

IMPLEMENTATION OF BIM IN POST-WAR, FRAGILE ECONOMY CONTEXT: CHALLENGES AND POTENTIALS IN THE CASE OF SYRIA

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Abstract

The restricted adoption of Building Information Modeling (BIM) within the Architecture, Engineering, and Construction (AEC) sector could have adverse consequences. Despite its worldwide popularity, the utilization of BIM in post-war and financially strained contexts remains sparse. This study delves into the potential and challenges of implementing BIM in Syria as a case study. The paper identifies potential factors affecting the implementation of BIM in Syria by analyzing secondary data gathered from an extensive review of existing literature. This comprehensive examination aims to unearth insights into the multifaceted challenges and opportunities of introducing BIM within Syria's post-conflict AEC landscape. In addition, a comparative analysis will be conducted to assess the adoption of BIM in various countries, including Syria, offering valuable insights into regional disparities and best practices. The research findings pinpointed BIM implementation gaps and challenges within post-conflict contexts. Moreover, they delved into the intricate dynamics and specific obstacles to deploying BIM technologies in such environments. This comprehensive analysis laid the foundation for crafting a tailored implementation framework to navigate the complexities and constraints inherent in post-conflict settings, leading to a better understanding of the future implementation potentials. This framework aims to facilitate BIM technologies' effective and sustainable integration, ultimately fostering resilience and revitalization within these vulnerable contexts.

Keywords: Building Information Modelling, Reconstruction, Management, Conflict.

Introduction

Building information modelling (BIM) digitally represents all the physical or functional elements of the buildings, helping to create a trustworthy and transparent environment involving all the stakeholders and facilitating their interaction through a shared platform where all the data is kept up-to-date and all the project teams are integrated and communicated the data to assure the efficiency of the resource sharing in the different phases of the project. BIM is known in the AEC industry (Architecture, Engineering and construction) as the design management methodology, connecting all the project phases by using three-dimensional models containing all the characteristics of the building. (Gharaibeh, Eriksson, & Lantz, 2024)

BIM plays a vital role in cost estimation, visualization, time framing, clash detection, and joint data coordination led by its parametric abilities, and that is what makes it advocated by scholars to be adopted in the construction supply chain, to overcome the challenges such as fragmentation and complexity. By looking at the nature of construction projects labelled with complexity, as it involves multiple stakeholders, condensed multidisciplinary coordination uninterrupted material flow, and simultaneous activities at shared locations, 'BIM's significance prevails. (Khanzode, Fischer, & Reed, 2008). Despite the growing attention and interest in implementing BIM in the AEC industry, in recognition of the 'technology's financial

benefits and the pivotal novel business model to organizational decision-makers, its implementation in the post-war context is still challenging and subject to varying circumstances. (Alhammad, Al-Mohammad, & Rahman, 2024).

Syria, the country entering its thirteenth year of conflict, is no exception. The ongoing conflict has caused massive destruction in most regions' infrastructure and physical texture. The aftermath is marked by chaos and nepotism in administration, economic fragility, instability, fragmentation and lack of basic services, which reflects deeply on the AEC sector development. (Keilo, 2023) Thus, there is a huge need to integrate modern design methodology and tools to help enhance the sector, which had suffered from poor performance and lack of technology even before the conflict. Such as delays, exceeding the budget, inferior quality, low productivity, lack of self-sustainability and more, are among the most prominent challenges that have been facing project implementation in Syria. (Mehran, 2016) Even though there have been several steps taken to ensure the integration of BIM in the AEC sector in Syria, it still faces several challenges and obstacles, which might hinder its full implementation in the future, such as economic, technical, organizational and legal barriers. (Elhendawi, Smith, & Elbeltagi, 2018)

Understanding and addressing factors affecting BIM implementation is crucial for project success. Stakeholders should develop tailored measures to tackle these factors. Identifying these factors helps prevent project failures and is essential for successful BIM adoption. Distinguishing between critical and non-critical factors enables the development of effective strategies. Lessons from pioneer countries can guide low-income economies, but high-cost strategies may not be feasible for them. Therefore, identifying factors specific to low-income economies is vital for crafting appropriate, cost-effective strategies and preventing their exclusion from BIM implementation efforts. (Al-Mohammad, Haron, Aloko, & Rahman, 2023)

