BIM in Infrastructure Projects

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Abstract

Building Information Modeling (BIM) has made one of the most significant and fundamental enhancements in the construction industry and has led to more in-depth collaboration among project stakeholders. Large infrastructure projects differ from other construction projects, mainly because of size, location, levels of interfacing, complexity, and time frame. Coordinating such intense projects challenge, particularly across multiple teams and numerous stakeholders However, Building Information Modeling (BIM) helped to resolve some of these difficulties by facilitating a collaborative environment. BIM for infrastructure projects helps ensure the efficiency and accuracy of large-scale infrastructure projects design and implementation phases, in addition to the management of these projects. This research is aimed to explore the benefits and importance of implementing BIM in an infrastructure project for stakeholders through analyzing Five international projects and investigating how the utilization of BIM enhanced the processes during projects' stages from design, construction, and operation. It was found that, amongst the various obstacles of implementing BIM practices the prime factor is the rarity of qualified BIM personnel in construction field; however, the near future promises to use BIM systems on a large scale in infrastructure projects.

Keywords: Building Information Modeling (BIM); Infrastructure; Civil Information Modeling; Transportation

1. Introduction

Building Information Modelling (BIM) is a set of interacting policies, processes, and technologies that generate "a methodology for managing basic building design and project data in digital form at all stages of the building lifecycle" [25]. BIM is not just a technology change; it is also a process change.

BIM has gradually transformed the way projects operate in the architecture, engineering, and construction (AEC) industry since its inception. For example, BIM has changed the traditional way of conveying design intent from adding symbols and human interpretation on graphics, to representing them by intelligent elements that carry detailed information that can speed up the design, procurement, and construction process in addition to energy saving in construction has become a necessity [16,17].

Building Information Modelling (BIM) use has dramatically increased during the past few years [27], however, BIM adoption is still significantly lower than [36] due to significant issues with AEC industry projects and the methodology of benefiting from the implementation of BIM [13].
In addition, utilizing the BIM maturity matrix (BIM3) through three levels could help businesses improve their BIM performance.1) Identifying BIM and its effectiveness, 2) Measuring performance and 3) enhancing performance [2]. Nevertheless, personal-related difficulties including aversion to change and an inadequate understanding of BIM slowed down the implementation of BIM [14].

Despite the fact that both the government and clients are crucial to the BIM mandate, the hybrid approach (top-down and bottom-up) is advised to hasten the deployment of BIM [30]. BIM Champions (also known as "change

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leaders") are responsible for overseeing the implementation of BIM in each site, much like in the UK where it is part of the country's strategy and Plan of Work. These Champions have demonstrated to be an essential component in determining and evaluating needs to facilitate the adoption of technology [7]. Moreover, a six-step framework for implementing BIM, including: 1) increasing awareness, 2) understanding the advantages, the 3) readiness of the AEC sector, 4) and organizational capacity; 5) figuring out the obstacles; 6) and removing the obstacles and identifying the important elements affecting the implementation [15].

Besides, the management system should examine the traditional risk assessment processes, and defined criteria must be incorporated and made a regular practice of all building projects in order to perform risk management with BIM technology [12]

Numerous researches have investigated the obstacles that slow down the adoption of BIM in AEC projects and concluded that: lack of experience, a lack of standards, and procedures, to name a few, are the main obstacles to the adoption of BIM. In addition to the availability of skilled experts to use the tools, evidence of cost savings from its adoption, the affordability of BIM Software, and knowledge of the technology among industry stakeholders are among the most important factors for both BIM adopters and non-adopters [18].

2. Adoption of BIM in Syria Construction Industry

In Syria, the transportation industry has suffered greatly along with other service industries. It was targeted for systematic destruction and vandalism. Several significant roadways connecting the Syrian governorates had broken down. In addition, terrorist activities have caused a number of railway stations and lines to be out of service. The Syrian body was therefore partially or completely shredded. As a result, a reconstruction strategy that takes into account the requirement to renovate or build essential hubs to connect all cities with one another should be adopted [1].

