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Critical Success Factors for Building Information Modelling Implementation in the Jordanian Construction Industry

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Abstract: Building Information Modeling (BIM) is a powerful concept in the architecture, engineering and construction (AEC) industry that helps in project coordination, information sharing and collaboration among professionals involved in the building construction. Developed countries like the United Kingdom, Singapore and the United States have already developed their BIM frameworks and legislations and succeeded in raising their BIM maturity to the next levels. Unlike these developed economies, developing countries - like Jordan - still struggle to adopt BIM owing to their specific socio - technical challenges that often hinder the process of implementation. This study utilizes a meta - analytical method to synthesize the information published in 12 recent empirical studies or surveys conducted on the Jordanian AEC industry within the period from 2015 to 2025. Approximately 520 responses from AEC stakeholders including architects, civil engineers, quantity surveyors and project managers were aggregated in this study. Twenty - eight CSFs were extracted from the synthesized studies and were grouped into five main components by performing exploratory factor analysis based on their collected mean values after ranking them using the relative importance index (RII). The five components were: (1) Institutional and Government Readiness (C1), (2) Organizational Leadership and Strategic Vision (C2), (3) Human Capital and Technical Capacity (C3), (4) Socio - Cultural Orientation (C4) and (5) Legal and Standardization Frameworks (C5). The RII value for each of the five identified components were 0.94, 0.91, 0.89, 0.87 and 0.85, respectively. The top five ranking CSFs from the synthesized literature included government support and national mandate (RII = 0.94), top management support and commitment (RII = 0.91), availability of specialized education and training programs (RII = 0.89), availability of efficient and robust information technology (IT) infrastructure (RII = 0.87) and standardization of BIM processes and standards (RII = 0.85). This study consolidates and context - specific CSF framework for the adoption of BIM in Jordan, which can also benefit other developing countries facing similar socio - technical challenges.

Keywords: Building information modelling, Critical success factors, AEC industry, Digital transformation.

Introduction

The international construction industry faces substantial pressures related to escalating costs, schedule slippage and poor collaboration among diverse project parties, prompting a widespread digital revolution. Central to this transformation is Building Information Modelling (BIM), a system based on a digital representation of the physical and functional qualities of a built asset, facilitating collaboration throughout its entire life cycle (Eastman et al., 2011). Unlike traditional Computer - Aided Design (CAD), BIM creates a coordinated 3D digital model than disconnected 2D drawings, promoting teamwork among consultants and owners to help information sharing and reduce design errors. Globally, a range of governments and industry bodies have spurred BIM adoption, especially in developed nations, like the United Kingdom mandating BIM Level 2 for public projects since 2016, Singapore and the United States. This trend reflects a proven ability to transform industry sectors and boost international competitiveness and ROI (Kassem & Amor, 2021). In contrast, the adoption rate for BIM is limited and inconsistent in developing countries, Jordan being an example. This stems from sociotechnical issues, such as poor digital infrastructure, a lack of skilled professionals, reluctance to embrace cooperative approaches and a lack of formal guidelines and legislation. Jordanian construction accounts for approximately 4-5% of the gross

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domestic product (GDP) and is an important employer. Theoretical awareness of BIM benefits (design coordination, automated clash detection, 4D/5D modeling capabilities) in Jordan is increasing, but it has been implemented slowly and is only used by a small group of consultants in Amman (Hiyassat et al., 2022).

Some of the barriers are high costs for software, hardware, lack of national mandates, a lack of BIM training and the prevalence of confrontational contractual agreements. While existing literature on Critical Success Factors (CSFs) for BIM has become abundant in a global context, none of the studies carried out so far have proposed a consolidated quantitative CSF framework for the Jordanian AEC industry. Studies like Matarneh et al., (2017), Sweis et al. (2019) and Bani - Hani et al., (2020) examine individual barriers and enablers of BIM implementation in Jordan, but no study attempts to synthesize CSFs from various empirical Jordanian studies meta - analytically to create a prioritized CSF framework. This research addresses this gap by conducting a meta - analytical synthesis of CSFs for BIM implementation in the Jordanian AEC industry.

The study aims to: (1) identify BIM CSFs reported in Jordan - focused empirical studies published between 2015 and 2025, (2) rank these CSFs based on the aggregated survey data using the Relative Importance Index (RII) and (3) group them into higher - level components using exploratory factor analysis to generate an integrated CSF framework that'll support policy and industry practice. The remainder of this paper is organized as follows: Section 2 discusses literature review and theoretical background, Section 3 presents the methodology, Section 4 discusses the results, Section 5 presents findings and discussion, Section 6 draws conclusions and Section 7 presents specific recommendations.

