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OBSTACLES TO BUILDING INFORMATION MODELING IMPLEMENTATION

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Abstract- Building Information Modeling (BIM) is utilized to organize everything into a single practical template when it applies to building projects. This study makes use of a questionnaire survey to learn more about the actual difficulties facing its adoption in the Libyan construction industry. The project participants were given a lot of attention to the study's design (Clients, Engineers, Managers, Contractors, Architects, etc.). The lack of widespread adoption of BIM can be attributed to several factors, which can be divided into six groups: organizational, culture, social, and economic. To examine the data and determine the greatest obstacles, we employed the following statistical methods: The Relative Importance Index (*RII*) is used to evaluate hypotheses, along with Cronbach's alpha, Pearson's correlation, and significance testing. The three major barriers to implementing BIM, according to this study, are a need of BIM training *RII*=0.853, an absence of promotion on experience *RII*=0.840, combined with an absence of comprehension of BIM along with its advantages *RII*=0.754. The biggest hurdles to project Implementation in the Libyan construction industry, ranked by category, are organizational *RII*=0.693, business *RII*=0.745, and personnel related *RII*=0.797.

Keywords: Construction Industry, Libya, Bim Obstacles, RII, Bim.

1. INTRODUCTION

Every new technological innovation that has occurred in the twenty-first century may primarily be attributed to the progress that has been made in computer science. You will need more information in order to go to where you want to go, and the process of evolution is all about acquiring new knowledge. The Architecture, Engineering, and Construction (AEC) businesses are undergoing transformations as a direct result of technological advances (Engineering, Architecture, and Construction). Over the past decade, there has been a dramatic change from two-dimensional and to three-dimensional modelling methodologies used in building projects [1]. Indeed, a change had occurred.

Traditional, two-dimensional presentations that can be provided in a variety of formats present a significant challenge for professionals working in the building and construction business. Communication between property managers, architects, and builders may become more challenging as a result of these displays, or it may take longer. This issue may surface at any point in time; it is not limited to the project's maintenance and operating phases only.

The BIM appears to be a versatile tool that is widely recognized as a leading-edge information technology that digitally streamlines the process of designing and constructing structures. Building Information Modeling, or BIM, fosters better collaboration within AEC and Facility Management (AECFM) industries by bringing together all project contributors for the life of a facility's existence [2]. As a result of Libya's aspirations to play a catalytic role in global transformation and to stay up with the rapidly increasing global standards of building technology, pressure is mounting on the country's construction industry to adopt BIM methods and to reject old work practices. Given the existing low levels of technology adoption in Libya's AEC, industry, as well as the absence of BIM there, it is vital to conduct an analysis of these obstacles and BIM enabling variables. While developing a plan for the deployment of BIM, these characteristics must be taken into consideration because, in the long run, they will lead to higher rates of BIM adoption.

The primary purpose of this research is to detect and assess the primary obstacles that stand in the way of BIM adoption within the AEC industry in Libya. In particular, the study's goal is to educate Libyan building industry managers, architects, engineers, and contractors on the major elements that favor or hinder the use of BIM. Both the formulation of a strategy for integrating novel technologies in the construction sector and the success of the AEC company may be attributed to the use of cutting-edge information technology. The AEC firm was responsible for both outcomes. Given that both events occurred, it is possible to argue that this is the case.

The aim of this study is to clarify the obstacles that are hindering the building and construction industry in Libya from fully embracing BIM.

Table 1. Top obstacles developed by various academic authors

Academic authors	Top BIM Obstacles
Arayici, et al. [18]	1. Cost of software 2. Staff training takes a lot of time 3. Absence of identifying suitable projects for BIM usage
Azhar [19]; Arayici, et al. [20]; AIA IPD [21]; Becerik-Gerber and Kensek [22]; Kent and Becerik-Gerber [23]; Ilozor and Kelly [24]	1. Computable digital data is a technical obstacle ➢ Interoperability of software ➢ Project delivery is a non-technical impediment 2. The law and contracts ➢ Opposition to change ➢ Workflows and strategies
Building Cost Information Service (BCIS) [26]	1. Absence of customer demand 2. Absence of standards 3. There are no links between BIM and apps from other parties 4. Lack of education or training
Eadie, et al. [13]	1. Size of the change needed 2. Supply chain buy-in is lacking 3. Not being flexible
Gu and London [9]	1. The AEC sector's fragmented character 2. Lack of knowledge and instruction 3. Roles, duties, and the allocation of benefits are not clearly defined
Kiani, et al. [15]	1. Absence of official legal support 2. Lack of proficient BIM software users 3. Expensive software 4. The benefits of utilizing BIM are unclear 5. Absence of customer demand
Lindblad [7]	1. Technology-related restrictions on BIM ➢ Interoperability ➢ Many perspectives on BIM ➢ Inadequate fits with the requirements of the customer 2. Stumbling blocks in the BIM procedure ➢ Altering business procedures ➢ Risks and difficulties associated with using a single model ➢ Legal matters ➢ Customer disinterest and a lack of demand 3. Obstacles affecting those who use BIM ➢ Jobs and responsibilities that change ➢ Individuals' lack of training
Marzia [16]	1. Program and training costs 2. The technology of today is adequate 3. Unfit for present projects 4. Humans reject education
Nanajkar [14]	1. Upgrading hardware and software costs 2. Staff training needs 3. Resistance to change 4. Technological Adoption Is Slow
Newton and Chileshe [11]	1. Lack of comprehension 2. Education and training expenses 3. Finding qualified personnel 4. Modifying how companies conduct business
Sebastian [25]	1. Deficiency of the current legal structures, including responsibility and risk-sharing contracts 2. Questions regarding the model's legal standing and intellectual property 3. Alterations to the roles, duties, and compensation systems 4. Absence of BIM benefits for project stakeholders right away
Young, et al. [17]	1. Insufficient training 2. Support from senior management 3. Software cost 4. Legal matters
Zuhairi, et al. [12]	1. Absence of BIM expertise 2. Inadequate client or governmental demand

