



## Comparing BIM Adoption around the World, Syria's Current Status and Future

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### Abstract

BIM (Building Information Modeling) is an old-new and ever evolving concept, technology, and method of construction, it's been a while since BIM obligated itself as a necessity not just a luxury, due to the massive benefits it had brought to the AEC industry. BIM is in a constant phase of evolvement and maturity with new ideas and elements being brought up to the table each day, and thus; the BIM level in each project and/or country is in a different level depending on specific factors.

In this research we will take a closer look on various countries' experiences in BIM and what maturity level each one of them have reached, what are the major obstacles standing in the way of Adopting BIM Technology and how to avoid them, with some examples and statistics to enrich the content, and at the end, and after exploring the most possible number of examples around the globe, we will be looking exclusively on the Middle Eastern region's experience in implementing BIM and then dive deeper to the Syrian current BIM Status, and why Syria is still falling behind in this criteria, how to develop this technology in the future within the nation, what had been done so far to encourage the usage of this technology, and what benefits would it bring to the Syrian Construction and Financial Industry especially under the current circumstances and during the upcoming phase of reconstructing the devastated areas.

**Keywords:** BIM Adoption; BIM Implementation; BIM Around the World

### 1- Introduction

BIM or Building Information Modelling, is a process supported by various tools, technologies and contracts involving the generation and management of digital representations of physical and functional characteristics of places. The concept of BIM has been in development since the 1970s, but it only became an agreed term in the early 2000s. Development of standards and adoption of BIM has progressed at different speeds in different countries; standards developed in the United Kingdom from 2007 onwards have formed the basis of international standard ISO 19650, launched in January 2019. ISO 19650:2019 defines BIM as: "Use of a shared digital representation of a built asset to facilitate design, construction and operation processes to form a reliable basis for decisions".[1]

For the professionals involved in a project, BIM enables a virtual information model to be shared by 64

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the design team (architects, landscape architects, surveyors, civil, structural and building services engineers, etc.), the main contractor and subcontractors, and the owner/operator. Each professional adds discipline-specific data to the shared model - commonly, a 'federated' model which combines several different disciplines' models into one.[2]

BIM is often associated with Industry Foundation Classes (IFCs) and aecXML – data structures for representing information – developed by building SMART. IFC is recognized by the ISO and has been an official international standard, ISO 16739, since 2013.[3]

However, BIM is adopted in developed countries, BIM still in its first stage in developing countries [33, 34, 35, 36]

The main goal of this article is to discover BIM experience around the world especially in leading countries like United Kingdom, and also in the Arabian region and Middle east\_ Syria in particular\_ and compare between statistics gathered from research and conclude to recommendations to lead the way of implement this technology in Syria

## **2- Research Method:**

In order to make more accurate study and statistics, countries were divided as the following:

1- First Group: represents only the United Kingdom and the United States as both are widely considered BIM leaders, 2- Second Group includes the European especially France, Scandinavian Region, Germany, and Italy.

3- The third Group will include Asian countries of China, Singapore, Japan, Vietnam, and Indonesia.

4-Fourth Group will include Brazil, Australia, and Russia

5- The fifth Group will represent countries of the middle east exclusively: Kingdom of Saudi Arabia, and United Arab Emirates because they are the most stable countries in the region with serious construction movement.

6- And finally as the main discussion country, Syria will be the sixth and final group.

Each countries' BIM experience will be evaluated on a scale from 1 to 10 regarding four major elements:

1- BIM Awareness within nation,

2- Number of BIM projects under Construction/Study,

3- Years of BIM Experience,

4- Governmental decisions to encourage BIM Implementation within regarded nation.

and after examining and exploring the different aspects in each group and give the individual score in every category, a column chart will be illustrated to conclude each group's evaluation. and in the very end a combined chart of all six groups' final overall score will be presented to facilitate the comparison between those groups and reach a clearer result. And after the final result, we will be pointing out the main obstacles standing in the way of adopting BIM within our nation, and we'll conclude with recommendations and final thoughts to help implementing BIM in Syria.