The Syrian AEC industry is currently undergoing a transition from CAD to BIM, and the government, as well as other related firms and individual expertise, must encourage it to spread as widely as possible in order to keep up with the ever-changing world of technology [3]. Besides, Syrian educational institutions should devote more time and resources to training engineers and assisting them in staying current with emerging technology. Additionally, the implementation of digital transformation is taking a very long period in institutes. All of it is a result of the AEC sector's lack of technical and technological expertise in Syria, where the majority of engineers lack experience working on projects based on cutting-edge technology and methodologies [29].

El-Hamoud and Ahmed [4] created a new plan that was anticipated to create a new generation of architects who are Highly-Tech qualified and fully conversant with BIM and its general ideas, making it easier for these architects to emerge within the job market and satisfy AEC firms' requirements. Of course, this would also help to positively influence the university's reputation and to promote BIM education among other local universities and to other engineering competencies. Technical issues and a lack of engineering firm help must still be resolved, and software training practical courses must still be developed. It was discovered that there is a knowledge and application gap for BIM programs [28].

The incorporation of BIM throughout the project stages is also essential, and several AEC firms in Syria have begun using 3D models as the main tool for their project work [31].

3. Infrastructure Projects

Oxford Dictionary states that infrastructure is constituted of the physical and organisational structures that are necessary for an enterprise to operate [23]. Therefore, Infrastructure assets can be divided into five basic categories [10].

- Transportation infrastructure - roads, bridges, tunnels, railways and mass transit hubs (such as airports, ports & harbours)
- Energy infrastructure – power generation plants (nuclear, wind, tidal etc.), oil & gas (storage/distribution terminals, refineries, wells, etc.) and mining.
- Utility infrastructure – networks/pipelines for the delivery and removal of electricity, gas, water & sewage
- Recreational facilities infrastructure – Parks, stadiums, etc.
- Environmental infrastructure – Structures for managing flood and coastal defence such as dams, levees, weirs, or embankments.

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Civil infrastructure projects are often large projects involving huge capital investments and complex relationships with multiple stakeholders, it is especially important to integrate all information and data analysis in order to better design, build and operate these complex structures. While some people believe that BIM can only be used for construction projects, many people argue that "building" in BIM is just a verb referring to the construction process, not the structure, and therefore BIM can also be adopted for civil infrastructure projects in order to improve project delivery.

A Smart Market report published by McGraw Hill Construction revealed that the success of BIM in terms of buildings increases the likelihood that BIM will be used for civil infrastructure facilities. Therefore, the application of BIM can be adopted in civil infrastructure facilities at a faster rate than when it was introduced for buildings [21].

4. Literature Review

BIM is often considered an instrument for visualization and coordination of construction and avoiding mistakes. According to the mentioned definitions and the significance of using BIM in projects, its concepts and principles are addressed accordingly [33].

Reducing study time and improving project cost estimation are both outcomes of improving quantity estimation accuracy in small projects. The modelling process may be lengthy in large projects; however, the final stages of the research are significantly expedited [26].

Building information modelling (BIM) has been widely adopted in the building industry. However, BIM for civil projects, also known as CIM, and despite of the potential benefits of its use, its adoption has been lagging. Various stakeholders in the industry and the academic field are working hard to advance the research and practice of CIM, but a systematic evaluation of their progress is still lacking [10].

The use of BIM has been one of the most talked-about subjects in the industry in European nations. The European Parliament published a regulation in January 2014 encouraging the use of BIM for publicly financed projects, such as infrastructure projects [11]. According to the European BIM Task Group, BIM is becoming a universal language for the infrastructure and construction industries. Delivering public infrastructure projects throughout the world will follow BIM as the standard. It has already been implemented in several projects across Europe.

While certain projects are currently at level 1, Lithuania has reached BIM implementation maturity level 2, demonstrating the potential of the Lithuanian AEC industry to fully and gradually transition to level 2 [19].