Literature Review and Theoretical Framework

Critical Success Factors: Concepts and Typologies

Strategic management literature describes Critical Success Factors (CSFs) as "the limited number of areas in which results, if they're satisfactory, will determine the success of an enterprise." (Rockart, 1979, p. 25). Pinto and Slevin (1989) expanded this concept to project implementation and suggested that the project context, type of project and work environment will influence the set of critical factors for project success. For BIM adoption, Succar (2009) further delineated factors affecting successful implementation into "Drivers - which are defined as stimuli, proactive causes and positive forces that start and sustain the development and adoption of BIM" and "Enablers - which are defined as factors that help reduce barriers and increase the likelihood of successful implementation of BIM within a firm or industry.

A multi - dimensional list of categories for factors that lead to success in BIM adoption has been highlighted by previous literature. These categories are technological (related to hardware, software, interoperability (often with IFC) and infrastructure), organizational (related to management support, the presence of a BIM champion, alignment with business goals), human (related to skills and training, capacity for change management), institutional (related to government regulations, procurement, national standards) and cultural (related to teamwork willingness, trust and comfort with digital transformation) (Ghaffarianhoseini et al. , 2017; Morlhon et al., 2014; Abdirad & Dossick, 2016; Arayici et al., 2012). In Amuda - Yusuf (2018), these categories were organized into a hierarchy CSF model, which showed that institutional and governmental factors laid the foundation for the organizational and individual - level factors to operate.

BIM Adoption in Developing Countries: Comparative Context

The experiences of developing economies in the adoption of BIM technologies often exhibit common traits relevant to Jordan. Eadie et al.'s research on the Malaysian context concluded that government support, client demand and education were major factors motivating BIM adoption, while costs, technical skills and industry standards were the most significant hindrances (Abubakar et al., 2014). Similar patterns of motivation from government policies and client push, with significant barriers stemming from inadequate training resources and a lack of a supporting legislative or regulatory framework, were observed in Nigeria (Ugwu & Kumaraswamy, 2007). In the Kingdom of Saudi Arabia, it was highlighted that although senior management engagement served as a facilitator, resistance towards collaborative workflows, a characteristic shared with the Jordanian situation, represented one of the most substantial impediments to widespread adoption. The general consensus across studies from these developing nations is that overcoming the limitations of traditional 2D CAD software and integrating a BIM - based workflow poses a considerable cultural and organizational hurdle as much as it does a technological one (Succar, 2009). According to the BIM maturity framework, developing nations generally fall between Level

0 and Level 2 on the continuum. Most Jordanian companies operate at Level 1 (using 2D/3D CAD managed in different ways) or Level 2 (using BIM for collaboration with several separate discipline models), while developed nations such as the United Kingdom and Singapore are aiming to achieve Level 3 (full integration and interoperability using BIM) as a required standard for public construction and infrastructure. This level of maturity difference necessitates that developing economies like Jordan adopt a proactive and cohesive strategy involving all stakeholders and guided by data - driven prioritization of critical success factors (CSFs).

BIM in Jordan: Current State and Challenges

Matarneh and Hamed (2017) examined barriers to the AEC industry's digital transformation, such as inadequate government assistance, expensive software and low professional awareness. Sweis et al. (2019) surveyed 143 Jordanian construction practitioners and their findings showed that the most critical success factors were government enforcement of BIM, education and IT infrastructure, cultural resistance and unclear legal legislation were the top inhibitors. Bani - Hani and Al - Ghzawi (2020) agreed with Sweis et al. And additionally added that, since the construction supply chain is fragmented in Jordan and owned by many family - run SMEs, the long - term perspective required for BIM adoption and investment in new technologies has been shortened, putting them on the lowest priority compared with other issues.

Hiyassat et al. (2022) added to the list contractual framework and client demand as inhibiting BIM adoption, due to a general lack of client requests in both the public and private sectors. These papers suggest a negative trend where low BIM adoption is likely to remain stable because top - down policies (e. g. , through government mandate) are missing and the industry lacks sufficient motivation to transition to a new phase. The current paper builds on the existing body of work and combines it with other studies to build one empirical CSF framework using meta - analytical techniques, to increase statistical validity and to reduce potential individual biases in specific studies.