Researchers Brewer and Gajendran [4] and Ashcraft and Esquire [3] are two examples of those who have consistently brought attention to the difficulties associated with creating BIM. Despite the numerous benefits that BIM offers, it has not yet achieved mainstream acceptance. Building Information Modeling, often known as BIM, is considered to be a one-of-a-kind phenomenon that strives to modernize the time-tested processes utilized in the construction and building industries [5], which makes its adoption and implementation more challenging. By classifying the challenges [6] presented a method for classifying the challenges that are encountered when implementing BIM in the AEC industry. As a method for describing BIM obstacles, various writers have divided them into a wide number of categories and categorized them accordingly. People, processes, and products are the three primary classifications that the elements that make up [7] can be sorted into [7].

Bottlenecks have been divided into two categories by Ashcraft as well as Esquire [3] by Ku and Taiebat [8] in order to better comprehend them: contractual challenges and personnel challenges. According to Gu and London [9], the potential challenges associated with implementing BIM can be broken down into three categories: process-related, social, and technical. The sluggish adoption of BIM is not the consequence of a single element operating in isolation from the other factors; rather, it is the result of the combined impact of multiple [6], [10]. Based on data provided by a variety of authors in an effort to raise awareness of the body of work that already exists, Table 1 offers a succinct review of the many significant challenges. This thesis fills a gap in the literature by creating six separate types of implementation impediments to BIM, which had been recognized as a problem with earlier studies. This problem had been noted as an issue with earlier studies.

2. METHODOLOGY

The results of a quantitative survey given to AEC institutions in Libya will serve as the main source of data for the study to accomplish its objectives. The design of the study placed a primary emphasis on the project participants (Architects, Builders, Managers, Engineers, Customers, etc.).

The survey consists of two main sections:

1) Employee Specifics

2) Implementation challenges for BIM

Element A, labeled "Personnel Data," is displayed first. In addition to one (1) free-form question, there were nine (9) multiple-choice questions. The sectors, principal industries, employee counts, geographical locations, and organizational details of the respondents' firms as well as the roles they held within those firms and their years of experience were also requested. Finally, they were asked if they were familiar with BIM.

The questions in Part B, "Obstacles to BIM Adoption," concentrate on factors that might prevent building information modeling from being widely used. Individual obstacles, BIM process obstacles, business obstacles, technical obstacles, organizational obstacles, and market obstacles are the six (6) various sorts of obstacles that make up this section. In section B of the survey, respondents were asked to select a number between 1 to 5, with 1 representing a serious disagreement and 5 signifying a strong agreement.

The questionnaire has 61 items in total, evenly distributed across Sections A (9) and B (27). The online survey was distributed and collected using Google Forms and human distribution. Before the survey questions, there was a brief explanation of BIM that outlined its definition and advantages in order to aid respondents in understanding it. This clarification has helped participants understand the survey's objective. The questionnaires received a total of 75 responses. The Google Forms questionnaires received 47 paper copies and 28 paper copies in total.

The methods utilized to analyze the information acquired for this study were as follows:
1. Evaluating dependability and analyzing variables,
2. The standard deviation and mean of the scores are included in the *RII*,
3. Analysis utilizing the significance test and the Pearson correlation,
4. Research hypotheses are t-tested.

2.1. Methodology to Data Analysis

Several approaches were used to examine the survey questions because stronger, more trustworthy conclusions can be drawn when there are many methods of analysis.
The Sections of A question is evaluated using both pie charts and bar charts. Using the percentages and frequencies of each bar item, these charts are easy to analyze. Several analytic approaches are used to dissect Part B, including that of the RII, standard deviation and means, and correlation of Pearson's (Obstacles to BIM adoption).

2.2. Evaluation of Conceptual Contributions to Determine Integrity

Cronbach's alpha was applied to assess internal consistency and ensure that the obtained components were homogeneous. The mean inter-variable interaction within each factor is what determines alpha (α), according to research [27]. The meaning of the factor loadings for each group constitutes Cronbach's alpha. It is preferable to use a higher alpha coefficient (α) value when assessing the reliability of a component or questionnaire. The absolute minimum is 0.7, as Nunnaly [28] pointed out.

2.3. Relative Importance Index Central Tendency and Dispersion

Using the Relative Importance Index, each component was assessed and ranked in ascending order according to how important each group and the section as a whole thought it was *RII*. The standard deviation (*SD*) was established to assist in differentiating between these elements when rating them because several factors had similar scores when *RII* was applied to the questionnaire survey data [30-32]. A statistical measure used to evaluate the distribution of a data collection is *SD*. When the standard deviation is modest (less than or equal to 0), the data points tend to cluster around the standard deviation (the net present value of the set), whereas when it is big (greater than or equal to 0), the data sets tend to be dispersed throughout a broader range of values. An average absolute score of at least 4.0 and a *RII* of at least 0.8 in this study's study show that a factor is significantly impacting the adoption of BIM.

