ICBASET 2024: International Conference on Basic Sciences, Engineering and Technology

A Comparative Analysis of the Opportunities and Challenges Associated with Building Information Modeling Implementation in Jordan and Kuwait

Samaher Asaad
Al-Zaytoonah University of Jordan

Akram Suleiman
Al-Zaytoonah University of Jordan

Abstract: Building Information Modeling (BIM) utilizes a multifaceted computer software data model to document building designs, simulate construction, and manage the operations of new facilities. This research aims to investigate the adoption of BIM in the Jordanian and Kuwaiti construction sectors. To achieve this objective, the research commenced with a comprehensive literature review on global and Middle Eastern BIM adoption, identifying the benefits and challenges of BIM in the construction industry. Subsequently, an exploratory study was conducted using an online survey to assess the current level of BIM expertise and characterize the perceived advantages and barriers associated with BIM implementation. The current state of BIM implementation in Jordan and Kuwait can be characterized as lagging behind. The study shows there is more awareness of BIM applications, programmes, and benefits in Jordan than Kuwait. The study identified and compared several barriers to BIM adoption in Jordan and Kuwait, including: Lack of government support, Lack of effective collaboration among project stakeholders, Lack of demand for BIM.

Keywords: Building Information Modeling (BIM), Construction industry, Civil engineering

Introduction

Building information modelling, or BIM, is a quickly developing idea in the field of building project management, and its development has had a significant impact on the highly fragmented construction sector. Even if there are many software programmes available today that support the idea of BIM, an increasing number of businesses are turning to applied research fields in order to profit from the use of BIM (Gerges et al., 2016). Even while utilising BIM for a project has many advantages, there are still a lot of obstacles preventing its widespread adoption in the construction sector. The cost of implementation, a lack of client demand, a lack of confidence in the integrity of BIM, a lack of standards for the description of BIM objects and a coding system, contract/legal issues and uncertainties, skills shortages, and the inability of firms to adapt to such a change due to cultural and financial factors are some of the barriers that Aibinu and Venkatesh (Aibinu and Venkatesh, 2014) identified in their research on the status of BIM adoption and the BIM experience of cost consultants in Australia.

Few studies have also looked into the obstacles that the Jordanian building industry faces when implementing BIM. Al Awad (2015) looked into the process, technical, and human factors that prevent SMEs from using BIM. These factors include poor educational attainment, a lack of knowledge and skills, training, and culture. According to Matarneh and Hamed (2017), the major obstacles impeding the adoption of BIM in the Jordanian building industry are the lack of incentives and support from construction policymakers, the unavailability of BIM standards and codes, lack of awareness, lack of client demand, resistance to change, lack of a BIM

specialist in Jordan, lack of necessary training, and the cost of BIM, which includes software, hardware upgrades, training, and time. Matarneh and Hamed (2017) did not, however, look at the connections between BIM barriers.

In Kuwait, the need for housing is growing, and this is turning into one of the main problems the nation is facing. In order to address Kuwait's housing crisis, effective building designs and construction techniques are essential (Nawari & Alsaffar, 2017). Gerges et al. (2016) showed that by promoting cooperation between project participants, practitioners saw enhanced communication and reduced project risks. It was also noted that in order for BIM to be fully implemented in the State of Kuwait, there will need to be a concentrated effort made to persuade clients to want BIM, overcome reluctance to change among construction industry professionals, and provide additional training for design team members. According to Umar (2022) the four primary areas of "organisation," "technical," "government and legal," and "environment" comprise the top challenges. Nawari and Alsaffar (2016) navigated Kuwaiti universities' and institutes' present BIM education situation. Additionally, an educational framework for the introduction of BIM courses in Kuwait was designed. The study also concentrated on establishing goals and content specifications for different college course levels. Previous study Nawari and Alsaffar (2017) proposed a new BIM-based permitting procedure. By utilising building information found in structural and architectural models, as well as programming tools found in BIM software applications, the proposed approach demonstrates how a BIM-based compliance checking framework holds the potential to optimise and streamline Kuwait's residential building codes conformance checks.