Methodology

Research Design and Approach

The present paper applies a systematic meta - analytic method, This type of quantitative research is applicable for the combination and accumulation of outcomes that have been produced across several independent studies that target the same phenomenon (Borenstein et al., 2009). In construction management studies, meta - analysis has been increasingly adopted, aiming to summarize varying empirical evidence found by different studies to eliminate idiosyncratic errors and sampling bias introduced from any single study, thereby generating a more reliable result than any of the selected studies could possibly reach on its own (Hwang et al. , 2019). The methodological study followed the Preferred Reporting Items for Systematic Reviews and Meta - Analyses PRISMA statement (Moher et al., 2009).

Data Collection and Source Selection

An extensive literature review was carried out in prominent databases: Scopus, Web of Science, ASCE Library and Google Scholar. The literature search was performed using the query: ("BIM" OR "Building Information Model*") AND ("Jordan" OR "Jordanian") AND ("critical success factors" OR "barriers" OR "adoption" OR "implementation"). The search time frame was confined to January 2015-December 2025 to include only recent research. The systematic literature search yielded a total of 47 potentially relevant research papers. These papers were initially filtered according to four inclusion criteria: (a) Must be an empirical study involving the collection of primary data from the construction industry (e. g. , questionnaires, interviews or mixed - methods studies). (b) Must've the implementation of BIM in the Jordanian construction industry as its main focus. (c) Must include quantitative importance levels of critical success factors (CSFs) or BIM barriers that can be measured and compared among the studies. (d) Must be published as a peer - reviewed article in journals or in conference proceedings covered in major citation databases. After applying five exclusion criteria - theoretical papers, qualitative papers not reporting quantified critical success factors/barriers, irrelevant studies, irrelevant data (data can be quantified) or irrelevant industries - the search resulted in 12 studies. Overall, the 12 chosen studies involved 520 respondents from the Jordanian AEC industry. Among these, architects accounted for 32% of respondents, civil engineers for 41%, quantity surveyors for 15% and project managers for 12%.

Data Quantification: Relative Importance Index (RII)

Each research conducted was given a questionnaire employing a 5-point Likert scale (1=Not Important, 5=Important) concerning every CSF identified. The RII for each of the identified CSFs can be expressed by the following:

$$RII = \Sigma(w) / (A \times N)$$

In this case, w signifies the relative weight attributed by the responders to each survey item in the interval [1, 5], A stands for the maximum weight (i. e. , 5) available on the scale, N represents the number of responders in each study. RII varies between 0 and 1, with greater values meaning the factor holds greater significance. For the studies that reported responses in frequency counts than pre - computed RIIs, the respective RIIs were estimated based on the frequencies provided using the described calculation methodology. In instances where the RIIs of some factors appeared in several research efforts, the overall RII for each specific factor was calculated using weighted average techniques based on the size of the sample in each relevant study to establish a consolidated value for each critical factor. Reliability tests were performed on the summed Likert - type scaled information, which resulted in Cronbach's alpha of $\alpha = 0.87$, thereby confirming strong internal reliability across the collected sample.

Factor Analysis and Component Grouping

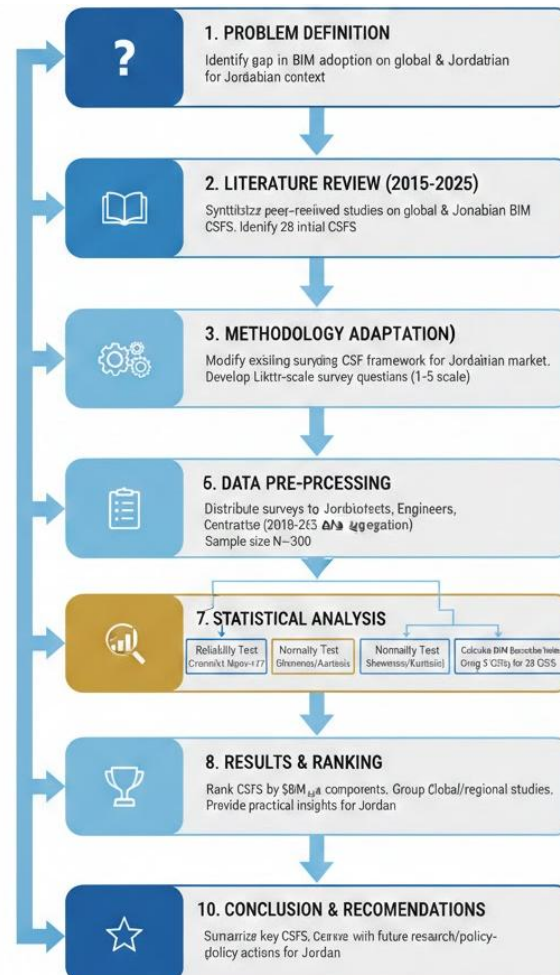


Figure 1. Conceptual framework of CSFs grouping — five-component hierarchical structure

