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6th UNDERGRADUATE SEMINAR ON BUILT ENVIRONMENT AND TECHNOLOGY (USBET) 2023

SUSTAINABLE BUILT ENVIRONMENT

25 - 27 SEPTEMBER 2023

E-PROCEEDING

USBET 2023

e-Proceeding

6th UNDERGRADUATE SEMINAR ON BUILT ENVIRONMENT AND TECHNOLOGY (USBET) 2023

SUSTAINABLE BUILT ENVIRONMENT

Published by,
Department Of Built Environment Studies And Technology
Faculty Of Architecture, Planning & Surveying
Universiti Teknologi MARA Perak Branch, Seri Iskandar Campus
usbet.fspuperak@gmail.com

eISSN 2821-3076

02 October 2023 | Perak, Malaysia
Universiti Teknologi MARA, Perak Branch, Seri Iskandar Campus

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REVOLUTIONIZING QUANTITY SURVEYOR ROLES IN HIGH-RISE PROJECTS: THE BIM IMPLICATION

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ABSTRACT

Abstract – *Building Information Modelling (BIM) is a software widely used by individuals, businesses, and government agencies for planning, designing, constructing, operating, and maintaining buildings and physical infrastructure. In the construction industry, Quantity Surveyors play a crucial role, and it is important for them to understand their responsibilities in various industry methods, including emerging technologies like BIM. However, a lack of historical data on rates, waste, and labor expenses poses a challenge. As of to date, there are limited empirical studies on the impact of BIM implementation in high-rise building. This study intended to identify the implication of BIM on the roles of consultants and Quantity Surveyors in high-rise building projects. In realizing the notion, a literature review was conducted, and a questionnaire survey was designed to gather data through a quantitative method. The survey targeted Quantity Surveyors around Kuala Lumpur which then will be filtered to Quantity Surveyors who work as consultants only. Accordingly, the finding reveals the frequency of BIM usage during construction phases and the impact of BIM applications on consultants' Quantity Surveyors. In conclusion, the study contributes to increasing the knowledge of Quantity Surveyors regarding BIM and its potential benefits, particularly for consultants in the construction industry.*

Keywords: *Building Information Modelling, consultant, implication, high-rise building*

INTRODUCTION

Building Information Modeling (BIM) is a software that has evolved since the 1970s, but its widespread adoption occurred in the early 2000s. It encompasses a process that involves creating and managing digital representations of physical and functional aspects of buildings, supported by a range of tools, technologies, and contracts. The main idea behind BIM is to construct a virtual representation of a facility prior to its physical construction, aiming to minimize uncertainty, enhance safety, address issues, and simulate and assess potential outcomes. Btoush and Harun (2017) suggest that BIM offers an alternative approach to construction design, simplifying digital representation while providing comprehensive project information before construction begins. The topic of this research is directly relevant to the role of Quantity Surveyors, who hold significant importance in the construction industry. Regardless of the methods employed by the industry, including technologies like BIM, Quantity Surveyors must understand their responsibilities. Traditionally, the construction industry in Malaysia has predominantly used non-tech or traditional methods for project development. However, with advancements in technology, the industry must implement and study these emerging tools for future purposes. Therefore, it becomes crucial to investigate the implications of BIM implementation on the roles of Quantity Surveyors.

Throughout the project lifecycle Quantity Surveyors undertake various roles such as cost estimators, negotiators, client advisors, and project coordinators. For instance, Davies (2017) highlighted in their study that some Quantity Surveyors face challenges in estimating costs due to a lack of historical data on current rates, waste, and labor expenses. In such cases, the expertise and experience of Quantity Surveyors are required to compensate for the absence of captured historical data. Understanding the implications of implementing BIM in the Quantity Surveyors's role is essential for optimising its benefits. By addressing the challenges and potential adjustments required, Quantity Surveyors can leverage BIM to enhance their performance and contribute to the success of construction projects.