In order to enable the construction industry to concentrate on these barriers and guarantee that BIM is accepted efficiently, this article focuses on identifying the major obstacles to the adoption of BIM in Jordan and Kuwait. In addition, this article conducts a critical investigation to determine the obstacles facing BIM using a survey, and a review of the literature throughout the Jordanian and Kuwaiti construction sector. The selection of these two countries was based on the fact that they reflect different economic environments in the Middle East. Jordan is categorised as a low-income country under the 2021 IWA Country Classification, which puts Kuwait, a high-income country, in sharp contrast (Asaad & Suleiman, 2023).

Materials and Methods

The purpose of this study is to look into how BIM is currently used in Jordan and Kuwait construction sector. In order to determine the present degree of BIM expertise and to characterise the perceived value, benefits, and obstacles facing BIM deployment, an exploratory study was subsequently carried out utilising a structured online survey that was created based on the literature analysis. In order to capture the present state of practice in Jordan and Kuwait on the use and implementation of BIM, the questionnaire was created to be straightforward, easy to understand, and specific.

Results and Analysis

The study's sample comprises architects, engineers, and contractors who work in the Jordanian and Kuwaiti AEC construction sectors. The questionnaire results are shown in the following subsections.

Respondents' Profiles

Table 1. The survey participants' demographics.

Demography	Respondents	Frequency
Type of respondents organization	Clients	17
	Consultants	33
	Contractors	37
	Others	7
Qualification of respondents	Civil Engineer	55
	Mechanical Engineer	8
	Architecture	13
	Electrical Engineer	14
	Others	4
Country of respondents	Jordan	58
	Kuwait	36

As shown in Table 1, there were 94 full replies to the survey. A total of 13 architects (13.8%), 55 Civil engineers (58.5%), 14 Electrical engineers (14.8%) and 8 Mechanical engineers (8.5%); 37 contractors (39.4%), 33 consultant (35.1%), and 17 clients (18.1). Thus, the survey's respondent distribution was not normally distributed, indicating that Engineers especially civil engineers are the group most interested in take part in surveys and increase your BIM knowledge.

Respondents' Experience of BIM

By asking respondents about their Knowledge about using the BIM application, the level of BIM awareness among the respondents was ascertained. As shown in table 2 only 29.8% of respondents' were answered with ''very strong'' and ''strong'', the bulk of respondents (41.5%) had < 25% ratio of BIM use during work, indicating that the present experience with BIM is still quite low. The responders who have worked with BIM with 25% to 50% (25.5%), came after these. According to the data, the responders with over 50% ratio of BIM use during work the lowest response rate (20.8%). Evidently, Jordan and Kuwait are still in the very early stages of BIM adoption. This result was consistent with the finding that the majority of respondents have little awareness of BIM.

Table 2. BIM awareness among the respondents.

''Ratio of BIM use during work''					
	<25%	25%TO 50%	50% to 75%	>75%%	Total
Jordan	25	12	13	7	57
Kuwait	14	12	5	4	35
Total	39	24	18	11	92
consultant	11	8	9	5	33
Contractor	19	8	7	2	36
Client	4	6	2	4	16
Others	5	2			7
Total	39	24	18	11	92
''Knowledge about using the BIM application''					
	Very weak	Weak	Average strength	Strong	Very Strong	Total
Jordan	17	7	15	9	10	58
Kuwait	9	6	12	5	4	36
Total	26	13	27	14	14	94
consultant	5	5	9	8	6	33
Contractor	13	5	11	4	4	37
Client	5	2	5	2	3	17
Others	3	1	2		1	7
Total	26	13	27	14	14	94

Table 3. The mean of BIM awareness questions.