It is worth noting that one of the top nations using BIM is the US. Although BIM for infrastructure in the US has a longer history, Europe is quickly catching up. The UK has the greatest percentage of BIM adoption, at 69%, as reported by [11], even though the US rate was 6% higher than the UK as illustrated in. (Table 1)

Table 1: Use of BIM in transportation infrastructure projects (based on engineers and contractors) as cited in [11]:

Country	2015	2016	2017
US	27%	55%	68%
UK	21%	57%	69%
France	21%	55%	62%
Germany	20%	48%	62%

At the infrastructure scale, the BIM is also called I-BIM (Infrastructures Building Information Modelling). As per the construction norms the infrastructure design is more complex than the building design. A key distinction involves the length and impact of the infrastructure, which can span several kilometres and encounter various obstacles from the nearby context. Consequently, an accurate georeferenced would be very crucial [31]. Additionally, Infrastructure projects (such as rail and road) are often linear in nature and are spread across a large

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geographic area [34], employers from the infrastructure sector are not fully acknowledging the potential benefits of I-BIM, hence there is a general lack of demand. Poor Interoperability and in-efficient functionality were also concluded as major factors hindering the effective implementation of I-BIM [22].

According to [9] the underlying factors running through all these identified gaps highlight a theme addressing not the Information itself but the usage and management of that information. The gaps cover 3 key factors or aspects of an Infrastructure BIM concept, these are:

1. Definition of information - in terms of both the structure and vocabulary of the data itself and defining the related aspects of a single data object, such as generator, consumer, rights and responsibility.
2. Process of information – an aligned methodology for the production of construction information providing a view or alignment from an operational/ organizational aspect and a project-specific production view.
3. Information connection - meeting the need to link and combine information dynamically while preserving the physical or virtual boundaries required to address current legal and security issues. [35] examined the application of BIM in the design, construction, and operation phases of 13 different projects, comprising ten infrastructure projects (roads, bridges, sewage treatment plant, liquefied natural gas project, power distribution lines, power transforming station, and wharf engineering), three building projects, and ten other types of projects (museum, hospital, sport centre).

As analysed by [35] the application of BIM in the design, construction, and operation phases of 13 different projects, including ten infrastructure projects (roads, bridges, sewage treatment plant, liquefied natural gas project, power distribution lines, power transforming station, and wharf engineering), projects of three buildings, and projects of ten other types (museum, hospital, sport centre). The following factors served as exploratory indicators: conflict frequency, quality of work, control/cost predictability, modification requests, and negotiation cycles. According to the research, BIM led to a 38.5% improvement in quality, a 38.5% decrease in conflict, a 61.5% clearer design, a 23.1% reduction in changes, and a 30.8% improvement in accurate cost estimates.
The authors came to the conclusion that while there are many studies on the benefits of BIM, there is a need for more accurate quantitative methodologies to replace the current ones now in use.

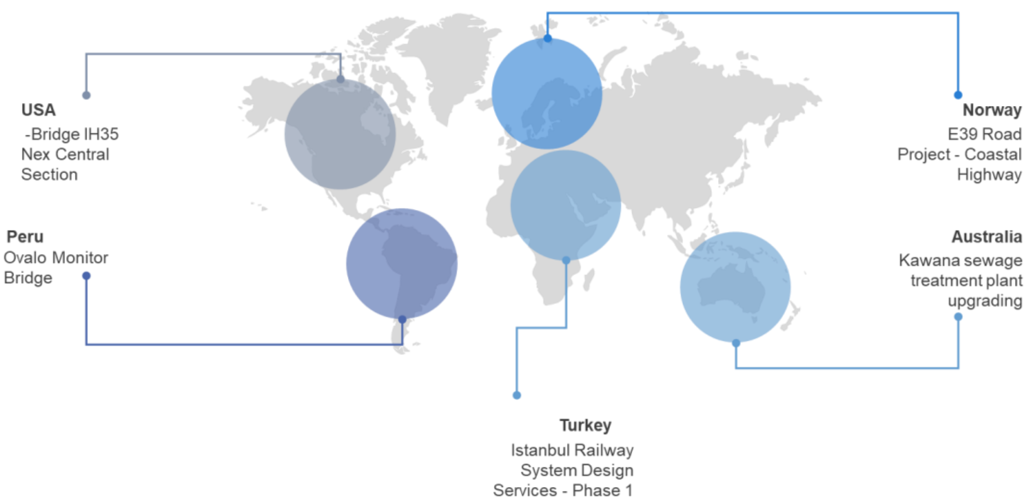

Figure 1: Selected Projects Locations

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5. Case Study Projects

We chose different types of projects and different locations around the world

5.1 Route E39 – Coastal Highway

In Norway, building roads, tunnels, and bridges is more than just doing infrastructure work—it's making strategic investments for the future. Connecting the entire nation is essential for achieving the nation's social and economic growth objectives. The design and construction of Route E39, a 15-mile section of the 680-mile Coastal Highway project, was contracted out to Norconsult and AF Gruppen by a new Norwegian road authority with an eye toward cutting-edge technology and advanced BIM processes. The four-lane highway's $490 million construction project including connections huge interchanges, and five road tunnels includes the Trysfjord Bridge, the biggest balanced concrete cantilever bridge in the world. [6].