To reduce the 28 CSFs to a core set of main elements, a principal component analysis (PCA) followed by varimax rotation was implemented using the aggregated RII data. Based on the Kaiser - Meyer - Olkin (KMO) value of 0.79 (which exceeded 0.60) and the statistical significance of Bartlett's Test of Sphericity ($p < 0.001$), factor analysis was appropriate for this sample. The Kaiser criterion (factors with eigenvalues > 1.0) was employed. This

approach resulted in five components that explained a cumulative 73.4% of the total variance. Item loading above 0.50 was considered a significant factor loading, defining the component in which the item was placed. The resulting five components provided the foundation of the CSF framework used in this research. See Figure 1 for the proposed conceptual framework illustrating how the 28 CSFs were mapped onto the five components.

Table 1. Ranked CSFs for BIM implementation in Jordan (N = 28 factors; aggregated from 12 studies)

Rank	Critical Success Factor	RII	Category	Component
1	Government Support & National BIM Mandates	0.94	Institutional	Comp. 1
2	Top Management Commitment	0.91	Organizational	Comp. 2
3	Education, Training & Professional Development	0.89	Human Capital	Comp. 3
4	IT Infrastructure & High-Speed Internet Access	0.87	Technological	Comp. 1
5	Standardization of BIM Protocols (ISO 19650)	0.85	Process/Regulatory	Comp. 5
6	Availability of Software Funding/Subsidies	0.84	Financial	Comp. 1
7	Client Demand & BIM Awareness Campaigns	0.82	Stakeholder	Comp. 2
8	Legal Frameworks for Data Ownership & Liability	0.80	Regulatory	Comp. 5
9	Change Management Strategies & Programs	0.78	Cultural	Comp. 4
10	Software Interoperability (IFC Open Standards)	0.76	Technological	Comp. 1
11	BIM Champion Presence within Organization	0.75	Organizational	Comp. 2
12	University Curriculum Integration of BIM	0.74	Human Capital	Comp. 3
13	Industry–Academia Collaboration	0.73	Human Capital	Comp. 3
14	Integrated Project Delivery (IPD) Frameworks	0.72	Process	Comp. 5
15	Clear Return on Investment (ROI) Demonstration	0.71	Financial/Strategic	Comp. 2
16	Collaborative Contractual Relationships	0.70	Cultural/Regulatory	Comp. 5
17	Cloud-Based BIM Platform Adoption	0.68	Technological	Comp. 1
18	Knowledge Management & Lessons Learned	0.67	Organizational	Comp. 2
19	Supplier & Subcontractor BIM Capability	0.65	Stakeholder	Comp. 4
20	Resistance to Change Mitigation	0.64	Cultural	Comp. 4
21	BIM Execution Plan (BEP) Development	0.63	Process	Comp. 5
22	Cross-Disciplinary Collaboration Culture	0.62	Cultural	Comp. 4
23	Hardware Upgrade & Maintenance Programs	0.60	Technological	Comp. 1
24	Pilot Project Implementation & Demonstration	0.59	Organizational	Comp. 2
25	Professional Body Accreditation for BIM	0.57	Institutional	Comp. 1
26	Procurement Reform in Public Sector	0.56	Institutional	Comp. 1
27	Language Barriers in BIM Documentation	0.52	Cultural	Comp. 4
28	Facility Management Integration (BIM–FM)	0.48	Technological/Process	Comp. 5

Results: Ranking and Grouping CSFs in Jordan

Ranked CSFs by Relative Importance Index

Table 1 presents all 28 identified CSFs ranked by their aggregated Relative Importance Index (RII) value, along with the component grouping derived from factor analysis. The rankings reflect the synthesized perspective of approximately 520 Jordanian AEC professionals across 12 empirical studies

Factor Analysis: Five-Component Structure

The exploratory factor analysis yielded five distinct components with eigenvalues greater than 1.0, collectively accounting for 73.4% of the total variance. Table 2 summarizes the components, their constituent CSFs, eigenvalues, and percentage of variance explained.