Question/ Country	Ratio of BIM use during work ''1.00 = "<25%" , 2.00 = "25%TO 50%"; 3.00 = 50% to 75%; 4.00= >75%	Knowledge about using the BIM application''1.00 = "very weak" , 2.00 = "weak"; 3.00 = ''average strength'';, 4.00= ''strong'', 5:00= ''very strong''
Jordan	2.04	2.79
Kuwait	1.97	2.69
Total	2.01	2.76
Type of organization or company		
consultant	2.24	3.15
Contractor	1.78	2.49
Client	2.38	2.76
Others	1.29	2.29
Total	2.01	2.76

The mean ratio of BIM use during work in Jordan is 2.04, or "25% - 50%," as table 3 illustrates for the question "Ratio of BIM use during work", this implies that a sizable fraction of Jordanian respondents are utilizing BIM technology at work. Conversely, Kuwait's mean ratio for using BIM in construction is 1.97, or "less than 25%". This implies that Kuwait does not use BIM technology to the same extent as Jordan does. The mean level of

knowledge about using BIM applications in Jordan is 2.79, which is equivalent to "weak". This suggests that respondents in Jordan have a moderate level of knowledge about using BIM applications. The mean level of knowledge about using BIM applications in Kuwait is 2.69, which is equivalent to "weak". This suggests that respondents in Kuwait have a similar level of knowledge about using BIM applications as respondents in Jordan. It's interesting to note that when various business types are examined, general contractors have the least amount of ratio of BIM use during work, according to type of organization or company, The mean ratio of BIM use during work for the clients was have the maximum mean followed by the consultants with values 2.38 and 2.24 respectively which is equivalent to "25%- 50%", where the contractor mean was 1.78 which is equivalent to'' <25%''. The mean level of knowledge about using BIM applications in Consultants group is 3.15, which is equivalent to "average strength". This suggests that respondents in Consultants group a moderate level of knowledge about using BIM applications. The mean level of knowledge about using BIM applications in Client and contractor groups are 2.76 and 2.49 respectively, which is equivalent to "weak".. This suggests that respondents in consultants group have higher level of knowledge about using BIM applications as respondents other groups.

Jordan and Kuwait's Barriers and Difficulties with BIM Implementation

Every new technology has various difficulties during introduction before being fully utilised.   This study also looked into obstacles to BIM implementation in Jordanian and Kuwaiti AEC construction projects. As seen in Table 4, respondents cited a number of obstacles that are crucial for BIM adoption in Jordan and Kuwait, ranging from technical problems to more subjective considerations. Table 4 demonstrates that three of the top five factors that have the greatest impact on the deployment of BIM were the same in both nations. Inadequate government legislation to fully support BIM implementation was one of the top three barriers for both nations that concurred with the results of study was performed in Jordan by Matarneh and Hamed (2017). Matarneh and Hamed, (2017) smaller business owners typically don't have these demands, even if the Jordanian government is currently implementing BIM for specific public projects. In fact, smaller enterprises are more likely to oppose technological advancements (Matarneh and Hamed, 2017). The other two common barriers were related to shortage of BIM expertise and the shortage of effective communication among project stakeholders, The Jordanian construction industry has to enhance its current communication status because poor communication is a common problem in the sector (Suleiman et al., 2023). '' Clients' lack of desire and interest in utilising BIM technology for project design and construction'' was top one in Jordan, but ranked nine in Kuwait. '' Small businesses lack the funding to establish a new workflow, which is essential for the successful implementation of BIM'' was ranked 2 and 9 in Kuwait and Jordan respectively.

Table 4. A ranking of barriers to using BIM.