The paper investigates the possible potential and challenges of BIM implementation in Syria, a post-war, fragile economic context country. It aims to lay the foundation for crafting a tailored implementation framework to navigate the complexities and constraints inherent in post-conflict settings, leading to a better understanding of the future implementing potentials. This framework aims to facilitate BIM technologies' effective and sustainable integration, ultimately fostering resilience and revitalization within these vulnerable contexts. The study's findings can be useful for other nations with similar economic conditions, especially post-conflict low-income economies.

Materials and Methods

The methodology of this study involves a comprehensive collection and analysis of secondary data from various reliable resources. Besides, the research holds a comparative approach to shed light on the practices in BIM implementation in diverse national contexts. It will contrast the efforts of BIM implementation in three settings: one of the countries facing post-conflict challenges, one of the developing countries and another country known for leading BIM implementation in the AEC sector.

This research will, therefore, use this comparative study to provide better insights into the complexities and nuances of BIM implementation in different socio-political and economic environments. The research seeks to identify common challenges, innovative strategies, and best practices that emerge from these contrasting scenarios.

The Importance of BIM in the AEC Sector

BIM was developed as an organizational method to become an alternative to the traditional paper-based project communication and delivery approach, which allows a bigger margin of errors and omissions causing over costs, delays, and tension and clashes between the several

involved stakeholders. (Ibrahim & Al-Kazzaz, 2021) Thus, BIM can tackle such issues through several channels.

Details Level

BIM emerged as a solution to problems identified with conventional systems, particularly the lack of adequate detailed documentation. Unlike the traditional CAD techniques, where data are merely graphical entities like lines and arcs, BIM introduces intelligent contextual semantic models representing walls and columns. On the other hand, conventional CAD systems lack the parametric tools, and BIM's parametric approach to the process assures that modifications to one variable are carried across others to update the model. (Azhar, Khalfan, & Maqsood, 2015)

Coordination and Communication Level

There is always a challenge in the coordination between the different teams in architectural projects. It is usually standard to identify and resolve issues by comparing several 2D drawings. Through the BIM model, plans are combined from different disciplines, and clash detection can be done. (Rokooei, 2015) (Figure 1)

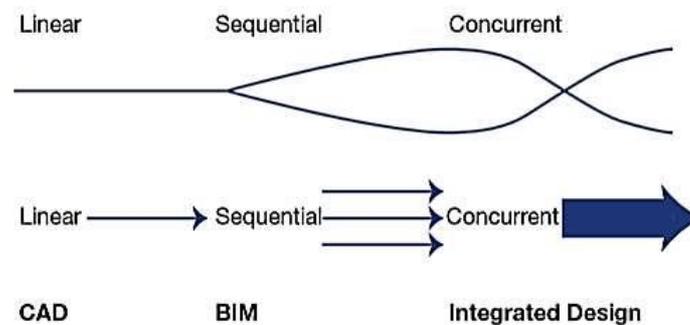


Figure 1. Different project workflow between the traditional CAD and BIM

Database Level

The conventional CAD method had no reliable digital database for project operations. Data became unusable after the project was completed because the data was lost. However, the BIM provides an integrated solution to the users because it gives an individual virtual 3D model of the building. The only source integrates all the details and documents of a project in coordinated data thus making accessing and reusing the data easier. (Ibrahim & Al-Kazzaz, 2021)

Design Complexity Level

BIM, or Building Information Modeling, modernizes traditional architecture practices by employing sophisticated technologies to meet complex design challenges. In projects such as the Shanghai Tower and Foundation Louis Vuitton, BIM simplifies the construction process through clash detection, risk mitigation, and improvement of communication. Through its single platform for collaboration and simulation, BIM optimizes project management and quality control for better, more effective delivery. (Gong, Fang, & Zuo, 2022)