LITERATURE REVIEW

BIM Definition

Throughout the evolution of Building Information Modelling (BIM), various definitions have emerged in the literature. Sinoh et al. (2020) provide insight into this matter, stating that BIM is often perceived as computer software, a collection of software, or simply a tool. In its early stages, BIM was primarily viewed as a tool for digitalizing building illustrations into computer-generated models, allowing for the integration of vital information within these models.

BIM History

BIM emerged in the early 2000s as a result of incorporating Information and Communication Technology (ICT) into construction industry practices. Its development aimed to address key challenges such as fostering collaboration, managing vast amounts of information, reducing project time and costs, and improving construction efficiency. Al-Ashmori et al. (2020) also emphasize in their study that BIM is recognized as an effective platform for producing environmentally-friendly buildings, mitigating risks in the construction industry, handling complexity, and resolving project management conflicts. However, Enegbuma et al. (2014) highlight in their research that the maturity level of BIM within Malaysia's construction industry currently stands at Level 1 and Level 2, indicating room for further advancement and implementation.

BIM Levels Overview

Building Information Modelling (BIM) implementation encompasses varying levels of complexity and detail, commonly known as the 'level of BIM'. These levels define the extent of BIM utilization and the level of information and model detail included in the process. One widely accepted framework for categorizing these levels is the UM BIM Level of Detail (LOD) specification. The LOD specification provides a standardization reference point for BIM implementation across projects. Awwad et al. (2022) highlight in their research the significance of the handbook produced by the National Building Specification (NBS) in defining and elucidating each level of BIM. The handbook serves as a valuable resource for professionals in the construction industry, offering comprehensive guidance. On the specific characteristics, requirements, and expectations associated with each BIM level. It provides clarity on the level of information, model accuracy, and level of collaboration required at each stage of BIM implementation. The guidance provides stakeholders involved in BIM projects gain a better understanding of the distinctive features and implications of each BIM level. It helps align expectations and facilitates effective communication and collaboration between project participants.

Implication of BIM Application

Several studies have identified multiple positive implications of implementing Building Information Modelling (BIM) in construction projects. Latiffi et al., (2014) discovered five key areas where BIM has a positive impact which are cost, time, project design, process, communication, and collaboration. HBM helps to prevent increased construction costs and delays by enabling better cost control and project planning. It identifies design conflicts early in the design stage, allowing for timely resolution and reducing the need for costly design changes and rework. Additionally, BIM improves workmanship in mechanical, electrical, and plumbing (MEP) installations by enhancing coordination and clash detection, leading to a smoother construction

process (Mohd Noor, et al., 2018). Besides, BIM increases the accuracy of cost estimates by automating information extraction and integrating cost data within the BIM model. This automation allows for early scheduling information and quick cost impact analysis, providing valuable insights during the pre-construction phase. Furthermore, the visual nature of BIM enhances comprehension, enabling stakeholders to better understand the project's scope and requirements.

According to Mayouf et al.(2019), the integration of cost data, quantities, and project schedules within a BIM model increases the value of Quantity Surveyor services. BIM facilitates more efficient and accurate quantity take-offs, enabling Quantity Surveyors to provide more precise cost estimates and better support project budgeting and control. Moreover, Pyung and Sungho (2016) note that BIM implementation in quantity surveying reduces cost estimation errors and saves time. The use of BIM tools and features streamlines the estimation process, improving the accuracy and reliability of cost assessments. Due to that, the positive implication of BIM implementation in construction projects encompasses cost control, time management, improved project design and coordination, enhanced communication, and increased efficiency in Quantity Surveyor services. These benefits contribute to more successful project outcomes, improved productivity, and greater client satisfaction.