Table 2: Properties of project 1

Route E39 – Coastal Highway	
Location	Norway
Company	Norconsult
CURRENT PHASE	Finished
COMPLETION DATE	2021
SOFTWARE USES	Autodesk® AEC Collection, Autodesk® 3ds Max®, Autodesk® AutoCAD®, Autodesk® BIM 360® Design, Autodesk® Civil 3D®, Autodesk® InfraWorks®, Autodesk® Navisworks®, Autodesk® ReCap™, Autodesk® Revit®, Autodesk® Forge
LOD	500
Awards	AEC EXCELLENCE AWARDS // 2020

Key Insights [6]

- By fully automating close to 70% of design updates when modifications are made, the team has decreased conflicts and improved accuracy.
- The project has reduced over 90% of traditional drawings normally printed and produced for construction on a similar scale. The team has also increased model-based certifications that were only paper based in the past.
- The team can design more specifics with more information in shorter amounts of time with Revit and Dynamo scripts, leading to design delivery that is close to 70% quicker than previously. For the tunnels, for instance, the use of Dynamo scripts enables both the design team and the contractor to optimize the design before construction even begins.

5.2 Istanbul Rail System Design Services - Phase 1

The first stage of the Istanbul Metropolitan Municipality's proposal includes designing a 16 km metro line, which when finished in 2023, will have 11 stations and link to five current metro lines. It strives to offer a sustainable alternative that makes commuting enjoyable.

The project will be essential to Istanbul's public transportation system and will provide a special logistical challenge for the design team made up of many AEC specialties. [5].

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Table 3: Properties of project 2

Istanbul Rail System Design Services - Phase 1	
Location	Turkey
Company	Yuksel Proje Inc.
CURRENT PHASE	Construction
COMPLETION DATE	2023
SOFTWARE	Autodesk® AEC Collection, Autodesk® 3ds Max®, Autodesk® AutoCAD®, Autodesk® BIM 360® Design, Autodesk® Civil 3D®, Autodesk® InfraWorks®, Autodesk® Navisworks®, Autodesk® ReCap™, Autodesk® Revit®
LOD	500
Awards	AEC EXCELLENCE AWARDS // 2019

The design process was specified, and a single, integrated BIM platform was developed using Autodesk AEC Collection and BIM 360.

Using Autodesk technologies such as Revit, Civil 3D, and Infraworks, 20 separate models from diverse disciplines were integrated into a single coordinating model to make cooperation simpler and cut down on time and expense.

The design team is utilizing this project, which is phase one of a 60km project, as an illustration of how BIM software and contemporary construction technologies can seamlessly integrate and coordinate several disciplines, such as HVAC, plumbing, and electrical [5].

5.3 KAWANA STP UPGRADE

The Sunshine Coast's water provider is expanding an existing STP to improve its capacity. The initial brief was for an increase to 150,000 EP, while the present capacity is around 90,000 EP. The Design and Construct project was given to Monadelphous, who also hired Acciona Aqua to handle the process design, Alliance Automation to handle the electrical design, and WSP to handle the balance of plant design. Additionally, WSP was hired to create, maintain, and update the project's BIM model [19].