Time Scheduling and Cost Estimation

Potential advantages of BIM over traditional CAD methods include: first, visualization of construction execution sequences and schedules, which cannot be captured by 2D graphics; second, automatic data analysis, quantification, and precise cost calculations through BIM tools, which avoid developing error-prone manual spreadsheet formats. These capabilities enhance the quality of project planning, efficiency, and accuracy, all assets of BIM in the realm of construction management. (Moses, Heesom, & Oloke, 2020)

BIM implementation can help the construction sector in post-war Syria and make projects more efficient, accurate, and collaborative, many challenges exist within the sector, and by investing in such a system, growth can be fostered.

BIM Practices in Other Countries

Some researchers argued that establishing clear guidance and a methodology is crucial to unlock the full benefits of BIM. Various researchers have developed frameworks, models, and methodologies for BIM implementation:

Olugboyega's strategy for the creation of a BIM environment includes the following steps: (1) Acquisition of BIM software and hardware, which must be customized to the aim of the project, (2) Development of a library of BIM contents, (3) Establishment of BIM standards, and (4) Establishment of a BIM platform with tools for interoperability, collaboration, integration, conflict detection, and communication compatible with the chosen BIM software and hardware.

Wang et al. developed a BIM user acceptance model based on the technology acceptance model (TAM) (Figure 2).

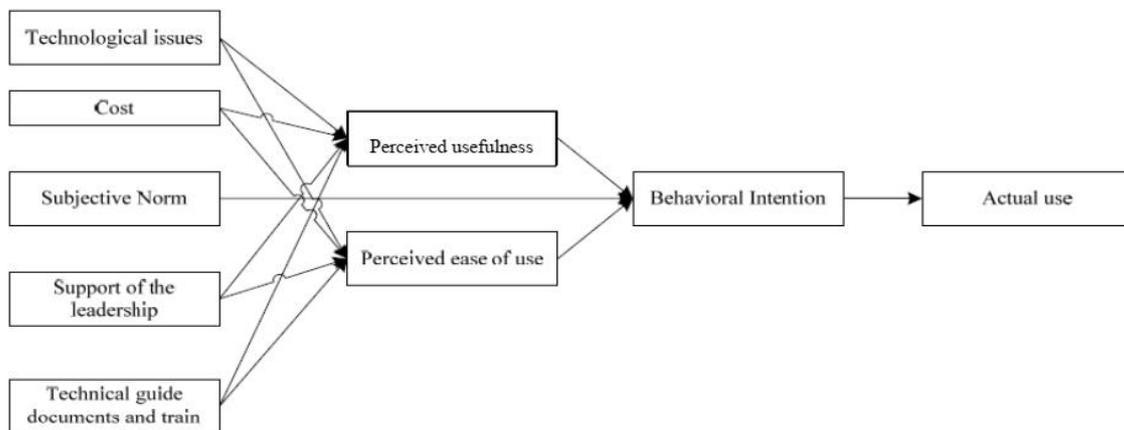


Figure 2. BIM Users Acceptance Model (Wang et al., 2013)

The EU BIM Task Group has published a strategic framework for BIM adoption in the public sector, which includes building capacity, pilots, measurement of performance, case studies, and institutionalizing change.

Furthermore, Jung and Joo introduced a BIM implementation framework elaborated in Table 1. (Elhendawi et al., 2018)

Table 1. BIM implementation framework by Jung and Joo

Technical (T)	Perspective (P)	Construction Business Function (C)		
1. Data Property	1. Industry	1. R&D	6. Quality Mgt.	11. Estimating
2. Relation	2. Organization	2. General Admin.	7. Cost Control	12. Design
3. Standards	3. Project	3. Finance	8. Contracting	13. Sales
4. Utilization		4. HR. mgt.	9. Materials Mgt.	14. Planning
		5. Safety Mgt.	10. Scheduling	

