), BIM benefits and barriers, Construction Management.

1. Introduction

The construction industry has a significant role in the Middle East especially in the last fifteen years, after major developments that occurred in Dubai, Qatar and Saudi Arabia. This growth increased the number of employment opportunities to satisfy the demand of the construction industry, for example, the United Arab Emirates in 2018. The statistics announced that the construction industry revenues were around £23.75 billion. According to Amer (2018), $1 trillion were invested in the Middle East on 117 major construction projects that are ongoing and to be completed by 2030. This huge amount of investment should be operated by proper technologies and very accurate management techniques.

For the Iraqi construction industry, the situation is different due to the status of instability inside the country after the war in 2003, where several reasons have affected the Iraqi construction industry, for instance, the internal political issues, the financial problems after the world's financial crisis and internal wars. Due to these issues, the Iraqi construction industry is still suffering from the recession but is expected to improve in the following years. Building Information Modelling (BIM) is one of the emerging tools and latest technologies used in the Architecture Engineer construction industry (AEC). Its application in developed countries such as the USA and the UK has shown significant improvement in the construction sector and has inspired its implementation in developing countries such as Iraq.

The BIM approach is considered as a new benchmark in construction management and smart technology because it has introduced a new platform to connect all project parties and work collaboratively together through the improvement of communication and information exchange in a flexible fashion in order to achieve project aims and objectives. As well as, enhance the role of stakeholders and transparently monitor all the project stages (Eastman et al. 2011). Gerges et al. (2017) stated that surveys in BIM adoption in the Middle East show that around 25% of the population sample are using BIM. However, after the Iraqi war in 2003, the construction industry suffered from a huge recession because the whole country was affected by the terrible incident. In consequence, all the experts that were working in the education and construction sector fled Iraq for their safety. Therefore, the construction sector suffered significantly after the revolution and the war. As a result, BIM implementation in Iraq remains very low and challenging for the construction companies. The use of traditional methods has shown to present less than satisfying results, especially in the mega projects happening in Iraq.

1.1 Building Information Modelling in Iraq

The Construction industry in Iraq does not have the knowledge of adopting BIM in the working process, due to the lack of experts in BIM technology and lack of awareness from the stakeholders involved in the projects, as well as, the lack of experienced and professional engineers in construction management (Hamada et al. 2016). One of the large projects in Baghdad, costs approximately £6.5 billion, was abandoned and more than 2000 projects were deferred in 2016 from the government of Iraq, since the economic crisis and after the drop in the oil price (Hamada et al. 2016). Also, the government was facing an internal war that also affected the country. However, the expectations refer to a growth in the economy and the Iraqi construction industry in the next 5 years (Hamada et al. 2016).

1.2 Barriers and Challenges to Implementing BIM in Construction Industry:

Barriers of BIM adoption vary from country to country and from company to another. The company size is a very important factor, since large companies have more capabilities than SMEs to implement BIM. Many barriers are found when adopting BIM, and after reviewing the literature, these barriers can be classified under three main categories:

Legal Barriers:

According, to the literature there are few legal barriers for BIM adoption. Iraq still uses the common traditional procurement method in project delivery, and this is a key barrier for the BIM adoption. The traditional method restricts

the collaboration and the communication process between stakeholders and project teams, which is one of the main benefits of BIM. Also, the public and private sectors have both agreed on acquiring the lowest bidder and this will limit BIM adoption in companies due to the high cost of BIM expenses. Kent et al. (2010) mentioned, the most commonly used contract in the Middle-East is the FIDIC red book and this standard form is following the traditional procurement design-bid-build method, which evidently constraints BIM tools. Iraq is one of the Middle-Eastern countries that follow the same FIDIC standard form.
There is no clear published agreement on BIM standards and protocols from the government. If these protocols and standards are amended to support the adoption of BIM, this will make a big difference in construction industry in Iraq. The Iraqi construction industry will rise to a higher level of success and profit gains, however, the Iraqi government is not committing to the effort to create an official standard for BIM adoption, since most of the clients do not have a clear understanding and knowledge of BIM and its practical implications (AbuHamra 2017).

Organizational Barriers:
One of the most common barriers for BIM adoption in organizations is the high initial cost, which plays a significant part in the adoption process. Each company has its resources and capabilities to invest and to develop new technology, therefore, the company needs high cash flow and recently very few companies are willing to pay this extra cost for new technologies, especially in Iraq. Furthermore, the cultural barrier is due to the fact that the construction industry not flexible to change and most of the company's owners tend to use the traditional methods of work, in which the system is familiar to them, and according to Azhar (2011) this is an additional challenge for BIM adoption in companies. Azhar (2011) seeks to change in organizations' internal culture, collaboration and communication methods between the employees and the stakeholders, as well as, try to break the rigidity of using particular methods of project delivery. Khosrowshahi and Arayici (2012) identified another factor that would be a barrier for the adoption of BIM and it is the avoidances of the company to get familiarized with BIM, also the unwillingness of trying to train the employees for basic BIM knowledge (AbuHamra 2017).