### **2-1- First Group**

#### **2-1-1- The United Kingdom Experience**

The UK is widely perceived to be a global leader in the adoption of Building Information Modelling (BIM) technology. In 2019, almost 70% of all construction industry professionals were using BIM on projects, and most of the rest were well aware of its existence.[4]

The UK's position as a global BIM leader started with the government's 2011 construction strategy. In 2011, the new policy mandated that BIM Level 2 had to be used on all projects as a minimum by 2016. BIM Level 2 means the design and storage of 3D models in a common environment where all stakeholders can see them. This step led to an overall increase in BIM adoption in both the public and private sector.[5]

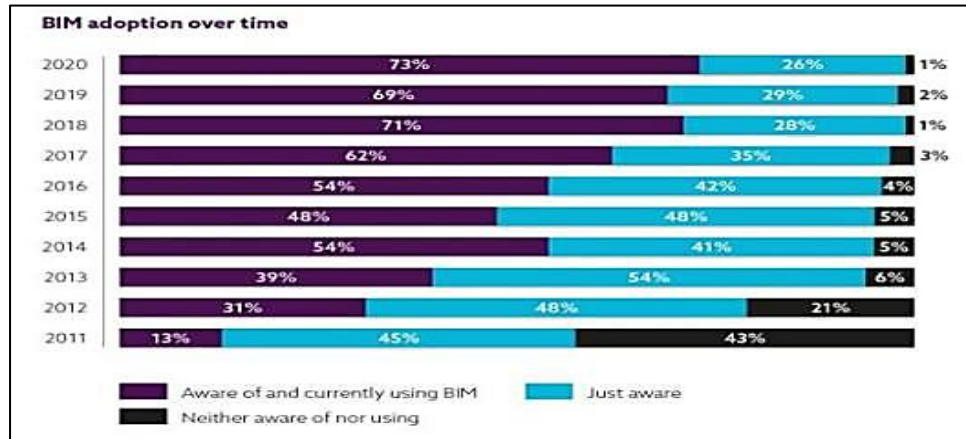


Figure -1- BIM Adoption over time “NBS National BIM Report 2020”

“The successful delivery of the UK Government Construction Strategy (GCS) Level 2 BIM program now sees the UK take on a global leadership role and represents an internationally unparalleled achievement on the journey towards the digitization of our built environment”

– National BIM Report, 2017.[4]. By 2017 some 62% of professionals were using a BIM system. Since then, the UK has continued to see rising BIM usage.[5] “The successful delivery of the UK Government Construction Strategy (GCS) Level 2 BIM program now sees the UK take on a global leadership role and represents an internationally unparalleled achievement on the journey towards the digitization of our built environment” –[ National BIM Report, 2017].[4] [5]

### 2-1-2- United States of America

BIM was initially utilized and successfully implemented in the 1990s all around the world. The United States were the pioneers to get their hands-on BIM development and adoption in the 1970s in the construction industry. BIM isn't mandated across all the states yet, but it is expected to grow significantly. Wisconsin state implemented and made it mandatory to implement BIM for public projects if equal or above the total budget of \$5 million. But it is only in the last three years the adoption of BIM has escalated. The implementation process of digitalizing the construction industry in the US has been slow, and it is because it is in the experimental form. Long term solutions and improvements are still under process.[6]

Till date there is no mandate from the government side to use BIM. Nonetheless, that doesn't mean the country is not taking the technology seriously. Many government departments have created their own criterion and published them to forums such as the National Institute of Building Sciences, but these standards are created independently with no relationship to one another. The US General Services Administration (GSA) formulated the National 3D-4D-BIM Program way back in 2003. This program established policy mandating BIM adoption for all Public Buildings Service projects.[6]

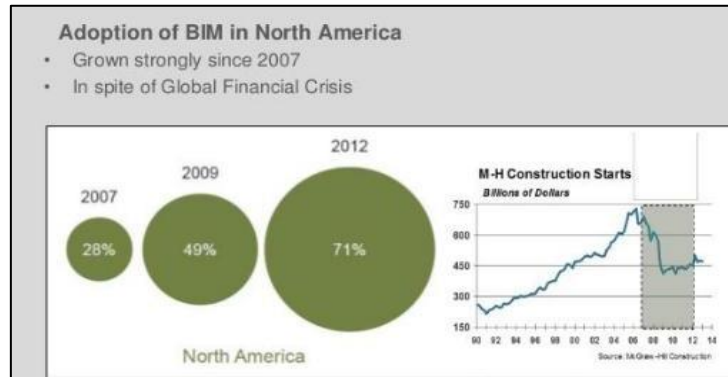


Figure -2-BIM Adoption in North America over the years, “McGraw-Hill in Construction”

The US government has recently released a plan that includes \$200 billion in federal money over the next decade to spur an additional \$1.3 trillion in spending from cities, states and private companies on major infrastructure projects. With expenditure reaching over 1.1 billion US dollars in 2017.[6]