BIM in the UK

The UK is considered to be one of the global leaders in the adoption of BIM technology. In fact, in 2019, just about 70% of professionals were reported to have used BIM on projects, and

the rest were at least aware of its existence. This was due to the government's construction strategy in 2011, which directed that on all projects, BIM Level 2 should be used on projects starting in 2016. BIM Level 2 describes the process of designing and storing 3D models in one shared environment for access by all stakeholders; this encourages adoption across both public and private sectors. The successful delivery of the UK Government Construction Strategy Level 2 BIM program places the UK as a global leader and is a landmark event in the digital transition of the built environment (Figure 3). (Hammoud, 2021)

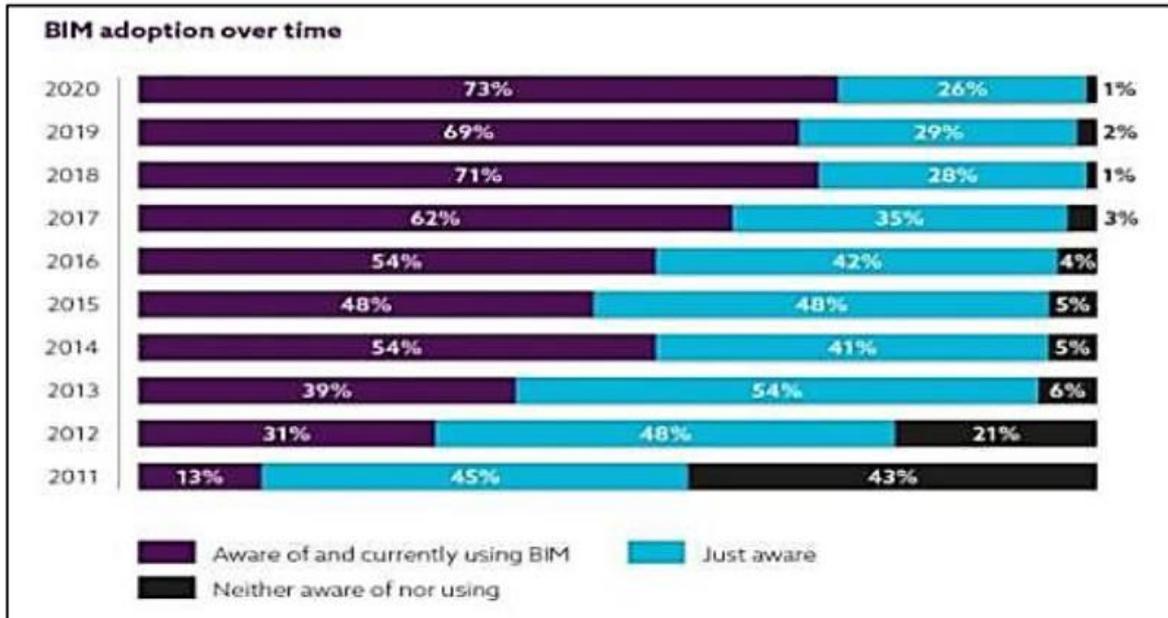


Figure 3. BIM Adoption over time (NBS National BIM Report 2020)

Initial costs, difficulty in benefits evaluation, difficulties in training, legal issues, interoperability problems, and a general lack of knowledge and awareness in the industry are some of the barriers to implementing BIM Level 2. Significant investment in terms of software and hardware transformation and training of staff, along with difficulty in assessing benefits, is the biggest challenge. Moreover, training the employees for new workflows is important, along with addressing the legal issues regarding data ownership. Other issues are interoperability between software and a general lack of understanding of BIM's maturity levels. Further, the industry is at large deficient in expertise, especially in small practices, which adds to the complexity of the difficulties. These barriers highlight the need for comprehensive training, addressing legal concerns, and increasing awareness to facilitate the successful adoption of BIM Level 2. (Awwad, 2024)

BIM in Portugal

The construction sector represents 6.2% of the total employment and approximately 5% of the national GDP in Portugal. According to the Eurostat data, from 2010 to 2021, the sector represented between 5 and 6% of the Gross Value Added within the European Union. In turn, these data confirm the role of the construction sector as an economic driver and source of employment. While of great importance, the sector has changed little, with traditional problems, such as delays in completion and cost overruns, being persistent, but concerns with cleaner production and sustainability in the sector have grown. (Sun, Jiang, Skibniewski, Man, & Shen, 2015)