Technological Barriers:
Technological barriers are also one of the main significant barriers found in the literature. The development of technology is the main reason for adopting the BIM approach and developing it in the construction industry. The companies that adopted and used new technology will not face a lot of issues in adopting BIM in there working process, but the other companies who are still working in traditional and basic technologies will face this barrier in the BIM adoption process. For instance, a lack of capital to invest and purchase the high-efficiency hardware and BIM software as well as a lack of sufficient training for the company staff on BIM application and concepts in construction projects. The aim of this training is to improve the engineers and other employees' skills with respect to BIM software since BIM has much software used in this platform such as Revit etc. The cost of training of BIM tools and software is high and it takes time that is why the new technology constitutes a barrier to BIM, it is hard to find and BIM program that can import data from another program and it is complicated if someone tried to do that (Azhar 2011).

2. Research Methodology

The methodology adopted in this research is a mix method approach. In this paper, the selected research approach is an inductive approach, where the author conducted a literature review to find out the knowledge gap related to the adoption of BIM techniques in Iraqi construction SMEs, as well as the barriers and benefits for this adoption process. In addition, the literature was used to give indication of the current situation of BIM adoption in the Middle Eastern countries. The data collected from the questionnaires and interviews which have been created to achieve the research objectives with experts in the Iraqi construction sector. As long as the research is exploring BIM adoption, the researcher should consider the facts related to the topic. BIM is known as a project management platform, but it is not only a small single concept or software, it includes many software and operations as well as human interactions. The survey is the adopted approach for quantitative data collection, so the questionnaires are a very effective method to collect fast and reliable data. It is also easy to collect a large number of participants based on closed-end questions.
This research also includes a qualitative form of data collection, where the researcher seeks to collect the participant's opinions about the topic by asking open-ended questions. questionnaires and semi-structured interviews, which are both related to the descriptive research approach are adopted methods in order to gather and provide all the information and the participant's point of view concerning the adoption of BIM in the Iraqi construction SMEs. Moreover, the questionnaires and interviews were constructed depending on the research aims, objectives and to provide answers to the research questions. Therefore, for the semi-structured interviews, the invited participants are divided into three

main groups, Architectures, structural engineers, and construction consultants. The reason for choosing experts with different backgrounds is to cover all the different perspectives for the project participants, as well as, increase the researcher's awareness about the BIM situation in the Iraqi construction industry.

3. Analysis and Discussion

3.1 Statistical Reliability for the Questionnaires:

One of the commonly used methods to check the reliability of data collected is Alpha Cronbach constant value, this constant value is between 0 and 1 and whenever it is closer to 1 that indicates the high data reliability (George and Mallery 2016).

Questionnaires Findings:

After conducting the questionnaire survey the findings were divided into three main sections according to the questions structure: The first section was general information about the respondents and demographics, according to figure 1 the majority of the population sample were consultants which are (45.8%), followed by (29%) of main contractors and the rest (25%) are between subcontractors and other types of construction companies as shown.

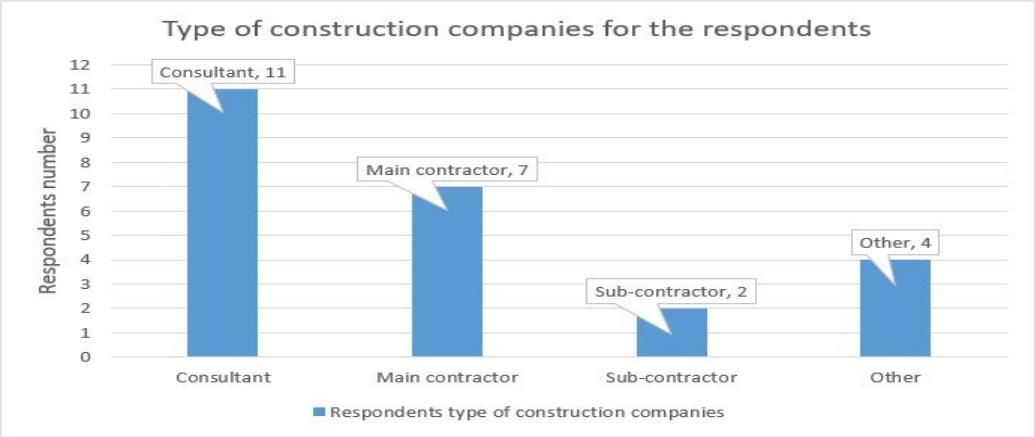

Figure 1: Type of Construction Company

Another demographic data is the years of experience in the Iraqi construction industry as shown in Figure 2, the survey participants were people with long experience because (83.3%) have experience more than 5 years, only (16.67%) of the response have less than five years of experience, followed by (20.8%) of the participants with (6-10) years of experience, majority of respondents had more than 10 years of working in the construction industry which are (62.5%) of the participants, (33.33%) out of (62.5%) are between (11-15) years and the rest (29.2%) are over 16 years of experience as discovered in figure below.