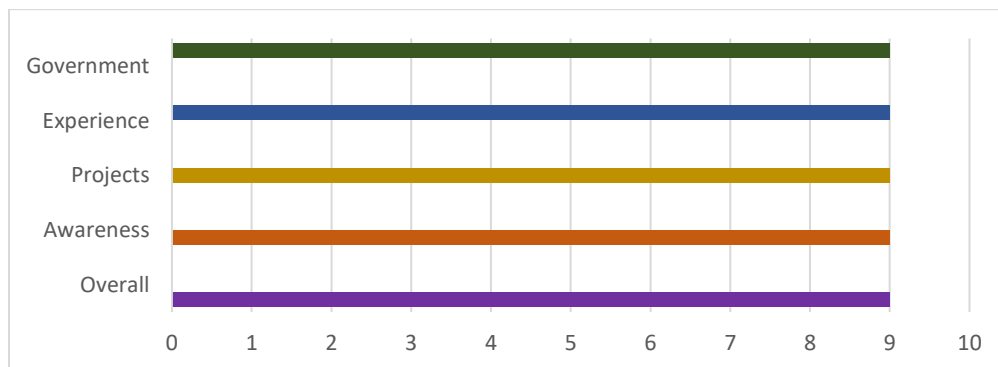
In recent years, US Architects developed what is called The Holy Grail of Successful BIM Adoption, as the picture below indicates it is consisted mainly out of three vital parts... The process, People, and Technology [7]

**2-1-3 First Group Evaluation**

As it’s been mentioned earlier, the UK and USA are widely considered as BIM Leaders and the first nations to implement BIM on a high level and their experience helped other countries and encouraged them to follow their lead, depending on the previous researches, reports and studies indicated above especially the national BIM report 2020 the, first group Evaluation will be 9/10 in each category.

- In order to set the standards of evaluation for other groups the final rating of first group is
- 1- BIM Awareness within nation: 9/10
- 2- Number of BIM projects under Construction/Study 9/10
- 3- Years of BIM Experience: 9/10
- 4- Governmental decisions 9/10

OVERALL 9/10



2-2- Figure -3- , Bar chart representing BIM factors and overall adoption for first group

## **Second Group**

### **2-2-1- France**

It has some of the world's biggest construction firms. Worth noting is the specific position of Bouygues (2nd construction group) who started using BIM at the end of the 2000s (for a Canadian hospital project) while the 3 other largest French construction firms are currently at the early adoption stage of BIM. BIM was then mostly used for complex (hospitals, airports...), large or repetitive projects (e.g., large office towers or residential housing).[9]

France does not yet have a single BIM standard enshrined in law or regulation, yet 35% of developers in France use BIM for their real estate projects. In addition, 50 to 60% of the leaders in the French construction market have switched to BIM, with level 2 as the most common maturity level [2021] [8]. At the end of 2018, BIM Plan 2022 was launched to encourage construction participants to integrate it into their workflows. Still, construction companies have struggled to agree since there is no single approved BIM standard.[8]

### **2-2-2- Scandinavian Region:**

The Scandinavian region is also a global leader in BIM adoption and Implementation. Norway, Denmark and Finland embraced the ArchiCAD software early and were amongst the first countries to adopt model- based design and advocate for interoperability and open standards and have been integral to the development of Industry Foundation of Classes (IFC) and another interoperability initiatives.[10]

### **2-2-3 Germany**

The transformation of the construction industry has been slower in Germany due to conflicts and miscommunication between the German authorities during the decision-making process.[8]

Approximately 70% of German construction companies use BIM at different levels. However, the majority are architects and design companies, making use of BIM in the design phase rather than construction and operation.

Since 2017, BIM has been mandatory for projects worth over €100 million. And from 31st December 2020, BIM became mandatory for all public contracts relating to the building of federal infrastructure.[8]

### **2-2-4 Italy**

The Italian Ministry of Infrastructure has introduced an initial plan for making BIM mandatory from 2019, but solely for projects above 100 million. This marks the first of a series of several deadlines, ending with full implementation by 2022, when BIM will become mandatory for all public procurement projects.[11]

### **2-2-5- Other European Countries:**

Even if the literature on BIM has progressively increased during the last decade, other countries currently do not yet have any specification about the use of the BIM process (e.g., Bulgaria, Greece and Malta) [12] highlighted by the EU BIM Task Group, "Without this top-down leadership, the sector's low and uneven adoption of information technology is likely to continue which would limit its opportunity to significantly improve productivity and value for money." The handbook delivered by the EU BIM Task Group "is a direct result of the European Commission's call for funding to form a European public sector network sharing best practices on BIM and for the development of a handbook of recommendations" [13]

### **2-2-6 Second Group Evaluation**

As a whole, countries of the European union seem to have decent amount of awareness and knowledge when it comes to the BIM topic, even though it varies and differs a lot when it comes to maturity level, and years of experience in these criteria, countries like Norway, France, Sweden.... Have more sophisticated

and developed techniques than others like Greece, Moldova who hadn't even started applying the technology in any kind of way.