Country	Jordan		Kuwait	
Barriers	Mean	Rank	Mean	Rank
Clients' lack of desire and interest in utilising BIM technology	3.48	1	2.62	9
lack of effective communication among project stakeholders	3.47	2	2.69	5
Inadequate government legislation to support BIM implementation	3.43	3	3.11	1
Lake of participants with expertise in BIM application	3.29	4	2.81	3
The absence of concern for the building's long-term maintenance	3.27	5	2.63	8
Organisations may oppose any changes to new technology.	3.17	6	2.67	6
Engineers often hesitant to learn new applications.	3.14	7	2.53	11
Absence of BIM-savvy architects and engineers	3.13	8	2.81	4
Small businesses lack the funding to establish a new workflow	3.09	9	2.94	2
A lack of understanding of BIM among relevant parties	3.04	10	2.50	12
not providing BIM instruction or training in universities	2.96	11	2.67	7
Experts believe that various traditional programmes fulfil the requirement and finishing the project.	2.91	12	2.57	10

Conclusion

The Design, Construction, and Operation (DECO) industry, as well as the Architectural and Construction Engineering industry, share a vast amount of knowledge regarding Building Information Modelling (BIM). In the Middle East, BIM adoption and implementation have grown more slowly than in previous studies. The study determined the awareness and the main obstacles to BIM adoption in Jordan and Kuwait, including: "The lack of government support"; "Lack of communication between the stakeholders"; and "Lack of demand for BIM. In

a similar vein, therefore, it follows that the Jordanian and Kuwaiti government ought to make a concerted effort to develop a roadmap and establish regional BIM standards and regulations at the procedural as well as organisational levels The study shows there is more awareness of BIM applications, programmes, and benefits in Jordan than Kuwait.

Recommendations

This study is an initial step towards comprehending Jordan's and Kuwait present state of BIM deployment. However, it offers a standard for upcoming research that should address other avenues further. Also, for the both countries consultants group have higher level of knowledge about using BIM applications than the contractor and clients groups.

Scientific Ethics Declaration

The authors declare that the scientific ethical and legal responsibility of this article published in EPSTEM Journal belongs to the authors.

Acknowledgements or Notes

References

Aibinu, A., & Venkatesh, S. (2014). Status of BIM adoption and the BIM experience of cost consultants in Australia. *Journal of Professional Issues in Engineering Education and practice, 140*(3), 04013021.

Al Awad, O. (2015). *The uptake of advanced IT with specific emphasis on BIM by SMEs in the Jordanian construction industry.* (Doctoral dissertation, University of Salford United Kingdom).

Asaad, S., & Suleiman, A. (2023). Socio-demographic factors and treated wastewater reuse in the MENA region: Insights and implications. *Desalination, 565*, 116830.

Gerges, M., Ahiakwo, O., Jaeger, M., & Asaad, A. (2016). Building Information Modeling and its application in the state of Kuwait. *International Journal of Civil, Environmental, Structural, Construction and Architectural Engineering, 10*(1), 81-86.

Matarneh, R., & Hamed, S. (2017). Barriers to the adoption of building information modeling in the Jordanian building industry. *Open Journal of Civil Engineering, 7*(3), 325-335.

Nawari, N. O., & Alsaffar, A. (2017). The role of BIM in simplifying construction permits in Kuwait. In AEI 2017 (pp. 855-866).

Nawari, N. O., & Alsaffar, A. (2016). Planning and development of bim curriculum for Kuwait. *Journal of Civil Engineering and Science (JCES), 5*(1), 15-32.

Suleiman, A., Almasaeid, H., Hussein, N., & Abahre, J. (2023). Addressing the causes and effects of poor communication in the jordanian construction industry: a study on improving project performance. *Civil and Environmental Engineering, 19*(1), 156-166.

Umar, T. (2022). Challenges of BIM implementation in GCC construction industry. *Engineering, Construction and Architectural Management, 29*(3), 1139-1168.

Author Information

Samaher Asaad	**Akram Suleiman**
Al-Zaytoonah University of Jordan, Amman, Jordan	Al-Zaytoonah University of Jordan, Amman, Jordan
Contact e-mail: *2968@zuj.edu.jo*	

To cite this article:

Asaad, S.A. & Suleiman, A.S. (2024). A comparative analysis of the opportunities and challenges associated with building information modeling implementation in Jordan and Kuwait. *The Eurasia Proceedings of Science, Technology, Engineering & Mathematics (EPSTEM), 28,* 581-585.