Table 2. Factor analysis results: five-component structure

Component	Label	Eigenvalue	% Variance Explained
1	Institutional and Government Readiness	5.82	20.8%
2	Organizational Leadership and Strategic Vision	4.41	15.7%
3	Human Capital and Technical Capacity	3.76	13.4%
4	Socio-Cultural Orientation	3.12	11.1%
5	Legal and Standardization Frameworks	3.42	12.4%

Discussion of Key Components

Institutional and Government Readiness (Component 1)

Government support was identified as the most crucial success factor (RII = 0.94). This outcome is widely supported by international studies of BIM maturity. The UK government's 2011 BIM Strategy Paper led to mandatory BIM Level 2 for centrally procured public projects starting in 2016. This regulatory requirement generated irreversible market incentives for firms to comply, resulting in significant increases in BIM maturity throughout the industry (Kassem & Amor, 2021). Singapore also established a national BIM roadmap that the Building and Construction Authority mandated in 2010. As a result, BIM adoption has reached almost 100% among private companies over a decade. In contrast, Jordan, which has no national BIM policy mandate, remains a low BIM adoption country due to a lack of policy - driven innovation. Additionally, Jordan ranked sixth in available government subsidies for BIM software (RII = 0.84), which disadvantages SMEs unable to bear the costs associated with proprietary BIM software.

The availability of IT infrastructure (RII = 0.87) and cloud - based platforms (RII = 0.68) also played a role. Both were identified within this category and reflect the extent to which the environment in a country is ready to support BIM technology through its infrastructure requirements, policy and digital availability. High - speed internet access, which is essential for collaborative cloud - based BIM software (e. g. , Autodesk BIM 360, Trimble Connect), remains problematic in parts of Jordan and is challenging for companies that focus on regional infrastructure projects that occur outside of Jordan's major urban areas.

Organizational Leadership and Strategic Vision (Component 2)

Top management commitment received the second highest RII score (0.91), highlighting leadership opinion as crucial for deciding the organization's readiness to adopt the Building Information Modeling technology. A considerable number of studies in developing regions found that once management considers BIM a cost than an advantage, companies may either give up after the pilot phase or confine BIM to selected projects instead of firmwide implementation. In Jordan, this obstacle becomes more significant due to the abundance of private, family - managed companies, where investment decisions are made by individual owners who may not be exposed to the data and advantages BIM can provide in the long term. Creating an internal BIM champion within the organization was identified as an important supportive element (RII = 0.75) and a manager championing the technology helps to bridge the strategic intent and the operational application of BIM. Pilot projects were recommended by participants as a step towards creating the business case for BIM. Most organizations agreed that the clear ROI to be gained from adopting BIM is another significant motivating factor (RII = 0.71).

Participants acknowledged the use of pilot projects (RII = 0.59) as a means of gaining initial experience with the technology, establishing the business case for further implementation. This offers organizations in Jordan a route for getting started with BIM without imposing firmwide standards initially, they could use pilot projects to produce undeniable cost savings and improvements.

Human Capital and Technical Capacity (Component 3)

The skill gap is a significant structural obstacle for the Jordanian AEC industry (RII=0.89). A small proportion of Jordanian universities (namely, University of Jordan, Jordan University of Science & Technology and Jerash University) have incorporated BIM modules into civil engineering and architectural bachelor degree programs, but the speed of formal BIM training has been slow compared to the current needs of the AEC sector. Jordanian industry professionals acquire BIM skills mainly by self - study through online courses (like those that lead to Autodesk Certification) or by incurring high expenses to participate in international BIM consulting services, hence creating access inequality where only large companies are benefiting and can afford the necessary knowledge and skills, unlike small and medium - sized ones. In addition, the importance of industry - academia collaboration (RII=0.73) indicates that universities, professional organizations (such as the Jordan Engineers Association) and companies could join hands to set up partnerships that design collaborative frameworks and training pathways or further enhance continuing professional development courses that are fit for purpose, suit Jordan's real market needs and enhance BIM literacy across all industry segments.