On the other hand, we find a serious effort from all of the European Union's Governments to mandate or help bringing the BIM technology to the construction industry, and so we reach the final evaluation for the second group as the following:

- 1- BIM Awareness within nation: 8/10
- 2- Number of BIM projects under Construction/Study: 6/10
- 3- Years of BIM Experience: 7/10
- 4-

Governmental decisions: 7/10  
OVER ALL: 7/10

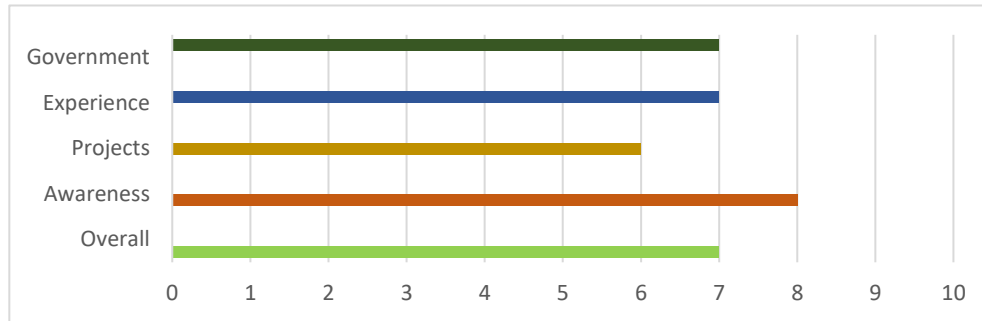


Figure -4- , Bar chart representing BIM factors and overall adoption for second group

## 2-3 Third Group

### 2-3-1 Singapore

The BCA (Building and Construction Authority) implemented the BIM Roadmap in 2010 with the aim that 80% of the construction industry will use BIM by 2015 [14]. This is part of the government's plan to improve the productivity by up to 25% over the next decade. To allow the public sector to take the lead, BCA collaborated with GPEs (government procurement entities) to request the use of BIM for their projects from 2012. These are remarkable policy to lead the industry.[14] Singapore Government has a policy to lead the implementation of BIM, whereas clients in private sector are evaluating the value and cost of BIM. It is obliged for architects and consulting engineers to use BIM for design. But the quality and density of the design drawings as output of BIM are not always enough, moreover, the drawings are not coordinated one another in many projects. General contractors accept BIM from product [15]

### 2-3-2 Japan:

There are differences in the development and the use of BIM software in Japan from those in other countries, such as the ability to check and fit the local building codes and standards.[16]

There are no articles that encourage BIM implementation in construction contracts unless specially defined so nobody covers the cost to set up BIM along with the contingency of the project is shrinking. BIM is still on the way to help stakeholders to reduce risk and uncertainty [14]

The Building Research Institute (a part of MLIT at that time) tried to develop a generic integrated information system for all of the general contractors. They launched a project team calling on the representatives of major companies to settle on definitions of requirements, but failed to achieve a practical system design. Individually developed software by private companies, Auto CAD etc., has expanded its

market share as a de facto standard, and the generic system lost the competition. Major general contractors have developed their own BIM software and its family as a “standalone” system until now.[16]

### **2-3-3 China**

The Chinese industry is in the early stages of BIM adoption. A survey taken by the China Construction Industry Association in 2012 found that less than 15% of 388 surveyed Chinese Construction Companies used BIM (McGraw Hill 2014). [10]

China is considered as the most advanced in implementing BIM especially by large firms within its AEC industry. Zhang et al. (2014) found that most of the surveyed respondents have little knowledge about BIM, in which the designers have more experience than the clients and the contractors [17]

### **2-3-4 Vietnam**

The Ministry of Construction of Vietnam is driving BIM application into the industry. The Institute of Construction Economics had developed the BIM Roadmap with the aim of requiring all public projects classified on level 2 to deliver BIM by year 2020. In December 12th 2016, the Deputy Prime Minister of Vietnam, Trinh Dinh Dung has signed and approved a framework on “Applying Building Information Modelling for construction and project operation & management activities. The framework has been officially approved and started its key milestone in January 2017. There are three parts in the framework consisting the planning of years 2017-2019, 2018-2020, and 2021 onwards. The first part from year 2017 to 2019 involves the preparation of necessary resources and skills for applying the BIM technology. From 2021 onwards, in sequence with the piloting period assessment, Circular Letter and Detailed Guidelines will be published by the Ministry of Construction, for BIM to be widely employed for the construction, operation and management activities. Apart from the program is funded by the National Budget, under the Law of National Budgeting, the cost for the BIM application in pilot projects stated in BIM roadmap, are included in the Law of Construction total investment [18].