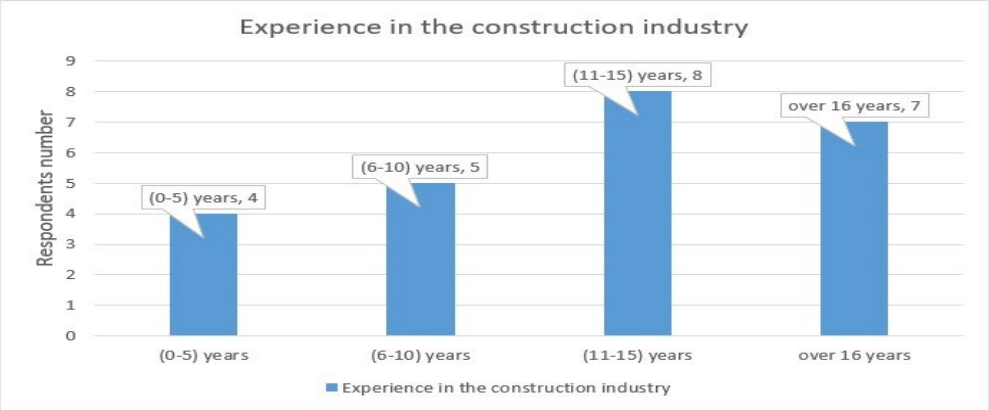

Figure 2: Years of Experience in the Iraqi Construction Industry

The last demographic question was about the types of construction projects that the respondents companies are specialized in or there major working field, this questions was a multiple answering questions which means any response can choose more than one answer, the answers were very close to each other which indicate the large experience for the participant companies in the construction field, between (11-12) were working in the main project type for the construction industry and these projects were House Buildings, Commercial Buildings and Infrastructure. Figure 3 shows the respondents numbers which express the field of the Iraqi construction companies that participated in this survey.

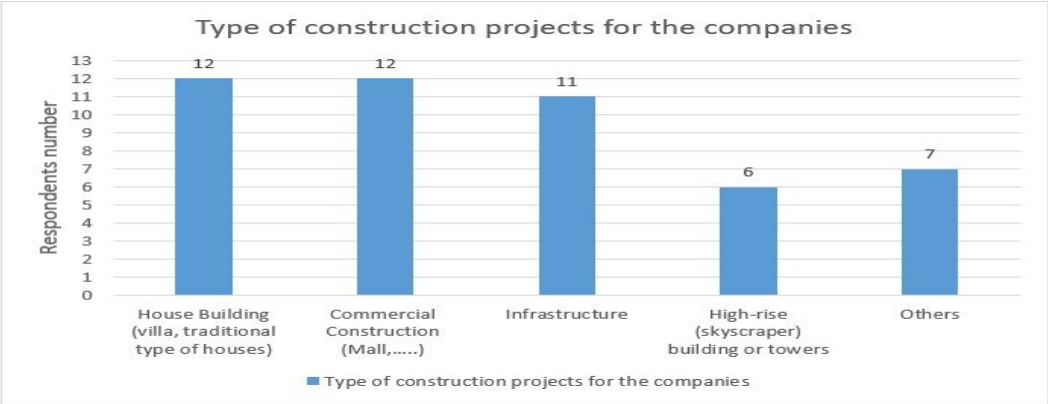

Figure 3: Type of Construction Projects for the Companies

The second section of the questionnaire findings is identifying the current status and awareness level of BIM in the Iraqi construction industry and to achieve a comprehensive idea. In this section the participants were asked several questions in order to know the current status of BIM, as well as find the future expectations for BIM technique in the Iraqi construction industry.

This section determines the respondent's knowledge about BIM among the Iraqi construction industry, as shown in figure 4 there is few percentages of Iraqi companies that use BIM technique in there working process and the percentage was (36%) of the respondents and the rest (64%) are not implementing BIM.

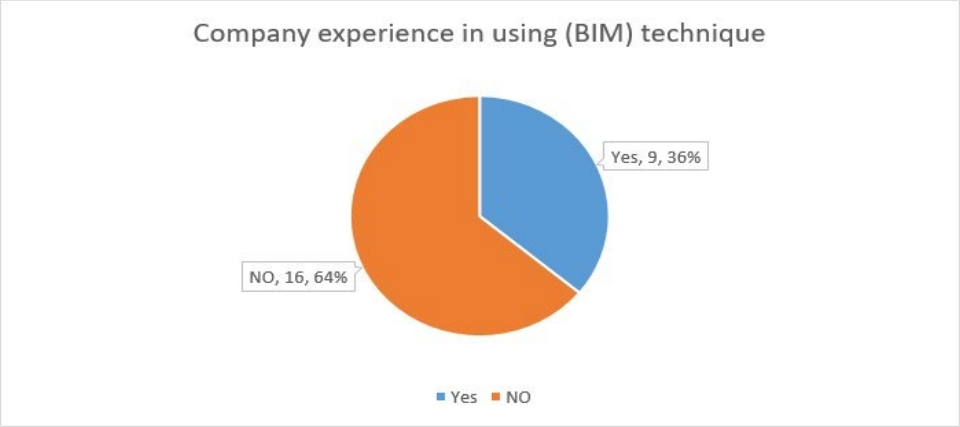

Figure 4: Company Experience in using BIM Technology

Regarding, the future plans for BIM implementation from the participant's perspective the findings shows that (92%) of the responses have an optimistic point of view about BIM implementation in the Iraqi construction companies, only (8%) do not expect that BIM will be adopted in construction firms, as shown in figure below.