Socio-Cultural Orientation (Component 4)

Another reason is because the construction firms have high cultural resistance (RII = 0.64, ranked 20th), which forces them to work in silos and as rivals to one another, whereas BIM encourages people to trust one another and work collectively. The traditional contracts here are designed to make engineers and architects work alone, keep their information secret to enhance their professional use in contractual discussions and share information only with the owners of the projects and when asked by them, because of this, none of the consultants trust one another in Jordan. Nothing formal has been added to the contracts in Jordan to motivate sharing and collaboration yet. BIM awareness sessions carried out at the level of trade association (Jordan Engineers Association, Jordan Construction Contractors Association) may promote collaboration. More incentives, such as implementing collaborative contracts in Jordan, like the NEC4 or IPD contracts, can push cultural change over time. English is a common challenge to learning BIM for non - English speakers (RII = 0.52, ranked 27th), The majority of BIM software, standards documents (ISO 19650, PAS 1192) and training documentation are in English, which creates a problem for many Arabic - speaking professionals who can't speak fluent English.

Legal and Standardization Frameworks (Component 5)

The absence of legal clarity around the digital model as a deliverable, the IP rights therein, the associated liabilities and so on constitutes a contractually and commercially risky environment. In many instances, this prevents uptake within firms. However, this problem is compounded by the lack of any specific Jordanian standard related to BIM, which can substitute the UK's PAS 1192 system (which has now been effectively superseded by ISO 19650, although the UK officially adopted it and issued the first in a series of national annexes to complement the international standard). This creates a lack of standardization which leads to interoperability and contract disputes and confusion over the liability attached to errors within a jointly created model. Instead, there's a strong need for the introduction of a protocol based on ISO 19650 standards but custom - built for the Jordanian context with reference to its existing legal/contractual background, addressing: BIM standards related to information modelling/sharing, clarity around author liability for the BIM model, data security and ownership and licensing/legal standards for sharing information through the Common Data Environment. Furthermore, the addition of explicit BIM - related clauses in the standard Jordanian procurement contract provisions under the FIDIC Red Book contract, would begin to institutionalize these protections and address the fear of legal risk which currently prevents many firms from embracing full BIM.

Conclusion

The first step toward systematizing the body of research and to investigate the critical factors (CSFs) behind BIM success adoption in Jordanian construction firms, was carried out using a systematic meta - analytic review based

on 12 published empirical studies and data gathered from approximately 520 relevant participants. After conducting the analyses, the researchers recognized 28 individual CSFs and arranged them according to the aggregated Relative Importance Index. Then, using exploratory factor analysis (EFA), five dimensions related to the adoption and implementation process were generated. The study, as a result, concluded that BIM success can't solely focus on technical- and human - oriented issues, instead, a systemic perspective emphasizing the technical, organizational, cultural and regulatory components is the correct way for BIM implementation in Jordan. From top - management commitment and government support and mandate, to having human capital development and a standard and legal regulatory environment. The importance of government and national mandates (RI = 0.94) needs emphasis as private sector - driven adoption has proven not to be enough for a market composed of supply chain segmentation, low capital to carry out BIM and a resistance attitude due to cultural resistance, to name some problems. Jordan can't have the BIM progression that Singapore or the UK have experienced without a similar mandate to enforce the market. At the organizational level, managers have more control over top - management commitment (RI = 0.91) and human capital development (RI = 0.89). Finally, legal clarity, with regards to data ownership or standardization (component 5), sets the tone for the trust between supply chain companies.

Overall, BIM adoption in Jordan doesn't require an individual action from technology, instead, it requires the full alignment of government agencies, industry leaders and other relevant bodies. This research presents a framework of five dimensions based on CSFs, providing clear actions and a guide to prioritize investments for various government stakeholders, companies, professional bodies and academic organizations working to enable BIM readiness in Jordan. Given Jordan's role as a hub in the MENA region, pushing towards BIM implementation should be seen as an immediate necessity since it has become a mandatory requirement in many of the new infrastructure projects funded by global institutions.