2.4. Analysis of Pearson Correlation

The importance of a relationship between two variables is calculated using the basic linear correlation formula, sometimes known as Pearson correlation (r). The range of the correlation coefficients is from -1.00 to +1.00. Several 1 represents a perfect positive correlation, while multiple values of 1 show a perfect negative correlation. If the value is 0, there is no correlation between the variables. Table 2 details the relationships between the reliability coefficient ranges and how strong each represents.

Table 2. Ranges of correlation strength [29]

Relationship	Correlation Coefficient (r)
Not Good	(-0.3 to 0.3)
Average	(-0.3 to -0.7) or (0.3 to 0.7)
Great	(-0.7 to -1.0) or (0.7 to 1.0)

2.5. Test of Significance Analysis

After calculating Pearson's coefficient value correlation, a significance test should be run to see if the two factors (Categorized Group Obstacles) are statistically associated. The following theories are investigated to achieve this:

If the value of the coefficient of correlation (r) is positive (+), there is likely a positive link in the data that will be investigated. Assuming there is, then:
H_0: $\rho = 0$, H_1: $\rho > 0$

If for any reason the coefficient value (r) turns out to have a negative value (-), then the following hypothesis will be put to the test using an analysis of the data:
H_0: $\rho = 0$, H_1: $\rho < 0$

Foreshadowing the importance of a connection, -values are used. If the p-value for the correlation between the two is less than 0.05, the link between the variables is statistically significant. This statistical significance test has two tails. One can tell whether a representative group is more or less than a specific interval by looking at the two important sections that correspond to certain distributions. If data falls under one of the appropriate zones, the following hypothesis is developed will be used instead of the null hypothesis.

3. DISCUSSION OF DATA EVALUATION AND THE RESULTS

The results and conclusions of the study are broken down into five areas. The first stage is to visualize and make sense of the information gathered from the respondent's demographic questions using tables and charts. Section B of the survey questionnaire served as the primary focus of the analyses. Relative Importance Index results are presented and discussed in *RII*. After the outcomes of the Pearson Correlation Analysis, the result of something like the Cronbach Coefficient (α) Methodology are given as the fourth and last stage of the data analysis process. In this final section, we show the findings from the hypothesis testing performed. Each of the four conclusions drawn from the technique is discussed in detail. An overview of the most important takeaways from the analysis is presented at the end.

3.1. Working Position

The following Figure 1 generated from Table 3, displays the proportion of respondents who said they worked in various positions within their respective companies. The poll respondents included 11% academics and students, 19% architects, 6% builders, 55% engineers, 6% administrators, and 3% business owners.

Table 3. Respondents' working positions as a percentage

Job	Percentage
Designers	19
Engineers	55
Holders	3
Leaders	6
Researchers	11
Suppliers	6

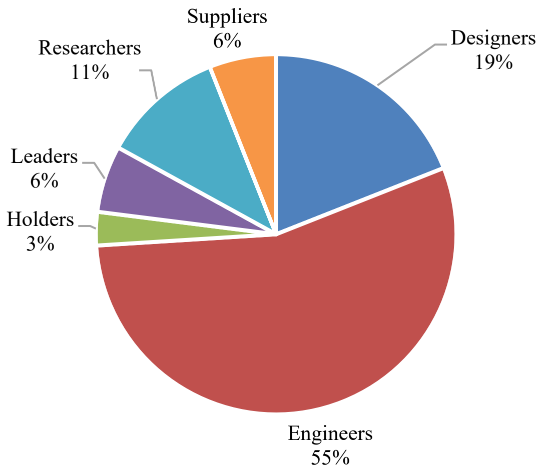

Figure 1. Respondents' working positions as a percentage

3.2. Learning Level

As shown in Table 4 and drawing in Figure 2, the majority of those polled 75% had a bachelor's degree in science, with the remainder having a master's 13%, doctoral degree 8% or a high school diploma 4%.

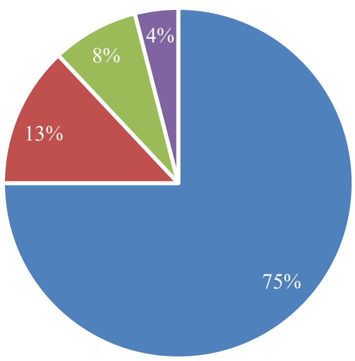

Figure 2. Degree of learning of respondents

Table 4. Degree of learning of respondents

Science Degree	Percentage
Bachelor	75
Master	13
Doctoral	8
Diploma	4

3.3. Experience

Table 5 and Figure 3 show that 53% of respondents lacked any relevant work experience, whereas 16% had 5-10 years of relevant experience, 15% had 10–15 years of relevant experience, and 16% had above 15 years of relevant work experience.