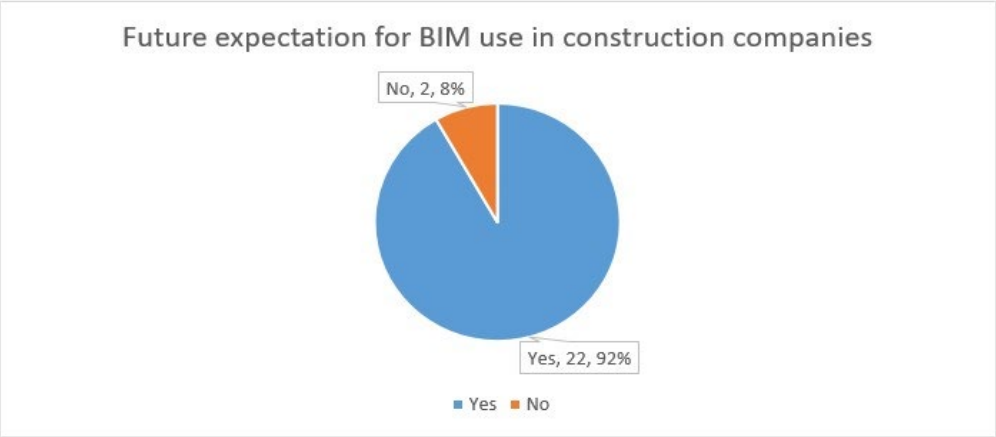

Figure 5: Future Expectation for BIM use in Construction Companies

Moreover, an unexpected percentage of awareness for BIM technology was recorded that (46%) of the respondents were aware of BIM as shown in figure 6, but that percentage is related to few reasons for instance the high experience of the participants. In the construction industry this factor will increase the knowledge of the participants.

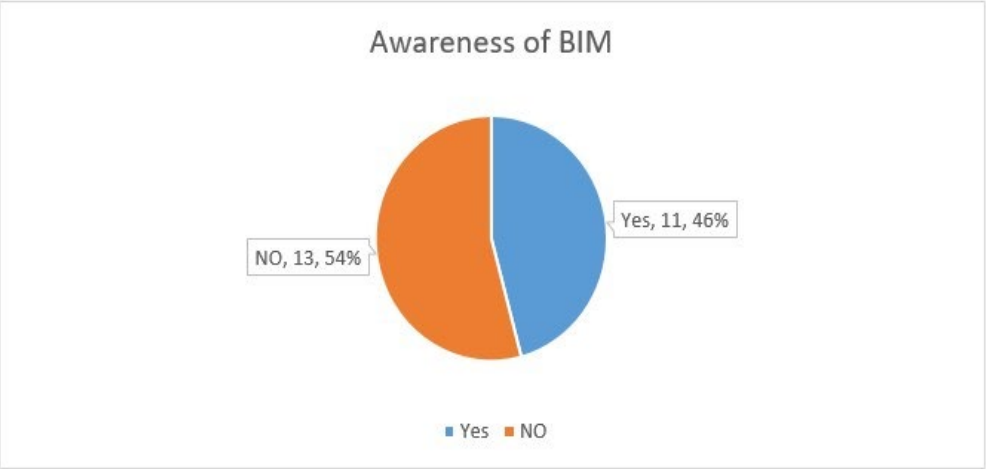

Figure 6: Awareness of BIM in Iraqi Construction Industry

In the figure below, the survey seeks to know the source of BIM awareness for the participants and most of the responses were between reading journals or books related to BIM and the other common source was using a few software during the work and practicing which means that they worked on the software only but not implementing BIM. Also, another tow close sources of BIM awareness were the personal training on BIM software and some of the participant discovered BIM through the high educational period as shown in the figure.