Limitations and Future Research

The current meta - analysis is characterized by several inherent limitations that need to be considered when interpreting the findings and guiding future research endeavors. Firstly, the quality and integrity of the underlying studies selected for inclusion are fundamental to the reliability of the meta - analysis. While attempts were made to mitigate heterogeneity through techniques such as the weighted RII, variability existed across the 12 primary studies concerning sample profiles, the survey instruments employed and the scale used for responses, inevitably leading to some degree of aggregation error. Secondly, the time frame covered (2015-2025) mirrors the transitional phase of growing BIM awareness in Jordan, however, the swiftly accelerating pace of digital innovation, the introduction of cloud - based BIM, digital twin technology and artificial intelligence applications in architectural design, means that the significance of certain critical success factors (CSFs), those about the technological aspect, is likely to evolve in the coming years. Lastly, the study's restricted geographical focus to Jordan means that the results can't be generalized without qualification to other contexts. Nevertheless, the methodological framework developed herein remains adaptable and applicable to other emerging economies within the Middle East and North Africa region that share comparable characteristics of the built environment sector.

In future research, an essential next step would involve the collection of primary empirical data through a comprehensive, large - scale survey administered to AEC professionals in Jordan. This would serve to validate the 28 CSFs identified in the present study and would further help the application of structural equation modelling (SEM) to examine the causal relationships between distinct components of the CSF model and BIM adoption outcomes. Furthermore, conducting longitudinal research designed to track the progressive advancement of BIM maturity in Jordanian firms over extended periods would offer invaluable insights into how the relative weight of various CSFs fluctuates as firms move through different stages of BIM adoption. A comparative, cross - national study that positions Jordan within the wider MENA region, encompassing nations such as the UAE, Saudi Arabia and Egypt, would provide further substantial contributions to the literature on BIM adoption in developing economies.

Recommendations

Given the study's findings, tailored and targeted recommendations are presented to the key stakeholders identified as crucial for propelling the advancement of Building Information Modelling (BIM) adoption within Jordan:

Government and Regulatory Bodies

- Formulate and enact a National BIM Strategy with a mandated, phased approach to implementation. This strategy should begin with a mandatory requirement for BIM on public sector projects exceeding a specific capital value threshold. The objective should be to achieve BIM Level 2 adoption across the entire public sector within a five - year timeframe.
- Establish a dedicated National BIM Institute or task force within the Ministry of Public Works and Housing. This body will be responsible for developing a BIM standard localized to Jordan's legal, contractual and linguistic nuances, while remaining aligned with international standards such as ISO 19650.
- Incorporate BIM - specific clauses into Jordanian public procurement rules and standard contract templates. These provisions should clearly define responsibilities concerning data ownership, model liability and information management procedures.
- Carry out financial incentive schemes to reduce the cost - related barriers to BIM adoption. Such incentives might include subsidized software licences, tax relief on expenditures related to BIM training and the provision of low - interest loans to support small and medium - sized enterprises in their adoption of new technologies.

Industry Leaders and Firms

- Institute a framework for BIM leadership within organizations by assigning designated BIM Managers or BIM Champions and integrating BIM performance criteria into project management systems and quality assurance protocols.
- Begin the process of BIM adoption by selecting several pilot projects that offer high potential for demonstrable success and clear returns on investment. Rigorous documentation of project outcomes and ROI will serve to build internal evidence, thereby supporting wider adoption initiatives throughout the firm.
- Make significant investments in ongoing professional development. Collaboration with universities and international BIM certification bodies should be pursued to offer employees recognized BIM qualifications that attest to their skills and competencies.
- Actively engage with supply chain partners - including subcontractors, specialist consultants and suppliers - by introducing them to BIM capability development programmes. This will ensure a unified approach to model quality across all levels of the project's supply chain.

Educational Institutions and Professional Bodies

- Make BIM a compulsory element within the curricula of civil engineering, architecture and quantity surveying undergraduate and postgraduate programmes offered by universities throughout Jordan. The BIM learning outcomes should be standardized and aligned with the current demands of the industry.
- Develop and provide BIM training materials, technical guides and standard documentation in Arabic. This is essential to address the language barrier that restricts access to valuable international BIM resources for many Arabic - speaking professionals.
- Establish dedicated Industry - Academia BIM Research Centers. These centers should focus on co - developing applied research projects, offering industry placement opportunities with BIM - active firms and acting as hubs for the delivery of continuous professional development courses.