The AEC industry in Portugal is generally characterized as being slow and resistant to technological advancement; it leans on manual labour, and antiquated methods with very little technological integration. The percentage of R&D investment in the AEC sector is extremely low, ranging from 0.01% to 0.4% of the value added in construction, compared to 3-4% in manufacturing and 2-3% in general industries. This lack of innovation investment has been a persistent problem; studies have proposed that increasing R&D spending could help to remediate productivity shortfalls relative to other sectors. New technologies and methodologies, such as Artificial Intelligence, Sustainability, Lean methodology, Business Process Reengineering, Total Quality Management, and Building Information Modeling, are being explored in the quest to fill this gap.(Onososen & Musonda, 2022)

Challenges that face the adoption of Building Information Modeling are many, varying across various fronts. Return on investment may be perceived as negative due to high software acquisition costs and unfamiliarity with the gains of BIM. Secondly, the transition to BIM will require significant IT investments in hardware and infrastructure, besides considerable time and capital investment to train employees in new workflows and protocols. Cultural and management resistance to change further complicates implementation efforts, while a lack of standardized BIM strategies and government regulation creates regulatory hurdles. The difficulty in finding skilled BIM professionals further complicates this, along with the fact that the construction industry is characterized by its fragmented state. These are the multifold problems that challenge the wide acceptance of BIM in the construction industry.(Ma, Jia, Ding, Shang, & Jiang, 2019)

BIM in Afghanistan

Afghanistan is described as one of the most war-torn countries in the world, where post-conflict reconstruction and economic recovery are formidable challenges. The damage to the infrastructure, including the road network and air transport sector, makes reconstruction processes more difficult. Both stakeholders and the government face severe challenges in rebuilding the AEC industry in such a war-battered region. More local factors, including political instability, dependency on financial aid, crime, corruption, and access to land, have combined to aggravate the scenario. Critical success factors for project schedule performance in Afghanistan have been recognized, with their intensity magnified by the post-conflict nature of the country. More precisely, Afghanistan faces a significant obstacle in the form of political and economic instability that impedes sustainable development and economic recovery of the country's AEC organizations. All in all, Afghanistan, due to its local environment, encounters particular uncertainties, constraints, and volatilities that are detrimental to the advance of post-war reconstruction and economic revival.

Barriers to BIM implementation within Afghanistan's AEC industry include technological, environmental, and organizational factors. Technologically, this includes perceived value, software interoperability issues, and high upfront costs for software and hardware purchases, which, coupled with poor financial resources and access to finance, makes implementation very difficult. The environmental barriers include low market demand because of reluctance by clients and the unsuitability of some projects, due to a lack of clear implementation guidelines by the government. Some organizational challenges are the risk of the BIM implementation contracts concerning data ownership and risk distribution, stakeholder resistance to change, and insufficient training—a reluctance to be a BIM adopter and changing the organizational culture. Reducing these barriers will require steps to address financial constraints, promote awareness of the benefits of BIM, mandate implementation, and provision of complete training and support to all stakeholders. (Al-Mohammad et al., 2023)

BIM Implementation Potentials and Challenges in The Case of Syria

Challenges to BIM implementation exist in economic, technical, organizational, legal, and human domains as follows:

In the case of Syria, there are barriers to the diffusion of BIM usage within the construction industry due to economic difficulties. The ongoing conflict and instability in the region have rendered a significant decrease in construction projects, hence the diminished demand for this kind of innovative technologies, including BIM, among project stakeholders. Besides, the unpredictable economic environment and lack of confidence in the return on investment in the country deter organizations from investing in the implementation of BIM. Resources, being squeezed tight because of the conflict, may mean that the priority of investment will be on immediate needs and not on long-term investment in technological advancements like BIM. Additionally, some economic sanctions on Syria might bar access to resources and expertise that will be used to effectively implement BIM, therefore increasing the economic challenges for the construction industry in the adoption of this technology. Economic challenges represent the need for infrastructure rebuilding, economic prospects rebuilding, and the creation of an enabling environment that could invest in advanced technologies for the construction industry, such as BIM.