BIM Application for High-Rise Buildings in Malaysia

The application of BIM in high-rise building projects In Malaysia offers several specific benefits that are particularly advantageous. High-rise buildings involve complex architectural, structural, and MEP systems. At this stage, BIM facilitates effective design coordination by providing a comprehensive and coordinated 3D model. This helps identify and resolves clashes or conflicts between various building elements, reducing errors and rework during construction (Tahir, et al.2017). On top of it, BIM supports structural analysis and simulation tools, enabling engineers to assess the performance and safety of high-rise building structures. By conducting a virtual structural analysis within the BIM environment, potential design flaws or structural weaknesses can be identified and addressed early in the design phase. This helps ensure the structural integrity and safety of the building. However, at this current stage in Malaysia, the application of BIM specifically for high-rise buildings is still limited. Manzoor et al. (2021), revealed that there is a need to increase the usage of BIM in high-rise buildings to boost sustainable growth as the findings show that fewer stakeholders have experience in using BIM for their high-rise building projects.

Ways to Implement BIM in Industry

The implementation of BIM in the Malaysian construction industry is still in its early stages and has yet to be fully realized. However, there is a growing recognition of the need to enhance the quality of BIM implementation in the industry. Various strategies have been identified by researchers to facilitate and improve the adoption in Malaysia.

According to Memon et al. (2014), a range of strategies were ranked in terms of their effectiveness. These strategies include the trial use of BIM software, providing staff training programs to develop the necessary skills and knowledge, introducing BIM into university curricular to ensure future professionals are well-prepared, providing subsidies for BIM software, enacting legislation to mandate BIM implementation, and mobilizing clients to drive the adoption of BIM.

Similarly, Daoor (2018) also identified key strategies for enhancing BIM implementation. These strategies include providing free or trial versions of BIM software to encourage its use and familiarization, conducting staff training programs to ensure the workforce is equipped with the necessary competencies, reducing the pricing of BIM software to make it more accessible, enacting legislation to promote BIM adoption and compliance, and organizing workshops to educate stakeholders on the benefits and usage of BIM. Hence, by implementing these strategies, the Malaysian construction industry can overcome barriers and accelerate the adoption of BIM. These efforts will help to improve the quality and effectiveness of BIM implementation, leading to enhanced collaboration, increased productivity, reduced costs, and improved project outcomes. It is essential for industry stakeholders, government bodies, educational institutions, and professionals to collaborate and actively promote the implementation of BIM, ensuring its successful integration into the construction industry's practices.

METHODOLOGY

This research specifically examines consultant Quantity Surveyors with experience in managing high-rise building projects utilizing Building Information Modelling (BIM) in Kuala Lumpur. As Kuala Lumpur is a city with a significant number of high-rise buildings, serves as an ideal location for this study. To gather data, a total of 200 questionnaires were distributed to Quantity Surveyors through online messaging platforms. Out of the total respondents, 170 individuals provided answers to the questionnaires. However, for the purpose of this study, only 148 respondents were valid for consideration in fulfilling the purposive sampling that was selected. Thus the analysis and findings presented in this research are based on the responses received from these 148 valid participants from the consultant sector. On top of it, there are also some limitations in this study where it might focus on short-term impacts and changes, potentially overlooking long-term effects that could emerge over the life cycle of high-rise projects. Moreover, BIM technology and its implication for roles are continually evolving. The study might become outdated quickly if conducted over an extended period and the findings might not reflect the latest advancements in BIM.

DATA ANALYSIS AND FINDINGS

Demographic Profiles of Respondents

Type of Organization

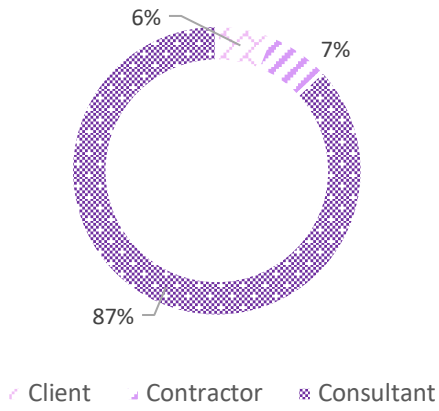

Figure 1: Respondent's Type of Organization

Figure 1 displays the distribution of respondents based on their type of organization in this study. The majority of respondents, comprising 148 individuals, identified themselves as being affiliated with consultant organizations, representing 87% of the total. Additionally, 12 respondents (7%) indicated that they belonged to contractor organizations. Ten respondents (6%) reported being associated with client organizations. Notably, no participants identified themselves under project manager companies among the total 170 total respondents. These findings are highly relevant to the research focus, which specifically targets consultants, thereby rendering the obtained results appropriate and aligned with the research objectives.