Table 4: Properties of project 3

KAWANA STP UPGRADE	
Location	Australia
Company	Monadelphous, WSP
CURRENT PHASE	Finished
COMPLETION DATE	2019
SOFTWARE	Autodesk® AEC Collection, Autodesk® 3ds Max®, Autodesk® AutoCAD®, Autodesk® BIM 360® Design, Autodesk® Civil 3D®, Autodesk® InfraWorks®, Autodesk® Navisworks®, Autodesk® ReCap™, Autodesk® Revit®
LOD	300

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Awards	-

Lessons Learned [19]:

The implementation of BIM on this project, while beneficial in many aspects, has not been a painless process. If the reader is going to implement BIM on their project, then the following lessons should be heeded.
• Establish the process and asset data requirements at the beginning of the project, including verified existing asset data and P&IDs.
• Survey and potholing that are accurate and usable are essential for inclusion in and verification of BIM.
• Engineering specifications that are well-defined and documented are needed for input into BIM design software (e.g. complete piping specifications). Specifications that are incomplete or inaccurate are unsuitable for use within BIM plant design software.
• Completing P&IDs before 3D modelling is undertaken is important. If P&IDs need to change, then it is important that P&ID changes are completed and verified before model changes occur as this is the optimal workflow within the Plant design software and is necessary to maintain the integrity of the BIM.
• Have well defined software use and data/model exchange workflows
• Vendor data was often an issue. It is important to ask the following:
• When will the design team receive it?
• Will it be 3D and what 3D format and LOD can it be supplied in?
• What level of asset tagging is required within a vendor model?
• A clearly defined BIM specification from the client is needed with appropriate supporting templates/content.
• Have a BEP (BIM Execution Plan) that clearly defines what is to be done, when, by whom, and to what purpose. All team members need to be familiar and on board with the intent of the BEP.
• Encourage the use of the BIM model to inform any review/decision-making before making design changes or requesting drawing updates.

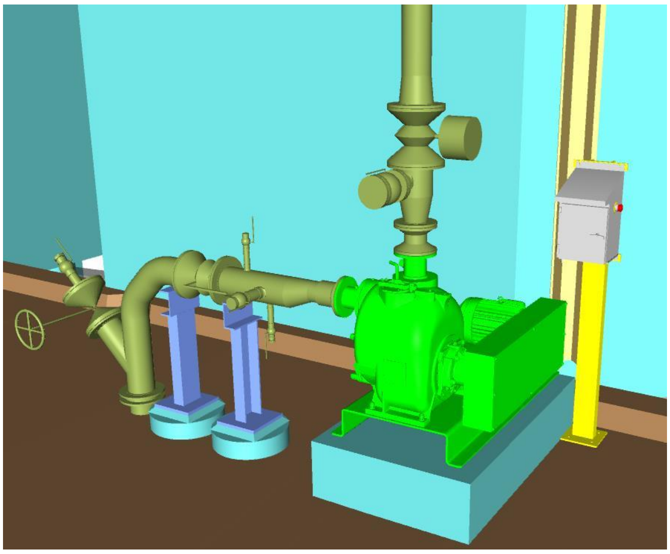
Figure 2: Modeling on Revit

5.4 Ovalo Monitor Bridge

The Ovalo Monitor project will be around 2.2 km long when finished, and it will have an overpass made of an 870-meter-long reinforced concrete traffic bridge. It features an intricate road layout with both straight and curvy portions. The superstructure of the bridge is a continuous box-section deck made of post-tensioned concrete, while the foundation is made up of two abutments and 21 piers.
This infrastructure, constructed by the Municipality of Lima through Emape with a budget of more than S/80 million, links two congested areas of the capital and aims to improve trafficability by reducing the vehicular load by 85%, improve the urban image, and provide benefits to more than 500,000 local residents [24].

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Table 5: Properties of project 4

Ovalo Monitor Bridge	
Location	Peru
Company	TSC Innovation, Aceros Arequipa, INCOT
CURRENT PHASE	Finished
COMPLETION DATE	2022
SOFTWARE	Tekla Structures, Tekla Model Sharing, Trimble Connect
LOD	400
Awards	Tekla BIM Awards 2022 The Best Infrastructure Project

Figure 3: Simplified production process

The project required a total of 2250tn of reinforcing steel, and the level of development needed was LOD 400. This enabled the supplier Aceros Arequipa to automatically fabricate dimensioned/pre-assembled steel by creating cutting and bending lists of bars. As a result, the BIM elements include properties that make it possible to effectively monitor and oversee the project online while guaranteeing information traceability throughout the various supply chain activities. As a result, stakeholders were better able to grasp what needed to be put together on site, execute quality control in the pre-assembly workshop using augmented reality, and verify structures in advance [24].