### **2-3-5- Indonesia**

Although BIM was mostly used and restricted to 3D modelling and visualization, the BIM users noted the benefits accustomed by the technology in terms of the efficiency related to time, performance, cost and workforce. There is yet no standard and regulation for BIM implementation in Indonesia, where only large projects have started using BIM mostly in design and engineering phase [19]

Amongst initiatives held were workshops on BIM software, BIM panel discussions with professionals and academicians, BIM delegation with building contractors, BIM forum, and workshops on using BIM processes on integrated large scale project planning and delivery. In addition, some of BIM courses were available at Department 080008-3 of Architecture University of Indonesia (UI) and Department of Architecture Institute of Technology Bandung (ITB) to develop fundamental BIM knowledge amongst students [20]

### **2-3-6 Other Asian Countries:**

Although most of the developing countries in Asia highlighted the low level of BIM implementation in their respective regions, the benefits of using the technology have also been acknowledged.

Government mandates could unquestionably become one of the main drivers in encouraging the construction industry players to engage BIM into their practice. However, for some of the developing countries in Asia, the efforts from private sectors in escalating the BIM usage in the construction industry is no less important. [20]

### **2-3-7- Third Group Evaluation**

The Asian continent is the largest of all, and its country’s development status and technology is very various. Because of that, Major forces of technology in Asia such as China, and Singapore have somewhat good BIM Maturity and Awareness and has already established their own BIM standards.

other countries like Indonesia, Japan, and Vietnam, have started to consider BIM as a futuristic plan, in spite the huge difference between those three in terms of development and technology, they all still finding their way to a successful BIM adoption. Some other Asian countries which are considered less developed,

like Malawi, Bhutan, Afghanistan, are almost not aware of this Technology and it's pretty much normal considering the financial, political, and overall situation in those countries.

In conclusion, and because of the massive diversity noticed in this continent, only countries mentioned above will be considered in the final evaluation.

- 1- BIM Awareness within nation: 6/10
  - 2- Number of BIM projects under Construction/Study: 5/10
  - 3- Years of BIM Experience: 5/10
  - 4- Governmental decisions: 6/10
- OVERALL: 5.5/10

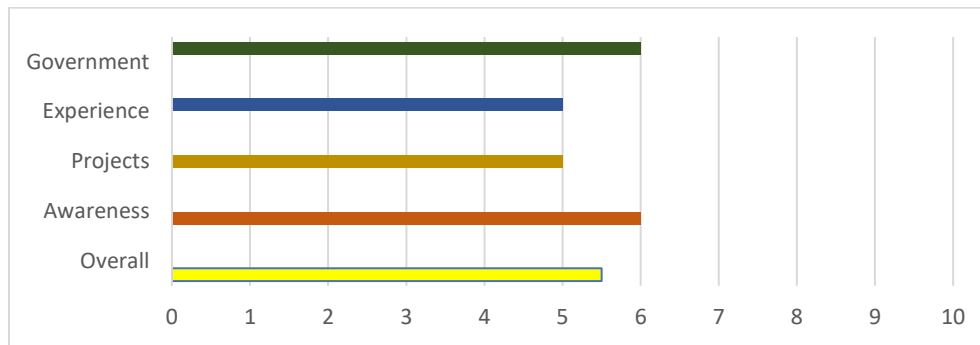


Figure -5- , Bar chart representing BIM factors and overall adoption for third group

#### 2-4- Fourth group:

##### 2-4-1 Brazil

Brazil's adoption of BIM has been slow, with only private individuals and few fragmented public initiatives fully embracing it "In Brazil, although BIM is not mandated at any level, industry. Reports shows that the use of BIM in Brazil is focused more on cost control at the construction phase rather than on the collaboration with owners. This represents a reversed BIM usage pattern to the one witnessed in other countries (UK, France, US, Germany, etc.) where BIM entailed more collaboration with owners and other project stakeholders. This use of BIM and the maturity level of contractors in Brazil could trigger a middle-out type of implementation pressure across the supply chain.[21].

Brazil has the largest economy in Latin America and has a major influence on the South American region. Brazilian Construction market was escalated by the hosting of major events such as the FIFA World Cup 2014 and The Olympic Games 2016. A lot of international firms worked in Brazil and influenced the BIM scene and lifted the level of BIM implementation by local market.[10]

##### 2-4-2 Australia

Adoption of BIM concepts in Australian construction industry can be traced back to a decade or earlier. However, in the past five years or so the interest in BIM adoption has intensified among numerous stakeholders in the ACE sector. In essence, momentum is building in the Architectural, Engineering and Construction (AEC) sector in Australia for adopting BIM based practices. The adoption trend of BIM is backed up by numerous initiatives engaging and informing the stakeholders about the potential productivity gains and best practices.[22]