Table 5. Years of experience of respondents

Experience	Years
0-5 Years	53
5-10 Years	16
10-15 Years	15
More than 15 Years	16

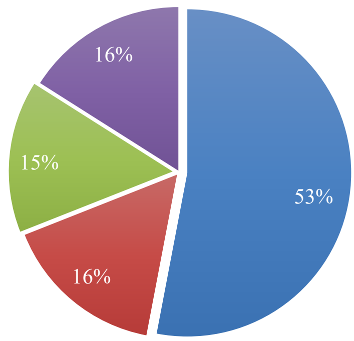

Figure 3. Years of experience of respondents

3.4. Professional Field of Organizations

In Figure 4, we see how the ownership of the groups produces consistent outcomes. As 39 of the respondents claimed to work for privately held companies, we asked them to provide a detailed description of the services they provide, such as consulting, building, or design. Figure 5 displays the results obtained.

Table 6. Organization ownership by the respondent

Ownership	Respondent
Private	52
Public	48

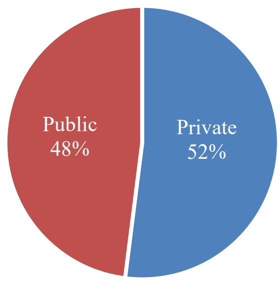

Figure 4. Organization ownership by the respondent

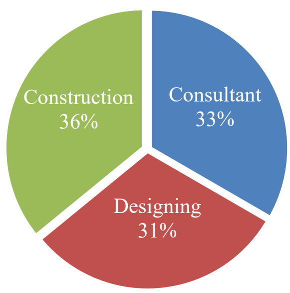

Figure 5. Types of private sector

Table 7. Types of private sector

Types	No
Consultant	13
Designing	12
Construction	14

3.5. Primary Sector of the Organization

The principal fields of business endeavor represented by the respondents' companies are broken out in Table 3. The residential sector accounts for the remaining 26.67% of businesses, followed by the commercial sector 24%, the industrial sector 8%, the retail sector 4%, and other sectors 4%. A third of these companies are specifically engaged in building structures for the public sector.

Table 8. Primary sector of the organization

Leading Manufacturing	Number of Businesses	Percentage (%)
Additional	3	24
Business	6	8
Industrial	3	4
Leadership	25	33.33
Organization	20	26.67
Residential	18	24

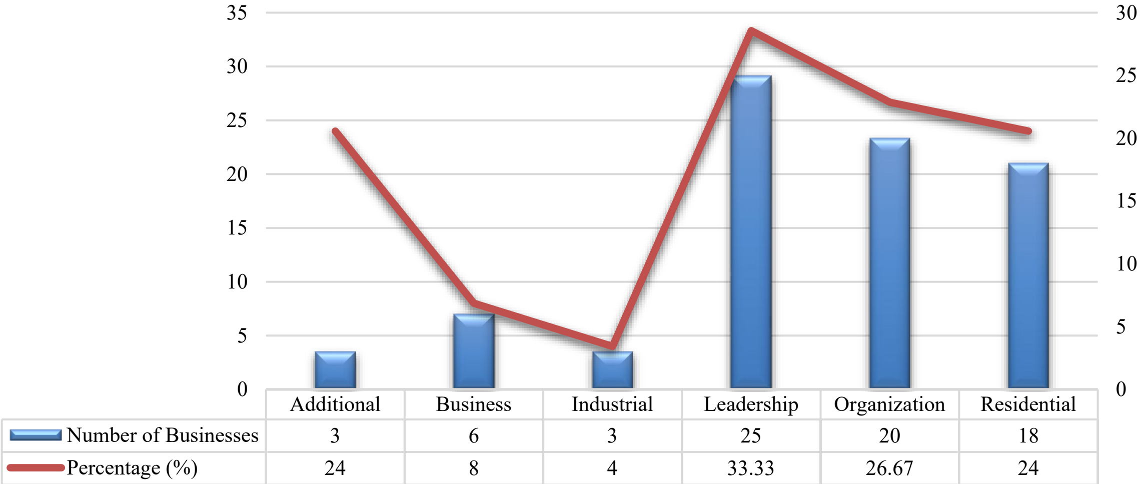

Figure 1. Primary sector of the organization

3.6. Organization Agencies

Fourteen percent of respondents work for minimal businesses with less than 15 employees, while twenty percent work for huge businesses with 100 or more workers. There were 14 medium-sized businesses represented, making up 18.67% of the total. There were around 30 different companies represented, representing the roughly 1,000 construction enterprises spread over Libya. The number of workers by company size is shown in Table 9.

Table 9. Number of personnel employed by the respondents' businesses

Company Size	Number of Respondents	Percentage (%)
≤15	33	44
16-30	8	10.67
31-50	14	18.67
51-100	5	6.67
Over 100 employees	15	20

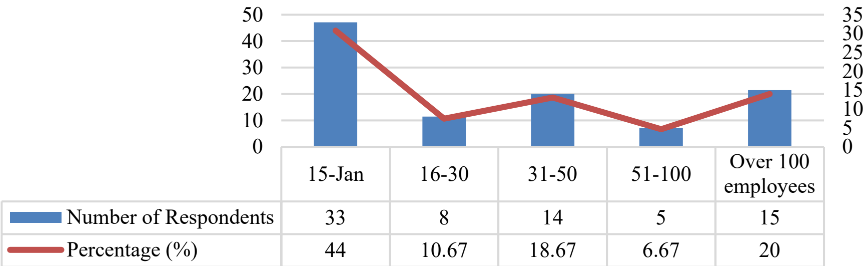

Figure 7. Number of personnel employed by the respondents' businesses

3.7. The Companies' Location

To provide a complete and accurate picture of respondents' experiences with AEC engineering, we questioned them for the location of their organization's headquarters. The geographical spread of the respondents' employment locations is depicted in Figure 8. The bulk of the total responses, 58.67% are employed by businesses in Tripoli, the country's capital. The nation's capital, which has a population of about 1.5 million, is continuously in need of new buildings. Zintan City comes in second with 16%. In terms of the types of economic activity that occur there and the types of construction industry that have been completed, the responders' locations make a lot of sense.