From a technical perspective, a lot of challenges exist in many situations, including Syria, which inhibit the implementation of effective Building Information Modeling. First, the recovery process would need internet connectivity and a reliable power supply infrastructure, as BIM processes are data intensive. The infrastructure damage caused by the conflict in Syria could have severely compromised the availability and stability of these essential utilities. Secondly, entrenched beliefs in the adequacy of conventional techniques of construction pose a big challenge. Many parties will not shift from traditional techniques to BIM due to either unawareness of its capacities or distrust in its potential benefits in comparison to conventional methods. Besides, the absence of standards and frameworks related to interoperability aggravates technical challenges. Without explicit guidelines and harmonized standards on the exchange of data and coordination among different software of BIM, integration and coordination become burdensome, which impedes smooth implementation in projects and across stakeholders. Technical challenges are not only addressed by investment in the revival of infrastructure but also in raising awareness and education regarding the benefits accrued from the use of BIM, while encouraging teamwork among the players in the industry toward developing standards and protocols that are interoperable and applicable to the Syrian context.

On the organizational side, poor cooperation by different construction disciplines will then affect the adoption of BIM. In Syria, like in most countries, this negatively affects how the seamless integration of BIM processes between the different project phases and stakeholders face fragmented communication and siloed workflows. Furthermore, the lack of support from governments exacerbates the organizational challenges, as a result of unclear policies and incentives not encouraging increased BIM adoption and cooperation.

Legally, designing contract provisions that accommodate the implementation of BIM and spell out the responsibility of the parties involved is another challenge. Since there are no standardized contractual frameworks in Syria that relate to the use of BIM in projects, it easily complicates legal agreements where liabilities, data ownership, and risk allocation remain uncertain. Clear and comprehensive contractual arrangements would therefore help in mitigating the potential legal risk within the project. The new law of data protection adopted in April 2024 is also a major obstacle since it does not consider the digitalization of contracts, bids, and tenders in AEC.

The human factor issues include a lack of competent and trained personnel in BIM. A talent shortage in Syria, aggravated by conflict and professional displacement of human capital, may

make it hard to access competent and well-qualified BIM practitioners. Second, low awareness of BIM benefits and resistance to change from stakeholders are significant barriers. Older engineers will not want to use BIM since it means that they have to switch over to new technologies, which they might not want to do since they know all the traditional software. These human barriers require focused training programs, awareness campaigns, and change management strategies that meet particular needs and apprehensions among the various stakeholders in the Syrian construction industry.

Work is required at all levels of the industry to be vigorous in creating awareness, promoting collaboration, developing standards, and providing training support. Comparison results between the case studies and Syria are elaborated in Table 2

Table 2. The comparison results of barriers to implementing BIM in the UK, Portugal, Afghanistan, and Syria (Developed by the author)

Aspect	UK	Portugal	Afghanistan	Syria
Adoption Rate	High (70% usage reported in 2019)	Slow adoption, traditional methods prevail	Low adoption due to war-torn conditions, significant reconstruction needs	Low adoption due to economic difficulties and conflict, diminished demand for innovative technologies
Government Influence	Strong government mandate for BIM Level 2 adoption	Limited government influence on BIM adoption	Limited government capacity due to political instability and economic challenges	Limited government support due to ongoing conflict and economic instability
Economic Factors	Initial costs are high but ROI recognized	Traditional industries with low R&D investment, slow to adapt to new technologies	Economic challenges compounded by war damage, limited financial resources, and access to finance	Economic difficulties and conflict deter investment in BIM implementation
Technical Challenges	Interoperability issues, upfront costs, training difficulties	Lack of technological integration, low R&D investment	Lack of infrastructure, connectivity, and expertise, compounded by post-conflict conditions	Infrastructure damage, entrenched beliefs, lack of standards, and unreliable utilities
Organizational Issues	Resistance to change, lack of collaboration, insufficient support	Slow cultural shift, resistance to change, lack of innovation investment	Limited organizational capacity, stakeholder resistance, cultural barriers to adoption	Fragmented communication, lack of government support, poor cooperation between disciplines
Legal Concerns	Clear contractual provisions for data ownership and responsibilities	Legal frameworks may be outdated or inadequate, need for BIM-specific regulations	Legal uncertainty due to conflict, lack of clear regulatory frameworks, challenges in enforcing contracts	Absence of standardized contractual frameworks, legal complexities, uncertain liabilities
Human Challenges	The dearth of skilled personnel, awareness issues, resistance to change	Limited expertise, lack of awareness of BIM benefits, resistance to change	Limited skilled workforce, awareness challenges, resistance to change, compounded by war conditions	Shortage of competent personnel, low awareness, resistance to change, professional displacement