As part of improving BIM practices, continuous research into different aspects of BIM is been conducted by Australian Universities and research institutions. Research into BIM has been funded by a number of Australian government funding bodies including CRC-CI (Corporate Research Centre for Construction Innovation), ARC (Australian Research Council) and OLT (Office for Learning and Teaching).[22]

##### 2-4-3 Russia

In Russian Federation the bulk of the designers in the field of civil engineering are at the first level now. Today, however, Russia has all chances to go to the second level and further to the third level. Of course, this is absolutely evolution and time-consuming process. And it is necessary to develop own intellectual tools for each design specialty and link them into a single technological process.[22]

In March 2015 the Working Group of BIM implementation was established by Ministry of Construction Industry, Housing and Utilities Sector (Minstroy, 2015). The major target of the Working Group is support of the realization of governmental phased plan of Building Information Modelling implementation in civil and industrial construction design field (Minstroy, 2014).[23]

On 22nd April 2015 the list of pilot projects for getting approval of State Expert Organization with BIM model was determined. The list includes 22 projects: 6 reconstruction projects, 16 new constructions. The functionality and the size of the projects are different.

According to Russian norms and regulations the design documentation is to be submitted to the expert organization only in the traditional 2D paper format. Nowadays there is a gap in law and requirements for submitting design documentation in information model format. For the pilot projects were taken an exception. The expert of pilot projects reveals the existing problems of BIM applications by AEC Companies [23]

#### 2-4-4- Fourth Group Evaluation:

This group contained three Important countries around the world, the region or the continent were overlooked to give a more accurate evaluation,

1- BIM Awareness within nation: 7/10

2- Number of BIM projects under Construction/Study: 5/10

3- Years of BIM Experience: 6/10

4- Governmental decisions: 7/10

OVERALL: 6.25/10

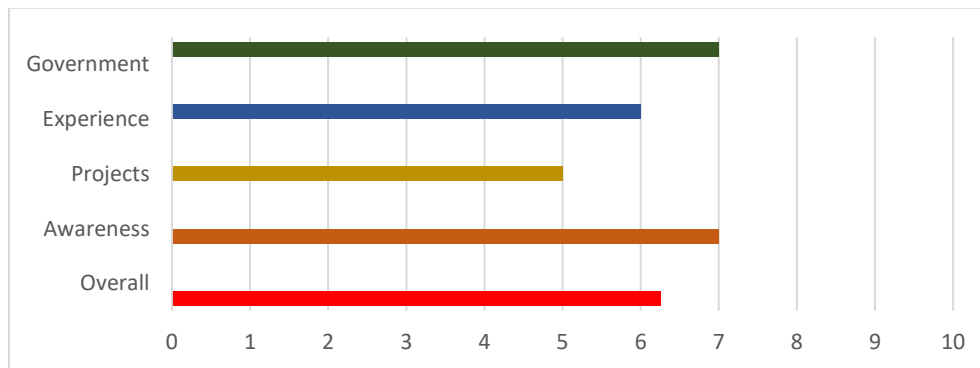


Figure -6- , Bar chart representing BIM factors and overall adoption for fourth group

#### 2-5 Fifth Group

##### 2-5-1 Kingdom of Saudi Arabia.

Currently has the fewest users at the heavy level of implementation (21%) and, although forecasting strong growth, is still projected to lag the other regions in heavy implementation in two years.[24]

As a new phenomenon, Building Information Modeling (BIM) technology can provide solutions for problems in the Saudi Arabian construction industry and improve its final outcomes. BIM is an advanced process and tools with combined virtual aspects, systems, and concepts facilitated [25].

The active role of this technology improves collaboration and communication among different project stakeholders. However, unfortunately, BIM Implementation in Saudi Arabia has neither been made mandatory by the Saudi Arabian government nor has been widely adopted by construction organizations.[26]

Currently, the attention of the construction industry is to eliminate waste and inefficiency to improve quality and profitability. However, BIM proved its competence in this way which motivated developed countries to use and mandate BIM. There are only limited examples of BIM implementation within the AEC Industry and AEC education in KSA. [27]

#### 2-5-2 United Arab Emirates:

Dubai Municipality mandated the implementation of BIM in its significant capital projects from 2014. [28] The recent Dubai Municipality's BIM mandate is an example for such pattern of BIM implementation. However, the mandate without the necessary social and infrastructure climate or BIM adoption readiness may not give the desired results. There is another approach of the pre mature adopters of BIM such as the developing nations, which is proceed with the implementation without any national or regional standards and guidelines.[29]