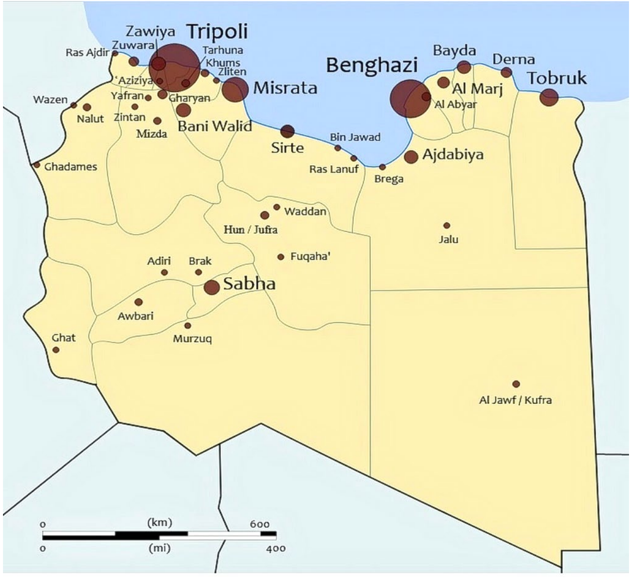

Figure 8. The companies' location

3.8. BIM Awareness

This section summarizes the survey respondents' responses based on their level of BIM knowledge. According to Figure 9, just 45.33% of survey participants are knowledgeable concerning BIM applications and solutions, while 54.67% are not.

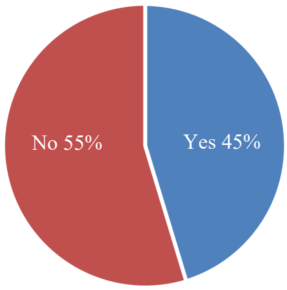

Figure 9. BIM knowledge

3.9. Factor Analysis and Cronbach's Alpha (*α*) Reliability Test

The internal reliability of the variables in the questionnaire is evaluated for reliability using Cronbach's alpha. Each of the classes has been discovered to have its own reliability coefficient (*α*). The range of loading factors, from 0.593 to 0.856, suggests that some factors are reliable to an acceptable level, while others are unreliable to an unsatisfactory one. With scores of 0.797 and 0.745 respectively, the personal and commercial challenges achieved the greatest reliability coefficient (*α*) for their respective segments of the Obstacle. The absence of BIM education was the lone factor with the greatest loading (0.285), and it was supported by a lack of advertisement and awareness of BIM, as well as a lacking interpretation of BIM as well as the advantages it offers. In Table 10, you can see the outcomes of the major component analysis and Cronbach's alpha test performed on the BIM Challenges section.

Table 10. Results of factor loading and Cronbach's alpha for BIM hurdles

Individual Obstacles		
Obstacles to the implementation of BIM	Factor Loading	Cronbach (α)
BIM education is lacking	0.842	0.797
lack of knowledge regarding the advantages of BIM	0.835	
absence of inadequate education	0.804	
Need of BIM expertise in using modern technology	0.758	
Insufficient skill development (resisting to change)	0.747	
Obstacles in the BIM Process		
The need for improved collaboration among project participants as work procedures change	0.698	0.647
Problems and risks associated with using a single component (BIM)	0.642	
Legal problems (availability of data)	0.601	
Business Challenges		
Roles, duties, and compensation structures that are evolving	0.695	0.637
Expense of instruction	0.648	
Return on Investment is in question	0.644	
High implementation costs	0.638	
Uncertain advantages	0.606	
Modeling techniques that are time-consuming and complicated	0.593	
Technological Challenges		
Technical infrastructure is insufficient	0.765	0.679
There is a scarcity of *BIM* engineers	0.744	
Without really being constrained by any norms or regulations	0.658	
This present technological age is adequate	0.645	
Interconnection	0.611	
Organizing Challenges		
Other competing initiatives are not present	0.762	0.693
Absence of backing from senior management	0.738	
Challenges in managing BIM's effects	0.664	
Resistance to change	0.658	
Employee turnover and the extent of change	0.642	
Market Obstacles		
Lack of awareness and publicity	0.847	0.745
Insufficient government or client requirements	0.856	
Market readiness is still lacking	0.662	

3.10. Mean Scores and Standard Deviations (*SD*) used in *RII*.

As previously mentioned, for a factor to be deemed significant, it needs to have a *RII* of 0.8 or greater and an adjusted statistical mean (median) score of 4.0 or higher. For the full context, please refer to the cited paper. The distribution of the statistical mean scores for each factor was examined using SPSS's frequency's function. This was investigated, thus there must be one. The graphs illustrating the average scores for each component are satisfactory and closely follow a normal distribution curve, according to the data. This distribution curve analysis offered additional support for the ranking of the main components. The findings of the *RII* assessment including the responses are shown in Table 11, which demonstrates that "Complete absence of BIM Training" is indeed the major issue for individuals. If you were to rate all Obstacles, this one would come in first place. This item's *RII* is 0.853. According to a 2011 survey done by Building Cost Information Service (*BCIS*) in the United Kingdom and the United States, one of the major Obstacles is a lack of BIM education.