5.5 IH35 Nex Central Section

To provide extra capacity to the I-35 Northeast Expansion (NEX) corridor, Texas Department of Transportation (TxDOT) initiated a USD 1.45 billion project to construct a viaduct that will add three lanes in each direction. The scope of the project included designing and constructing 21.8 miles of viaduct, two interchanges, and more piping for the drainage system. TxDOT awarded the contract to Ferrovial Construction, which had to overcome the challenges of working in a tight space while integrating the complex bridge structure with existing utilities and infrastructure. They realized that their traditional 2D design methods were costly and inefficient, requiring them to seek a collaborative 3D technology solution [8].

Table 6: Properties of project 5

IH35 Nex Central Section	
Location	USA
Company	FERROVIAL CONSTRUCTION AND ALAMO CONSTRUCTION
CURRENT PHASE	Construction
COMPLETION DATE	2027
SOFTWARE	iTwin, MicroStation, OpenBridge, OpenRoads, ProjectWise
LOD	400

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Awards	Bentley Best Infrastructure and Going Digital Award of 2022

The qualitative and quantitative benefits [8]:

- Accurate tracking of quantities
- Buy more accurate
- Reduce wastage
- Quality improvement
- Reduces re-designs
- Reduces unnecessary demolitions

6. Data Analysing:

The collected data from the studied projects was then be analysed to explore the utilized uses of BIM and the contribution of BIM tools in facilitating and enhancing the infrastructure technical and management performance.

6.1. Implemented BIM Tools in Case Study Projects:

Table 7: BIM uses in the five projects

No.	BIM Uses	Cases of infrastructure projects				
		Project 1	Project 2	Project 3	Project 4	Project 5
1	Visualization	√	√	√	√	√
2	Lifecycle information management	√	√			√
3	Design review	√	√	√	√	√
4	Computational fluid dynamics					
5	Structural analysis				√	√
6	Sunlight analysis		√			√
7	Traffic flow simulation		√			√
8	Environmental simulation and analysis	√	√		√	
9	Clash detection	√	√	√		√
10	Schedule modeling (4D)		√			√
11	Cost estimation (5D)		√	√		√
12	Quantity takeoff	√	√	√	√	√
13	Constructability analysis					
14	Crane operation simulation			√		
15	Virtual facility Inspection	√	√	√		

As illustrated in Table (7) and Figure (4), the most common practices of BIM in the projects above are visualization, life cycle information management, design review, and quantity take-off, this outcome is an expected because these uses are always repeated in all stages of the project life cycle. Besides, they are used in the initial stages of modelling where models are often created for visualization and design review purposes. In addition, life cycle information management, is a common database for project workers, in order to easily exchange information between project parties. For the purpose of take-off of quantities, BIM facilitated the work, and the contractors are

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not exposed to losses and waste of materials due to human errors of quantities take-off for the modelled elements. On the other hand, table (7) manifests the, importance of utilizing BIM infrastructure projects, especially for large and strategic projects.