#### 2-5-3 Other Countries in the Middle East:

Design and construction professionals in the Middle East who are currently using BIM expect a significant increase in the percentage of their projects that will involve BIM over the next two years (2017) [24] today, only about half of BIM users in the Middle East are engaging with it on more than 30% of their projects, but that within two years, well over three quarters (79%) say they will be operating at that level of BIM implementation. Plans to increase BIM implementation throughout the Middle East are robust, but there are some differences among specific regions. [24]

#### 2-5-4 Fifth Group Evaluation:

BIM seems to be in his best possible form in the middle east in U.A.E, with some serious steps from other countries like Qatar, Saudi Arabia, but generally, this region seems to be falling behind this global trend and needs to take some serious steps towards wider, more extensive adoption, especially countries like Saudi Arabia and Kuwait which are considered huge Economic and construction forces in the region

- 1- BIM Awareness within nation: 6/10
  - 2- Number of BIM projects under Construction/Study: 3/10
  - 3- Years of BIM Experience: 3/10
  - 4- Governmental decisions: 4/10
- OVERALL: 4.25/10

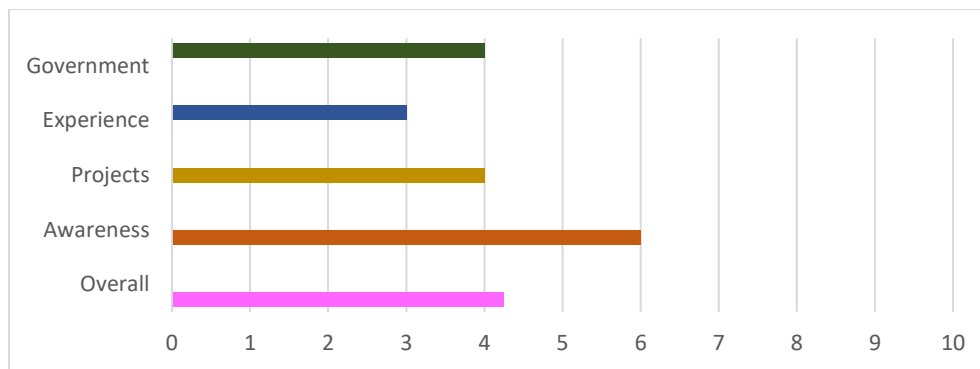


Figure -7- , Bar chart representing BIM factors and overall adoption for fifth group

#### 2-6 Sixth Group, Syria:

According to the war conditions; Syria was an exception, but there is understanding of the need for the introducing modern technologies and advanced management tools to building projects in Syria, like other countries that suffered from poor performance and lack of technology in the past. AEC projects in Syria

suffered from myriad issues such as Behind the Schedule, over budget, inferior quality, low productivity, without sustainability and more. However, building information Modelling (BIM) proves its capability to solve these issues.[31]

clients usually worried about quality improvement with reduced time, and cost, contractors, and architects are interested in performance improvements to increase their profits and enhance their competitive advantages. BIM proves its capability to enhance the cooperation between all project parties. Unfortunately, BIM is not fully applied in Syrian projects in general[32]

Beside the desire of the Syrian engineers and government to reconstruct Syria with local hands and expertise, BIM now has a study plan at all undergraduate, Master, Ph.D. degree courses at Syrian universities. In addition, there are individual and local training, conferences, workshops etc. So, a gradual transition towards the adoption of BIM has really started in Syria.[30].

After the national conference for Digital Transformation in Construction Industry held by the Invention Committee of the Syrian Syndicate for Engineers in August/2021, a governmental committee of experts and involved individuals was formed to draw a futuristic roadmap to a proper BIM adoption in Syria and to organize and provide required training programs for the digital transformation in the construction industry.

The BIMM master's program (building information modelling and management) in the Syrian Virtual University, has a major contribution in spreading BIM culture among Syrian Engineers, also the Syrian Syndicate of Engineers had held numerous conferences and lectures as a stepping stone towards digital awakening in the construction industry, all of this has been an important factor to increase awareness about BIM in Syria.

BIM projects under construction are not as extensive and wide-spread as it should be, but it is worth mentioning some of the most important ones like MAROTA City, BASILIA city, and the Engineers' Retirement Vault building in Hama, all of those projects in spite of using early level of BIM (modelling) are a huge push forward towards a wider BIM adoption and a more advanced level as well.