The second-ranked Obstacle (*RII*=0.835) and third-most important Obstacle overall is a lack of knowledge with building information modeling (BIM) and its benefits. With a relatively important index score of 0.824, inadequate training comes third on the list of main difficulties. This component is rated fourth best overall. The category of human challenges we are considering here is a significant obstacle to BIM adoption, with a score of 0.807 on the average group relative significance index. All elements in the categories of business, technical, organizational, and BIM process hurdles have *RII* values around 0.8, indicating that they are not highly significant issues.

Lack of publicity and awareness is the top obstacle in the market category, achieving a substantial *RII* score of 0.840, moving it up to second place in the overall ranking of obstacles. Absence of consumer and governmental demand is the second important market Obstacle, where *RII*=0.819, and the fifth significant obstacle overall. The average *RII* for this group, however, came in at 0.703. After considering all of the obstacles, "The shifting responsibilities, duties, and payment arrangements" and "Changing work practices" were both assigned the same *RII* score of 0.701, which indicates that they share the same level of difficulty. *SD* for the hurdle "The different working procedures" was 1.167 while *SD* for the subcomponent "The shifting tasks, responsibilities, and recompense arrangements" was 1.005. This was done by calculating the difference between the two. This is the reason why "The other" is placed 13th and "The shifting roles, duties, and remuneration systems" is ranked 12th in the list.

The factors "The market hasn't been ready enough" and "Legal concerns (control of data)" have the identical RII values, analytical means, and standard deviations, giving them both a ranking of 25. The category of internal Obstacles is, consequently, the most common of the six that were taken into consideration. In Table 12, we compare our findings to those of an earlier study and highlight the five influential elements that we believe to be the most significant overall.

Table 11. To rank obstacles, mean, standard deviation, and *RII* are used

Rank in Group	Total Rank	Problems that arise when BIM is used	*Mean*	*SD*	*RII*	*RII* Group
Personal Obstacles						
1	1	There is a paucity for BIM education	4.267	1.082	0.853	0.807
2	3	Insufficient familiarity with BIM's benefits	4.173	1.018	0.835	
3	4	Poor education or preparation	4.120	1.090	0.824	
4	8	Not enough people have enough experience with BIM to use current technologies	3.840	1.103	0.768	
5	9	Insufficient training and growth of competence	3.787	1.189	0.757	
BIM Procedure Obstacles						
1	13	Reforming company practices (Improper coordination between construction stakeholders)	3.507	1.167	0.701	0.655
2	20	Classification model issues and dangers (BIM)	3.253	1.015	0.651	
3	25	Problems with the law (ownership of statistics)	3.067	1.200	0.613	
Obstacles in Business						
1	12	Changes in roles, financial commitments, and pay scales	3.507	1.005	0.701	0.645
2	18	The cost of education.	3.280	1.192	0.656	
3	19	The potential for profit is in question	3.267	1.178	0.653	
4	23	Tough financial commitment is required to put into action	3.213	1.233	0.643	
5	24	Difficult to gauge benefits	3.093	1.307	0.619	
6	27	It's a laborious and intricate modelling method	2.987	1.033	0.597	
Technical Obstacles						
1	6	Inadequate technological support framework	3.933	1.057	0.787	0.700
2	11	Absence of BIM technical specialists	3.587	1.242	0.717	
3	14	Unable to follow any sort of rules or regulations	3.387	1.184	0.677	
4	16	Modern technology is sufficient	3.373	1.383	0.675	
5	22	Interoperability	3.213	1.211	0.643	
Organization Obstacles						
1	7	There are no other projects to worry about	3.867	1.095	0.773	0.703
2	10	Not having the support of upper management	3.747	1.206	0.749	
3	15	Issues with BIM impact management	3.373	1.228	0.675	
4	17	To oppose or oppose the introduction of something new	3.347	1.457	0.669	
5	21	The number of workers who have left and how much has changed	3.253	1.187	0.651	
Market Obstacles						
1	2	Insufficient expertise and exposure	4.200	0.986	0.840	0.757
2	5	Low levels of interest from customers or authorities	4.093	1.147	0.819	
3	25	Currently, the industry is not prepared	3.067	1.200	0.613	

Table 12. Past research on Libya's biggest *BIM* hurdles

Ranking	Most Difficult Obstacles to Using BIM
1	The absence of *BIM* training
2	Due to a lack of exposure and understanding
3	Insufficient familiarity with BIM and its advantages
4	Poor education and preparation
5	Do of a lack of interest for of customers and the government

3.11. Pearson's Method Significance and Correlation Tests

We utilized *SPSS* to conduct a study based on Pearson's Correlation to investigate the possibility of finding any correlations, whether they be positive or negative, between the five significant blockages uncovered by *RII* analysis. Using the approaches to analysis that were discussed there, we investigated three distinct case studies. The significance of a relationship can be directly proportional to its worth. A p value less than or equal to 0.05 indicates a statistically significant link in an investigation involving two or more variables. The results are presented in Table 13. Based on the information in the table above, we can conclude that all correlations between variables are moderately strong. We can state that there's a positive correlation between each combination of obstacles with 99% certainty (at the significance level of 0.01) because all interactions p-values were much less than 0.05.