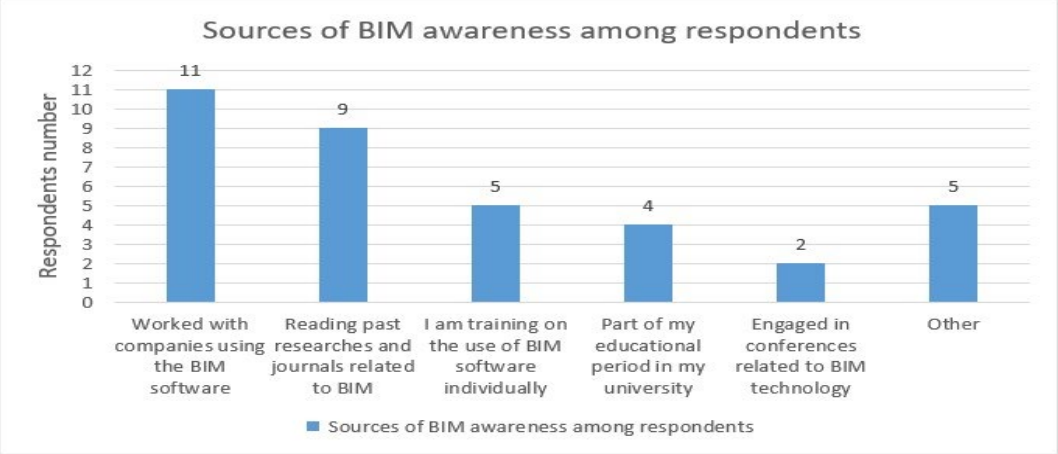

Figure 7: Sources of BIM awareness among respondents

In addition, the survey participants were asked about the current awareness of BIM in AEC Iraqi construction industry and the findings were (41.67%) said that only a few people form the Iraqi construction industry were aware of BIM as well as (29.2%) were neutral and in between probably that could expect the awareness level of BIM, (16.67%) said that its very few and rare to find people from the industry aware of BIM, among all these responses there is also (12.5%) think that the level of awareness can be high in AEC construction industry as shown in figure above.

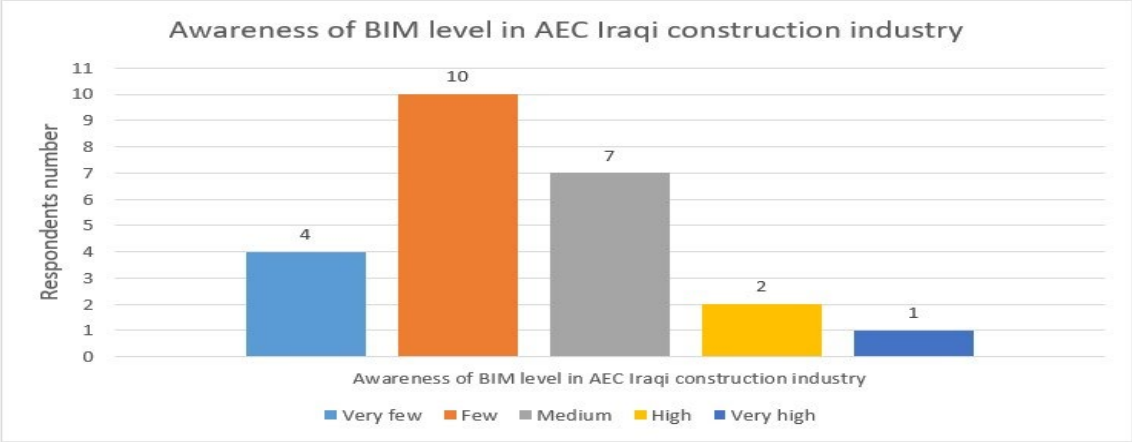

Figure 8: Awareness of BIM level in Iraqi AEC industry

The last part of the questionnaire findings was identifying and ranking for the potential barriers for BIM adoption in the Iraqi construction SMEs, the barriers ranking is designed based on the Likert scale which consists of five scales (very week, week, moderate, strong, very strong) and these barriers are analyzed by using descriptive analysis to evaluate all the barriers and provide rankings as well as a correlation test that was conducted for the validity

Table 1: Spearman's rho correlation for BIM potential barriers

Correlations			total
Spearman's rho	Barrier1	Correlation Coefficient	.916**
		Sig. (2-tailed)	.000
		N	24
	Barrier2	Correlation Coefficient	.810**
		Sig. (2-tailed)	.000
		N	24
	Barrier3	Correlation Coefficient	.774**
		Sig. (2-tailed)	.000
		N	24
	Barrier4	Correlation Coefficient	.532**
		Sig. (2-tailed)	.007
		N	24
	Barrier5	Correlation Coefficient	.665**
		Sig. (2-tailed)	.000
		N	24
	Barrier6	Correlation Coefficient	.464*
		Sig. (2-tailed)	.022
		N	24
**. Correlation is significant at the 0.01 level (2-tailed).			
*. Correlation is significant at the 0.05 level (2-tailed).			

The finding in table 1 showed the range of correlations coefficients were from 0.464 to 0.916 and P-values are less than 0.05, this indicates that the barriers results are valid to measure and consistent.