Proposed Model for BIM Implementation in Syria

An integrated implementation strategy for BIM in Syria that includes technical, organizational, legal, and human factors is proposed. (Figure 4)

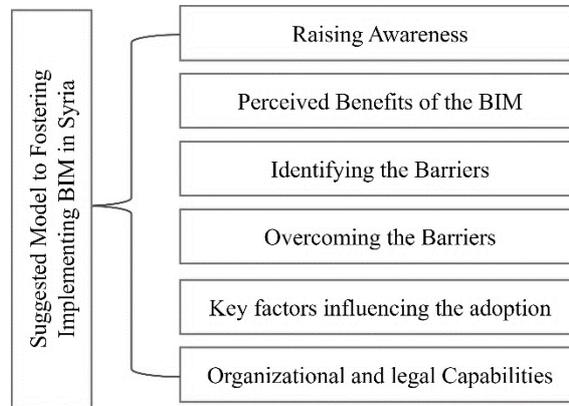


Figure 4. Suggested BIM implementing model in Syria (Developed by the author)

On a **technical level**, strong internet connectivity and power supply infrastructures need to be guaranteed to support BIM processes, even though the war has led to huge damage to Syria's infrastructure. These challenges can be mitigated by investment in the revival of infrastructure and by increasing awareness of the benefits of BIM. The use of GIS database, which was established before the war, can speed up data retrieval and foster the benefits of BIM implementation.

Organizationally, the lack of cooperation and coordination between construction disciplines has been an issue in BIM implementation. Regionally implemented organizational frameworks can enforce coordination and governmental support through well-defined policies and incentives.

Legally, contractual provision design for BIM implementation is significant. Tailor-made standard contractual frameworks for projects implementing BIM are needed to clarify responsibility and diminish legal risk. These frameworks can be included in the electronic government platform started to be established in 2024.

On the human side, the shortage of trained personnel and resistance to change should be addressed. Targeted training programs, awareness campaigns, and change management strategies can help overcome these barriers so that BIM is adopted by the Syrian construction industry at large. (Table 3)

Table 3. The Suggested solutions for the discussed challenges facing BIM implementation in Syria.

Aspect	Challenges	Proposed Solutions
Technical	<ul style="list-style-type: none"> - Damage to infrastructure due to war - Limited internet connectivity and power supply 	<ul style="list-style-type: none"> -Investment in infrastructure revival -Guarantee strong internet connectivity and power supply infrastructure to support BIM processes -Increase awareness of the benefits of BIM to encourage investment and support for infrastructure reconstruction
Organizational	<ul style="list-style-type: none"> - Lack of cooperation and coordination 	<ul style="list-style-type: none"> - Implement regionally enforced organizational frameworks to ensure coordination and governmental support - Define clear policies and incentives to promote cooperation and coordination between construction disciplines
Legal	<ul style="list-style-type: none"> - Lack of standardized contractual provisions 	<ul style="list-style-type: none"> - Develop tailor-made standard contractual frameworks for projects implementing BIM to clarify responsibility and reduce legal risk
Human	<ul style="list-style-type: none"> - Shortage of trained personnel - Resistance to change 	<ul style="list-style-type: none"> - Implement targeted training programs to address the shortage of skilled personnel in BIM implementation - Conduct awareness campaigns to highlight the benefits of BIM and mitigate resistance to change - Employ change management strategies to facilitate the smooth adoption of BIM across the Syrian construction industry