Table 13. Pearson correlation of the five important challenges

Variable quantity		$S1$	$S2$	$S3$	$S4$	$S5$
Not enough people know about BIM	Correlation ρ-value	1.000				
Due to a lack of exposure and understanding	Correlation ρ-value	0.468* 0.001	1.000			
BIM unfamiliarity and its benefits	Correlation ρ-value	0.693* 0.001	0.396* 0.001	1.000		
Poor education and preparation	Correlation ρ-value	0.694* 0.001	0.518* 0.001	0.529* 0.001	1.000	
Due to government and customer apathy	Correlation ρ-value	0.565* 0.001	0.420* 0.001	0.485* 0.001	0.425* 0.001	1.000

*At the 0.01 level, correlation is important

4. CONCLUSIONS

With the help of BIM-building grading tools, getting a green certification can be done more quickly. After reading the papers, it's clear that not much study has been done on how BIM and building rating systems can work together. This is why the manual method is still widely used to rate green buildings. In contrast to Green Mark, Green RE, BREEAM, GBI, and BEAM Plus, LEED is a popular building rating system for integrating BIM software. More study needs to be done on BIM-green building technologies because the strategy for integrating them may not have been set. Also, study on the BIM-building rating tool is mostly focused on collecting data from the BIM model to improve the sustainability of buildings, rather than automating the green certification process. When it comes to getting credit through BIM, energy efficiency subcategories are more developed than other subcategories. In the context of BIM-building rating, other green certification subcategories that aren't studied enough are water efficiency, location and mobility, materials and resources, sustainable site, internal environmental quality, innovation, and regional priority. Future study could focus on these subcategories to find more ways to use BIM for environmental ratings. The study is limited because it doesn't look into publications that use BIM software to improve sustainability. Instead, it looks at publications that combine BIM and building rating systems.

After doing this analysis, it is clear that the Libyan company can't adopt BIM because of individual factors and market barriers. The biggest problem is that BIM is not taught in higher education. Also, there isn't enough demand, customer or government pressure, or training for BIM employees. Each of the five main problems has a positive association at the 0.05 level of significance. For BIM to be popular and widely used in Libya, support and encouragement from the government are not enough. Everyone in the construction business needs to do more to spread the word BIM and include it in their projects.

REFERENCES

[1] R. Volk, J. Stengel, F. Schultmann, "Building, Information Modeling (BIM) for Existing Buildings - Literature Review and Future Needs", Automation in Construction, Issue 38, pp. 109-127, 2014.

[2] B. Manzoor, I. Othman, S. Gardezi, E. Harirchian, "Strategies for Adopting Building Information Modeling (BIM) in Sustainable Building Projects - A Case of Malaysia", Buildings, Issue 11, Vol. 249, 2021.

[3] N.A. Haron, R.P.Z.A. Raja Soh, A.N. Harun, "Implementation of Building Information Modelling (BIM) in Malaysia: A Review Pertanika", Journal of Science and Technology, Issue 25, pp. 661-674, 2017.

[4] E.C. Akcay, D. Arditi, "Desired Points at Minimum Cost in the "Optimize Energy Performance" Credit of Leed Certification", Journal of Civil Engineering and Management, Issue 23, Vol. 6, pp. 796-805, 2017.

[5] S.G. Al Ghamdi, M.M. Bilec, "Lifecycle Thinking and the LEED Rating System: Global Perspective on Building Energy Use and Environmental Impacts", Environmental Science & Technology, Iss. 49, Vol. 7, pp. 4048-4056, 2015.

[6] Z. Alwan, D. Greenwood, B. Gledson, "Rapid LEED Evaluation Performed with BIM- Based Sustainability Analysis on a Virtual Construction Project", Construction Innovation, Issue 15, Vol. 2, pp. 134-150, 2015.

[7] K.A.B. Asare, K.D. Ruikar, M. Zanni, R. Soetanto, "BIM-based LCA and Energy Analysis for Optimized Sustainable Building Design in Ghana", Applied Science, Issue 2, Vol. 11, pp. 1-20, 2020.

[8] S. Atabay, A. Pelin Gurgun, K. Koc, "Incorporating BIM and Green Building in Engineering Education: Assessment of a School Building for LEED Certification, Practice Periodical", Structural Design and Construction, Issue 25, Vol. 4, 2020.

[9] S. Azhar, J. Brown, R. Farooqui, "BIM-Based Sustainability Analysis: An Evaluation of Building Performance Analysis Software", The 45th ASC Annual Conference, pp. 1-4, 2019.

[10] S. Azhar, W.A. Carlton, D. Olsen, I. Ahmad, "Building Information Modeling for Sustainable Design and LEED Rating Analysis", Automation in Construction, Issue 20, Vol. 2, pp. 217-224, 2011.

[11] J. Basbagill, F. Flager, M. Lepech, M. Fischer, "Application of Life-Cycle Assessment to Early Stage Building Design for Reduced Embodied Environmental Impacts", Building and Environment, Issue 60, pp. 81-92, 2013.