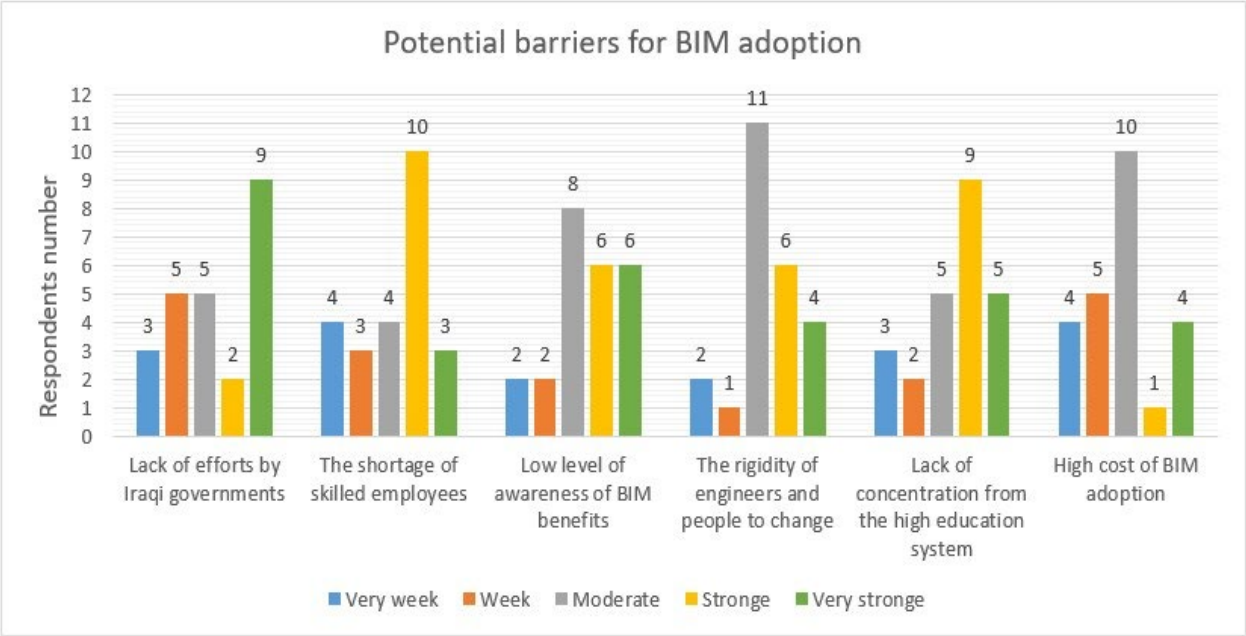

Figure 9: Potential Barriers for BIM adoption

Figure above clarifies the potential barriers for BIM adoption and shows the reflection of the respondent's point of view about each barrier if it was a strong and effective barrier or weak. As shown in figure 9 most of the participants answers are between strong and very strong which gives a good indication on the effectiveness of the barriers.
Only one barrier was moderate from the respondent's perspective which was the cost of BIM adoption that part of the majority of the respondents did not see that it can be an issue for them. Other studies show that it is one of the main issues and barriers, the respondents answer, and barriers ranking will be clarified in the next part within the descriptive analysis as shown in table (3) below.
Descriptive analysis can be defined as statistical method or process of summarizing data by exporting the statistical data to software like SPSS or EXCEL to do the tables and illustrating factors that expresses the analysis process, the descriptive data in this research are analyzed by using SPSS software (George and Mallery 2016).

Table 2: Descriptive statistical Analysis

Regarding the potential barriers ranking, after conducting the descriptive analysis the results showed that the highest barrier ranking was "Low level of awareness of BIM approach and the beneficial advantages of implementing it" with (Mean=3.50, SD=1.216), the mean gives indication for the barrier strength as well as indicate the importance of it, depending on the mean these barriers had been ranked.

Descriptive Statistics								
	N	Range	Minimum	Maximum	Mean		Std. Deviation	Variance
	Statistic	Statistic	Statistic	Statistic	Statistic	Ranking	Statistic	Statistic
Lack of efforts by Iraqi governments regarding to promote and support the implementation of BIM	24	4	1	5	3.38	3	1.498	2.245
The shortage of skilled employees in BIM field and low client request for this technology in their projects	24	4	1	5	3.21	5	1.318	1.737
Low level of awareness of BIM approach and the beneficial advantages of implementing it	24	4	1	5	3.50	1	1.216	1.478
The rigidity engineers and people who works in the construction industry to change and use new technologies and project delivery methods instead of using the basic and familiar software	24	4	1	5	3.37	4	1.096	1.201
Lack of concentration from the high educational system and universities on teaching BIM approach and training the students on it	24	4	1	5	3.46	2	1.285	1.650
The high cost of BIM adoption comparing to the Iraqi current currency especially the prices of software	24	4	1	5	2.83	6	1.274	1.623
Valid N	24							

The second barrier from the respondents' perspective was "Lack of concentration from the high educational system and universities on teaching BIM approach and training the students on it", with results (Mean=3.46, SD=1.285) and the rest of the barriers ranking results are identified in descriptive analysis table shown in Table 2.

3.2 Qualitative Analysis of Interviews and Discussion:

Three interviews were conducted to perform qualitative analysis, where the first interviewee was with a Project Manager with 25 years of work experience, while the second interviewee was with a design engineer who had 10 years of work experience, and the third interviewee was with a site engineer who has 5 years of work experience. The interviewees were asked eight questions related to BIM and their responses were analyzed using content analysis.