Scientific Ethics Declaration

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Conflict of Interest

* The author declares that there is no conflict of interest

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References

- Abdirad, H., & Dossick, C. S. (2016). BIM curriculum design in architecture, engineering, and construction education: A systematic review. *Journal of Information Technology in Construction (ITcon)*, 21, 250–271.
- Abubakar, M., Ibrahim, Y. M., Kado, D., & Bala, K. (2014). Contractors' perception of the factors affecting building information modelling (BIM) adoption in the Nigerian construction industry. In R. Issa & I. Flood (Eds.), *Computing in Civil and Building Engineering (2014)* (pp. 167–178). Reston, VA: American Society of Civil Engineers.
- Amuda-Yusuf, G. (2018). Critical success factors for building information modelling implementation. *Construction Economics and Building*, 18(3), 55–74.
- Arayici, Y., Egbu, C., & Coates, P. (2012). Building information modelling (BIM) implementation and remote construction projects: Issues, challenges, and critiques. *Journal of Information Technology in Construction (ITcon)*, 17, 75–92.
- Azhar, S. (2011). Building information modeling (BIM): Trends, benefits, risks, and challenges for the AEC industry. *Leadership and Management in Engineering*, 11(3), 241–252.
- Bani-Hani, K. A., & Al-Ghzawi, M. (2020). Assessment of building information modeling (BIM) adoption in Jordan. *International Journal of Civil Engineering and Technology*, 11(4), 112–125.
- Borenstein, M., Hedges, L. V., Higgins, J. P. T., & Rothstein, H. R. (2009). *Introduction to meta-analysis*. Chichester, UK: Wiley.
- Eadie, R., Browne, M., Odeyinka, H., McKeown, C., & McNiff, S. (2013). BIM implementation throughout the UK construction project lifecycle: An analysis. *Automation in Construction*, 36, 145–151.
- Eastman, C., Teicholz, P., Sacks, R., & Liston, K. (2011). *BIM handbook: A guide to building information modeling for owners, managers, designers, engineers and contractors* (2nd ed.). Hoboken, NJ: Wiley.
- Ghaffarianhoseini, A., Tookey, J., Ghaffarianhoseini, A., Naismith, N., Azhar, S., Efimova, O., & Raahemifar, K. (2017). Building Information Modelling (BIM) uptake: Clear benefits, understanding its implementation, risks and challenges. *Renewable and Sustainable Energy Reviews*, 75, 1046–1053.
- Hiyassat, M. A., Hiyari, M. A., & Sweis, G. J. (2022). Factors affecting BIM implementation in the Jordanian construction industry. *International Journal of Construction Management*, 22(13), 2510–2521.
- Hwang, B. G., Zhao, X., & Chin, E. W. Y. (2017). International construction joint ventures between Singapore and developing countries: Risk assessment and allocation preferences. *Engineering, Construction and Architectural Management*, 24(2), 209–228.
- International Organization for Standardization. (2018). *Organization and digitization of information about buildings and civil engineering works, including building information modelling (BIM)—Information management using building information modelling—Part 1: Concepts and principles* (ISO Standard No. 19650-1:2018). Geneva, Switzerland: Author.
- Kassem, M., & Amor, R. (2021). BIM policies in the UK: Analysis and future directions. *Automation in Construction*, 125, 103606.
- 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.
- Morlhon, R., Pellerin, R., & Bourgault, M. (2014). Building information modeling implementation through maturity evaluation and critical success factors management. *Procedia Technology*, 16, 1126–1134.
- Olatunji, O. A. (2011). Modelling the costs of corporate implementation of building information modelling. *Journal of Financial Management of Property and Construction*, 16(3), 211–231.
- Pinto, J. L., & Slevin, D. P. (1989). Critical success factors in R&D projects. *Research-Technology Management*, 32(1), 31–35.
- Rockart, J. F. (1979). Chief executives define their own data needs. *Harvard Business Review*, 57(2), 81–93.
- Smith, P. (2014). BIM implementation—Global strategies. *Procedia Engineering*, 85, 482–492.
- Succar, B. (2009). Building information modelling framework: A research and delivery foundation for industry stakeholders. *Automation in Construction*, 18(3), 357–375.
- Sweis, G. J., Alzubi, M., & Saleh, R. (2019). Investigating the critical success factors for BIM implementation in Jordan. *Jordan Journal of Civil Engineering*, 13(4), 588–601.

- Ugwu, O. O., & Kumaraswamy, M. M. (2007). Critical success factors for construction ICT projects—Some empirical evidence and lessons for emerging economies. *Journal of Information Technology in Construction (ITcon)*, 12, 231–249.
- Won, J., Lee, G., Dossick, C., & Messner, J. (2013). Where to focus for successful adoption of building information modeling within an organization. *Journal of Construction Engineering and Management*, 139(11), 04013014.

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