[12] J. Carneiro, R.J.F. Rossetti, D.C. Silva, E.C. Oliveira, "BIM, GIS, IoT, and AR/VR Integration for Smart Maintenance and Management of Road Networks: A Review", The IEEE International Smart Cities Conference ISC2, 2018.

[13] J.P. Carvalho, I. Alecrim, L. Braganca, R. Mateus, "Integrating BIM-Based LCA and Building Sustainability Assessment", Sustainability, Issue 12, Vol. 7468, pp. 1-17, Switzerland, 2018.

[14] P.H. Chen, T.C. Nguyen, "Integrating Web Map Service and Building Information Modeling for Location and Transportation Analysis in Green Building Certification Process", Automation in Construction, Vol. 77, pp. 52-66, 2017.

[15] P.H. Chen, T.C. Nguyen, "A BIM-WMS Integrated Decision Support Tool for Supply Chain Management in Construction", Automation in Construction, Issue 98, pp. 289-301, 2019.

[16] J. Crippa, A.M. Araujo, F. Bem, D. Ugaya, S. Scheer, "A Systematic Review of BIM Usage for Life Cycle Impact Assessment", Built Environment Project and Asset Management, Issue 10, Vol. 4, pp. 603-618, 2020.

[17] J. Crippa, L.C. Boeing, A.P.A. Caparelli, R. da Costa, "A BIM-LCA Integration Technique to Embodied Carbon Estimation Applied on Wall Systems in Brazil", Built Environment Project and Asset Management, Issue 8, Vol. 5, pp. 491-503, 2018.
[18] S. Eleftheriadis, P. Duffour, D. Mumovic, "BIM-Embedded Life Cycle Carbon Assessment of RC Buildings Using Optimized Structural Design Alternatives 2018a", Energy and Buildings Journal, Issue 173, pp. 587-600, 2018.
[19] S. Eleftheriadis, P. Duffour, D. Mumovic, "BIM-Embedded Life Cycle Carbon Assessment of RC Buildings Using Optimized Structural Design Alternatives 2018b", Energy and Buildings Journal, Issue 173, pp. 587-600, 2018.
[20] B. Ilhan, H. Yaman, "Green Building Assessment Tool (GBAT) for Integrated BIM-Based Design Decisions", Automation in Construction Journal, Issue 70, pp. 26-37, 2016.
[21] F. Jalaei, S. Mohammadi, "An Integrated BIM-LEED Application to Automate Sustainable Design Assessment Framework at the Conceptual Stage of Building Projects", Sustainable Cities and Society, Issue 53, 2020.
[22] F. Jalaei, A. Jrade, "An Automated BIM Model to Conceptually Design, Analyze, Simulate, and Assess Sustainable Building Projects 2014a", Journal of Construction Engineering, Issue 2, pp. 1-21, 2014.
[23] F. Jalaei, A. Jrade, "Integrating Building Information Modeling (BIM) and LEED System at the Conceptual Design Stage of Sustainable Buildings", Sustainable Cities and Society, Issue 18, pp. 95-107, 2015.
[24] F. Jalaei, A. Jrade, "Integrating BIM with Green Building Certification System, Energy Analysis and Cost Estimation Tools to Conceptually Design Sustainable Buildings 2014b", Construction Research Congress, Issue 8, p. 140, 2014.
[25] T. Kang, "Rule-Based LEED Evaluation Method Considering BIM Linkage and Variability", KSCE Journal of Civil Engineering, Issue 24, Vol. 1, pp. 110-121, 2019.
[26] G. Khoshedlnezamiha, S.C. Liew, V.S.N. Bong, D.E.L. Ong, "Evaluation of BIM Application for Water Efficiency Assessment", Journal of Green Building, Issue 15, Vol. 4, pp. 91-115, 2020.
[27] R. Krishnamurti, T. Biswas, T.H. Wang, "Modeling Water Use for Sustainable Urban Design", Communications in Computer and Information Science, Issue 242, pp. 138-155, 2012.
[28] S. Lee, S. Tae, H. Jang, C.U. Chae, Y. Bok, "Development of Building Information Modeling Template for Environmental Impact Assessment", Sustainability, Issue 13, Vol. 6, Switzerland, 2021.
[29] B. Davorin, N. Srete, G. Dario, M. Nedeljko, "Pearson Correlation in Determination of Quality of Current Transformers", Sensors, Issue 23, Vol. 5, pp. 2704-2721, 2023.
[30] A.I. Khudiyeva, M.Z. Yusifov, "Reconstruction of Structural Elements Damaged under Influence of Pressure and Wave on Stationary Sea Platforms", International Journal on Technical and Physical Problems of Engineering (IJTPE), Issue 50, Vol. 14, No. 1, pp 64-70, March 2022.
[31] J.N. Aslanov, K.S. Mammadov, "Design and Performance Analysis of Improved Valve Construction Being Used in Oil and Gas Industry", International Journal on Technical and Physical Problems of Engineering (IJTPE), Issue 51, Vol. 14, No. 2, pp. 98-103, June 2022.
[32] N.R. Rahmanov, N.M. Tabatabaei, R.E. Kerimov, A.Z. Mahmudova, "Hybrid Distributed Generation Systems Construction with Renewable Energy Sources for Remote Consumers Power Supply", International Journal on Technical and Physical Problems of Engineering (IJTPE), Iss. 50, Vol. 14, No. 1, pp. 149-155, March 2022.

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