When the interviewees were asked, how often are they asked about BIM. In reply the first interviewee answered 'frequently, while the second and the third interviewees answered 'almost always. This shows that SMEs in Iraq have been frequently discussing the idea of BIM.
When the interviewees were asked, have you used BIM on any project so far, the first and the third interviewees answered 'no' they have not used BIM on any project they have worked on. However, the second interviewee answered 'yes' that he did use BIM on a project because it was forced by the client. This shows that the demand for BIM projects is relatively low in Iraq.
Subsequently, the interviewees were asked if SMEs in Iraq are ready to accept the adoption of BIM within the industry. Based on their answers it was identified that the demand for BIM projects is increasing but unfortunately not enough to consider investing in training programs and acquisition of such expensive software. Moreover, in Iraq there is a shortage of BIM professionals in terms of skill and knowledge. While existing engineers are not able to apply this process effectively, younger generations seem to have more interest in BIM, yet the facilities are not available.
Afterward, when the interviewees were asked if they had received any external requests for BIM users, all of them answered 'yes'. Based on the content analysis of their answers it was identified that they received external requests for BIM-based projects from outside clients working on new projects in surrounding countries. The implication is that the BIM knowledge is starting to grow yet the applications remain low compared to neighboring countries.
Furthermore, the interviewees were asked which strategy they think is more suitable and easier to facilitate the adoption of BIM in SMEs in the Iraqi construction industry. The suggestion was that engineers should invest in themselves and acquire the required knowledge to adopt BIM, due to the company's inability to provide such opportunities.
When the interviewees were asked about the internal/external barriers to the adoption of BIM in Iraqi SMEs, they suggested the following barriers; stakeholders unwillingness to change traditional working practices, high cost of training for BIM, too much time is needed for learning BIM software, lack of expertise among the project participants, and a long implementation process.
Lastly the interviewees were asked how the barriers in BIM adoption can be overcome to successfully acquire BIM in SMEs. Based on the content analysis of their answers the following measures can be taken to successfully adopt BIM in the Iraqi SMEs; improve awareness and education on BIM to support changing the from a traditional method to a more integrated approach. Provide facilities and training programs of engineers to acquire the necessary knowledge aiding the BIM adoption process. Finally, invest in a more sustainable and efficient building sector.

4. Conclusion and Recommendations

Building Information Modelling (BIM) is a revolution of new technology and technique in the AEC construction industry especially in Iraq and the Middle East. This study evaluates the current status of BIM adoption in the Iraqi construction SMEs and other objectives that were mentioned in the first chapter. Any adoption of new technology must be accompanied by challenges and obstacles because it is considered as now knowledge which means increase the efforts to understand the new knowledge. This chapter presents the conclusion of this research and recommendations for future researches depending on the results of this study.

Due to the anticipated increase in the demand of projects within the upcoming ten years whether it was a large complex project or normal project. From both public and private sectors, the Iraqi construction companies should keep up with the evolution of the new working technologies and techniques to increase the productivity and profitability of the companies. As well as the client's satisfaction, for many reasons BIM adoption is a good step for the Iraqi construction industry because it is one of the leading management technologies in the world.

According to the results of this study, BIM technology has many benefits that illustrated in the literature of this research and was extracted from the conducted interviews, these benefits are summarized in the following points:

- Improve communication and collaboration for all project participants through a unified platform
- Reduce delays in scheduling and cost overruns by improving approximations and lowering design errors
- Facilitate managerial aspects such as project design and tracking throughout the project lifecycle

- Reduce rework levels with aid from clash detection simulation and improved design preparations

- Transparency of work throughout the project which aid in risk mitigation and reduce variations

Many other advantages were mentioned earlier, but all these benefits are facing many barriers and challenges that prevent the implementation process, these barriers were identified from two sources. The first one was barriers extracted from similar studies in other countries and the second one is practical barriers like the legal and organizational barriers which are found from the Iraqi construction firm points of view by conducting the interviews and survey of this research. The findings indicated that the awareness level is increasing slowly comparing to the previous researches but generally the awareness of BIM in the AEC Iraqi construction industry is still low and needs more efforts from the government and the construction companies to motivate the adoption process. The government has the main role in the BIM adoption process, and they must lead this process by setting up a plan for BIM implementation in the public-funded projects and make this technique one of the general requirements for the projects. On the other hand, they have to change the idea of the company that provides the lowest price tender is the winner in the bid. Moreover, this adoption will enhance the quality of work delivered to the client or the government. Furthermore, the current situation in Iraq is still unstable, due to the security issues and the world financial problems that affect Iraq, this will lead to an increase in the number of companies that will leave Iraq and will increase the immigration of the experts to other countries is another issue. Due to these issues, a lot of consequences will appear in front of BIM adoption and it will reduce the adoption of this technology. Any adoption of new technology needs to start gradually to avoid and decrease the risks that can appear from sudden changing or fast adoption. For BIM adoption the companies should start applying BIM technology in small projects to ensure the integration process with the new working technique of the company in order to familiarize the employees and stakeholders with the new technique and to avoid the financial losses in case of facing few problems. Although the most important institutions that considered as the base of changing in any development or new knowledge in the world are the universities and any academic organization, they play a significant role in introducing the new knowledge and enhance the role of implementing this knowledge and that should be done from the Iraqi educational institutions for BIM adoption.