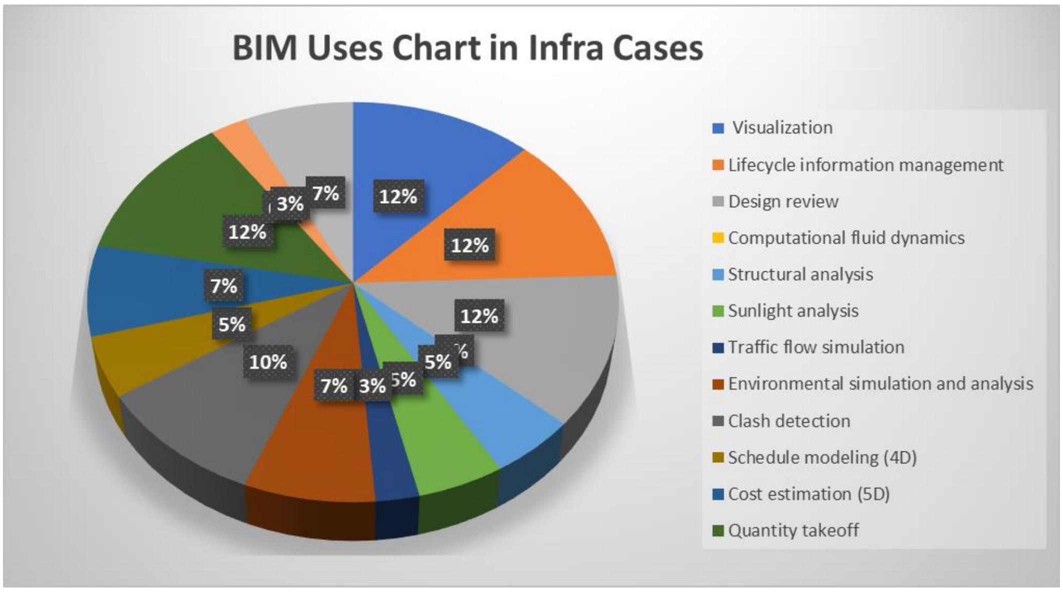

Figure 4: Percentage of BIM uses in the projects

6.2 LOD Level in these projects:

The second stage of analyzing the studied project was to investigate the level of development (LOD) for each project as summarized in Table (8) and illustrated in Figure (5).

Table 8: level of development for each project

No.	Levels of development (LOD)	Cases of infrastructure projects				
		Project 1	Project 2	Project 3	Project 4	Project 5
1	LOD 100					
2	LOD 200					
3	LOD 300			√		
4	LOD 400				√	√
5	LOD 500	√	√			

As shown in Table (8) and Figure (5), it is not desirable to have less than LOD3 in infrastructure projects in order to get the maximum benefits from using the BIM.

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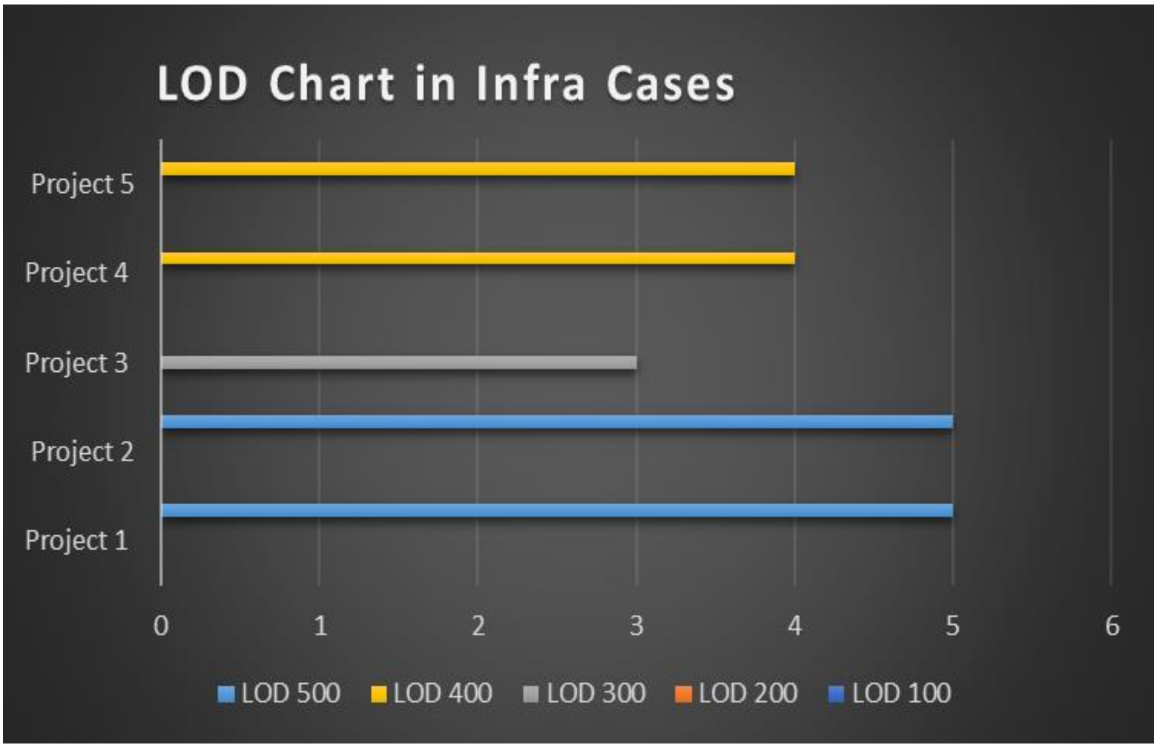

Figure 5: LOD chart

6.2. Used Software in the Studied Projects

The used software in BIM modelling of the studied project were then be grouped and summarized in Table (9) to discover the most influencing software in BIM implementation.