- 1- BIM Awareness within nation: 6/10
  - 2- Number of BIM projects under Construction/Study: 2/10
  - 3- Years of BIM Experience: 2/10
  - 4- Governmental decisions: 4/10
- OVERALL: 3.5/10

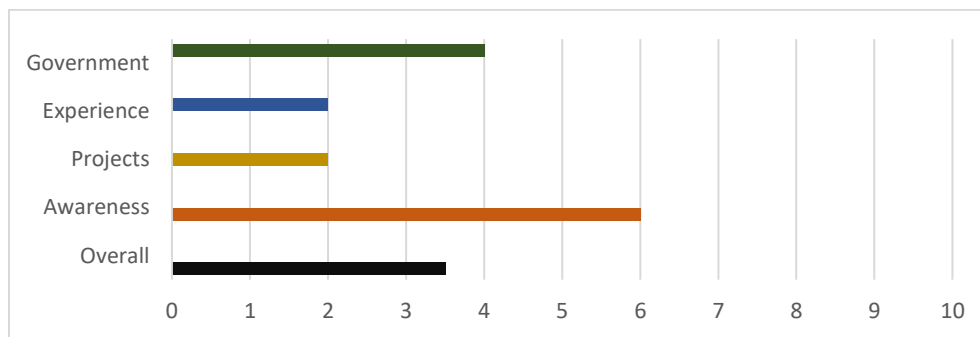


Figure -8- , Bar chart representing BIM factors and overall adoption for sixth group

## 27 Overall Comparison:

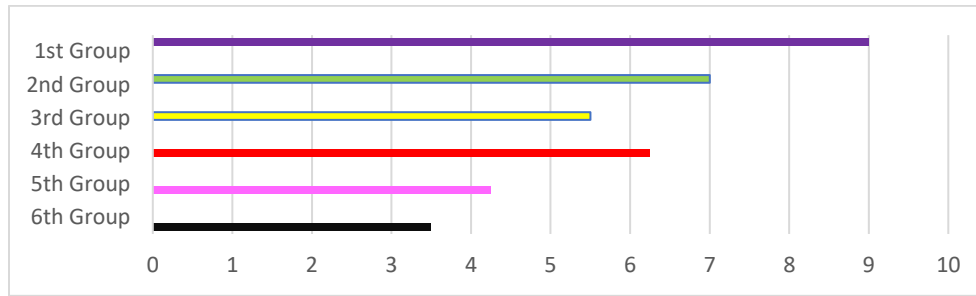


Figure -9- , Bar chart representing overall comparison between all six groups

The Chart indicates the clear lead of European countries and the U.S (1<sup>st</sup> and 2<sup>nd</sup> Group) with some good other major countries (4<sup>th</sup> Group), followed by the Asian countries (3<sup>rd</sup> Group) It's also clear that the Middle Eastern countries and Syria (5<sup>th</sup> and 6<sup>th</sup> Group) are still falling behind other groups especially after arriving late to adopt this new technology.

### 3- Obstacles of Adopting BIM in Syria:

#### 3-1- Economic challenges.

- Lack of demand for BIM by other parties involved in the projects, Lack of clarity of investment due to BIM application.
- The recruitment of BIM specialists and additional staff.[30]

#### 3-2-Technical challenges.

- The need for a strong Internet connection and uninterrupted power Believing that existing techniques are adequate, there is no need to apply BIM.
- Insufficient standards and protocols related to BIM. Interoperability as one of the standard challenges of BIM[30]

#### 3-3-Organizational challenges.

- Weak cooperation between different disciplines. Inadequate government efforts to adopt and implement BIM.
- The need to manage sophisticated data with the level of evolution of the model.[30]

#### 3-4-Legal challenges.

- The need to formulate BIM contracts. Lack of clarity of responsibilities between project parties.[30]

#### 3-5-Human challenges.

- Lack of experience and lack of staff trained for BIM programs.
- Weak knowledge of the benefits offered by BIM.
- The sharp resistance to change, especially the aged persons, and the engineer's affection to their familiar programs.[30]

### 4-Conclusion:

BIM is a technological revolution in the engineering field and there is no way that any nation can develop at this particular aspect without considering BIM as a strong partner, everyone opposed the transformation when CAD was replacing the hand-drawn plans, but eventually it fully replaced the latter, and now Syrian AEC industry is witnessing the transformation from CAD to BIM so it must be encouraged by the government and other related firms and individual expertise to spread it as much as possible in order to keep up with the ever-evolving world of technology.

Considering the war situation and the restriction rules applied on our country, there is not much to be done to improve or enhance the use of BIM in Syria. But from the author's point of view, making Level 2 BIM mandatory -gradually- is essential for Giant projects.

The future plans have begun to become a bit clearer and a road map to adopt BIM in Syria is on the way, but this could cause an un expected turn of events to most engineers and so this research's recommendations to a better transformation are:

- 1- Introduce BIM to the students of engineering faculties and institutes in Syria via academic conferences or as an intro subject in their curriculum.
- 2- Arrange recurrent practicing programs and workshops to engineers to prepare them for the upcoming phase.
- 3- Give governmental advantages and benefits to firms and engineers who would like to adopt BIM in their studies.

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