Findings and Discussion

- There is a difference in the adoption rate of BIM between the different countries, for instance, The UK has one of the highest rates, meanwhile countries suffering from economic hardship and conflict, such as Syria, have a very poor adoption meaning reduced demand for innovative technologies like BIM.
- Boosting the adoption of BIM depends strongly on solid government mandates, such as those of the UK. On the contrary, limited government capacity, fragmentation and multiple *de facto* authorities in countries such as Afghanistan and Syria translate to weak mandates.
- Economic factors are considered to be one of the most significant barriers to BIM adoption due to the high initial cost and the financial resources required to attain BIM technology. This can be the case in times of war and financial crises, like in Syria and Afghanistan.
- Technical issues such as interoperability and infrastructural damages hinder the proper implementation of BIM in situations like in the post-war countries of Syria and Afghanistan.

- Weak facilitation and coordination between several stakeholders and construction disciplines accompanied by the lack of governmental support exacerbate the organizational issues.
- Lack of standardized contracting frameworks for implementing BIM, poses several legal issues causing more complications to the status quo and escalates the legal risks, as has been witnessed in conflict situations such as in Syria and Afghanistan.
- Lack of skilled human resources due to immigration, deaths or displacement in the post conflict aftermath, and the resistance to change are considered major barriers to the adoption of BIM in countries like Syria, where professional displacement and low awareness further complicate the challenge.

Discussion

On organizational and legal levels, the challenges facing BIM implementation in Syria are huge as could be recognized in other contexts. Fragile and poor communication and loose workflows are obstacles in the face of smooth integration between the different phases of the project and among stakeholders. The absence of standardized contracts for BIM projects presents a legal challenge, resulting in complex agreements with unclear liabilities and data ownership. Despite the great prospects and benefits of BIM in cost estimation and project quality, it has limited adoption in post-war contexts like Syria.

The comparative analysis of other countries sheds light on regional disparities and good practices. The findings identify implementation gaps and challenges that are peculiar to the setting of post-conflict and also lay the foundation for an implementation framework. This implementation framework is targeted at the integration of BIM, thereby enhancing resilience and revitalization in vulnerable settings.

Conclusion and Recommendations

BIM is one of the most significant technological breakthroughs in the engineering field. Any developing nation should adopt it as the mainstream tool. Just as people moved from hand-drawn plans to CAD, people are going to resist the change, but BIM is going to completely replace its predecessor. Currently, the Syrian AEC industry is in this transition from CAD to BIM, and it is crucial for the government and other concerned parties to actively support widespread adoption to catch up with the fast-changing technological world.

Due to the ongoing conflict and hostile laws in Syria, it's challenging to adopt BIM; however, some steps can be taken to make the most of it. The author believes that making Level 2 BIM compulsory for large-scale projects should be done gradually. As in 2000s the chambers of architects and municipalities started to ask for CDs with the drawings of the projects using CAD, replacing the manual drawings for getting construction license, similar gradual approach can be implemented. Looking forward to the plans, a roadmap needs to be set out for BIM adoption in Syria, but this may come with some unexpected hurdles for many engineers. Therefore, the following is proposed for a smoother transition:

1. BIM can be introduced to the students at engineering faculties and institutes by holding academic conferences or introductory courses included in the curriculum.
2. Regular training programs and workshops should be conducted for engineers to train and equip them with the knowledge and skills about BIM implementation.
3. Governmental incentives and benefits should be provided to firms and engineers willing to implement BIM in their projects.

This research informs about the barriers and facilitators for implementing BIM in post-war low-income economies and offers great value to researchers and policymakers. To facilitate BIM, local governments should encourage local demand, stimulate pilot projects, and work on removing the challenges to obtain successful BIM implementation within the AEC industry.

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