Based on this research for future work, aspects can be conducted on the execution of sustainable building by BIM technology in Iraq, as well as describe the role of BIM in project life cycle cost from quantity surveyor's perspective. Also creating online database platforms by using online cloud storage technology instead of using the traditional documentation for the project's information to encourage sharing the information and collaboration in the Iraqi construction industry. Furthermore, the increase of researches related to creating a BIM execution plan and the practical BIM working mechanism in projects.

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References

AbuHamra, L.A., *An investigation into Building Information Modeling (BIM) application in Architecture, Engineering and Construction (AEC) industry in Gaza strip,* 1st Edition, LAP LAMBERT Academic Publishing, Germany, 2017.

Amer, W., Abd, A., and Nawwar, N., Barriers of Adoption Building Information Modeling (BIM) in Construction Projects of Iraq, *Engineering Journal,* vol. 22, no. 2, pp. 58-81, 2018.

Azhar, S., Building Information Modeling (BIM): Trends, Benefits, Risks, And Challenges For The AEC Industry, *Leadership And Management In Engineering,* vol. 11, no. 3, pp. 241-252, 2011.

Eastman, C., Teicholz, P., Sacks, R., and Liston, K., *Bim Handbook: A Guide to Building Information Modeling for Owners, Managers, Designers, Engineers and Contractors*, 2nd Edition, John Wiley & Sons, 2011.

George, D., and Mallery, P., *IBM SPSS Statistics 23 Step by Step A Simple Guide and Reference*, 14th Edition, Routledge, New York, 2016.

Gerges, M., Austin, S., Mayouf, M., Ahiakwo, O., Jaeger, M., Saad, A., and Gohary, T., An investigation into the implementation of building information modeling in the middle east, *Electronic Journal of Information Technology in Construction,* vol. 22, no. 1, pp. 1-15, 2017.

Hamada, H., Haron, A., Zakiria, Z., and Humada, A., Benefits and Barriers of BIM Adoption in the Iraqi Construction Firms, *International Journal of Innovative Research in Advanced Engineering,* vol. 3, no. 8, pp. 76-84, 2016.

Kent, D., Asce, S., Becerik-Gerber, B., and Asce, A., Understanding Construction Industry Experience and Attitudes toward Integrated Project Delivery, *Journal of Construction Engineering and Management,* vol. 136, no. 8, pp. 815-825, 2010.

Khosrowshahi, F., and Arayici, Y., Roadmap for implementation of BIM in the UK construction industry, *Engineering Construction & Architectural Management,* vol. 19, no. 6, pp. 610-635, 2012.

Biography

Abdussalam Shibani is an assistant professor, and course director of Master of Construction Management with BIM in the School of Energy, Construction and Environment at Coventry University. Dr Shibani has achieved his master and PhD degree from Coventry University. In addition, he pursued his work as a Post-Doctoral Research fellow at the same university. Dr Shibani has extensive publications in both high quality journals and conferences. His research interest is based on various topics as Building Information Modelling (BIM), Total Quality Management (TQM), Supply chain management, Construction productivity and performance and Six Sigma implementation within the construction context. Alongside his interest in research, he is accepting PhD research students and currently he is supervising three students whose research is based on BIM.

Khaled Abu Awwad is a Ph.D. student in Civil Engineering, Architecture, and Building at Coventry University. The focus of his research is to investigate the implementation of Building Information Modeling Level 2 in Small and Medium Enterprises in the UK construction Industry. After completing his Bachelor's Degree (B.E.) in Civil Engineering, he moved on to concentrate in Construction Management and received his Master's Degree (MSc.) in Construction Management from Coventry University in 2016. The experienced he gained while working as a Civil Site Engineer, helped him initiate his academic career as a part-time lecturer in Project Management at Coventry University, where he is currently involved in many research areas, such as Building Information Modelling, Six Sigma implementation and Sustainable Development in construction.

Michel Ghostin is a Ph.D. student in Civil Engineering, Architecture, and Building at Coventry University. The focus of his research is to investigate the implementation of Building Information Modeling and evaluate its impact on Sustainable Development in the construction industry. After completing his Bachelor's Degree (B.E.) in Civil

Engineering, he moved on to specialize in Construction Management and received his Master's Degree (MSc.) in Construction Management from Coventry University where he began his research in Building Information Modeling and Construction Technology. The experienced he gained while working as a Civil Site Engineer, helped him initiate his academic career as a part-time lecturer in Project Management at Coventry University, where he is currently involved in several research areas, focusing on Construction Management and Technology, mainly Building Information Modeling and Sustainable Development.

Kalim is an economist, specializing in Development Economics and International Economics. His work, which combines elements of international and development economics, economic policy, economic history and political economy, often challenges prevailing orthodoxy about which policies promote overall development in less developed countries.