Table 9: Used software in each project

Vendor	Software tool	Cases of infrastructure projects				
		Project 1	Project 2	Project 3	Project 4	Project 5
Autodesk	Revit	√	√	√		
	AutoCAD	√	√			
	AutoCAD Map 3D					
	AutoCAD Civil 3D	√	√			
	Autodesk InfraWorks (formerly Infrastructure Modeler)	√	√			
	Structural Bridge Design					
	AutoCAD Utility Design					
	Autodesk 3ds Max Design	√	√			
	Navisworks	√	√	√		
Bentley	Bentley RM Bridge, LEAP Bridge, LARS Bridge					
	Power Rail Track, Power Rail Overhead Line, MXRAIL					
	Power InRoads, Power GEOPAK, MXROAD, and PowerCivil					
	PlantWise, OpenPlant, AutoPLANT, and PlantSpace					
	HAMMER, WaterCAD, WaterGEMS, SewerCAD, SewerGEM					
	CivilStorm, StormCAD					
	MicroStation					
	AECOsim Building Designer (Bentley Architecture, Structural Modeler)					
	Prosteel					
	Bentley Substation					
	Bentley Navigator					
	ProjectWise					√
	AutoPIPE and STAAD.Pro					
CSI	CSI SAP2000					
	CSiBridge					
Tekla	Tekla Tekla Structures				√	
	Trimble connect				√	
	Tekla Bimsight					
Graphisc	ArchiCAD					
Vico	Vico Office Suite					
FORUM8	UC-win/Road					

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As illustrated in Table (9) there are multiple software to be utilized and there is no only single program that can be used to complete all degrees of BIM development, especially in infrastructure projects due the higher complexity level than other types of projects. However, it was found out that Autodesk, Bentley, and Tekla are among the highest companies that produce BIM modelling software.

7. Suggestions and Recommendations:

Countries typically need to make a variety of investments to ensure they improve their use of BIM. These investments include not only technology, but training, process improvement and creation of material libraries, among others. Understanding the investment plans of BIM users can reveal a lot about how they use them and what their priorities are.

- training

Training is the most important investment, whether now or in the coming years. Engineers must be qualified and trained in the field of building information modelling in infrastructure projects through training courses in the Engineers Syndicate and the Training Company by international specialists with experience in the field of using programs that are useful in modelling and simulation with the introduction of teaching this Programs at universities and engineering schools concerned with at least graduate project work in the use of BIM in infrastructures

- Operations and collaboration

Investments to improve internal and external collaboration since the ability to work collaboratively is the most important business benefit of BIM

8. Conclusion s and Recommendations

The goal of this research is to highlight the significance of BIM in infrastructure projects through global experiences. The BIM was used extensively and had significant impacts on the environment construction quality, design and construction performance, time management, resource, efficiency, waste reduction, and cost effectiveness.

All of these benefits of utilizing BIM in different types of projects, would support Syria after long time of continuous crises that resulted in full destruction of different sectors of infrastructure including roads, bridges, and airports, In addition to the severe damages of main services such as water pumping stations, water treatment plants, power stations, and the main networks. This study explored the implementation of BIM techniques in improving the performance of infrastructure projects in addition to investigating the BIM Uses in these projects and the utilized software. It was found out that:

1. The most common uses of BIM in the studied projects are visualization, life cycle information management, design review, and quantity take-off.
2. It is not desirable to have less than LOD3 in infrastructure projects in order to get the maximum benefits from using the BIM.
3. There is no single program that can be used to complete all degrees of BIM development, especially in infrastructure projects due to the higher complexity level than other types of projects
4. Using BIM in Infrastructure projects in Syria during the reconstruction phase we will provide higher quality, more time and cost efficiency, and more sustainability.
5. Training is very crucial for all engineers to practice and manage building information modelling in infrastructure projects and this should start from under graduate stages.

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