Experiences in using BIM

Figure 2 presents the data regarding respondents' experiences in using BIM in recent years. The chart reveals that a majority of the respondents have had no experience with BIM for construction projects. Specifically, 92 respondents, denotes with 62% of the total reported no prior exposure to BIM. On the other hand, 56 respondents, representing 38% of the total, indicated that they had previous experience with BIM. The finding that the majority of respondents lacked experience with BIM aligns with the observation made by Al-Ashmori et al. (2022) who noted that many local organizations perceive BIM implementation in construction projects as an uncertain technology.

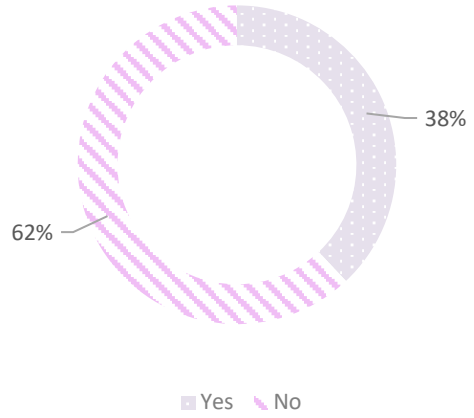

Figure 2: Respondent's Experiences in using BIM

This perception is often attributed to the unpredictable nature of process changes associated with BIM adoption, as well as the perceived high costs associated with the system's digital project management processes. These results, shed light on the current state of BIM utilization in the surveyed sample, highlighting the need for further exploration and understanding of the challenges and barriers that hinder broader BIM implementation in Malaysia's construction industry. The findings also underscore the importance of addressing issues related to cost, uncertainty, and process changes to foster more widespread adoption of BIM and leverage its potential benefits in future construction projects.

Experiences handling high-rise building projects using BIM

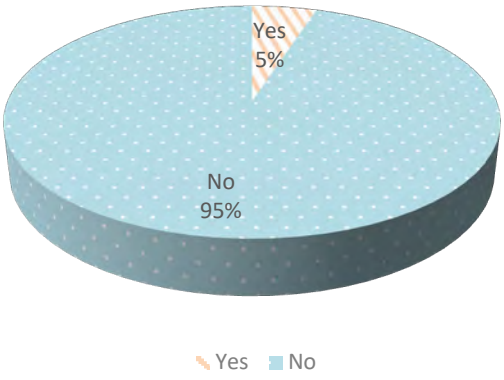

Figure 3: Respondent's Experiences Handling High Rise Building Project using BIM

Figure 3 presents the data on respondents' experiences in handling high-rise building projects using BIM. The chart indicates that a significant majority of respondents, 141 in total, accounting for 85% of the respondents, reported no prior experience in handling high-rise building projects using BIM. In contrast, a small percentage of respondents, 5% to be precise, which translates to 7 individuals, indicated that they had some level of experience in handling high-rise building projects using BIM. The data from Figure 3 highlight a clear trend suggesting that the Malaysian construction industry still faces challenges in the widespread implementation of BIM, particularly in the context of high-rise building projects. The fact that only a small number of respondents have hands-on experience with BIM in this specific project type suggests that there are hurdles and barriers hindering its adoption.

One potential challenge mentioned in the context of BIM implementation is the high initial cost. It is possible that the cost associated with acquiring the necessary software, training the workforce, and adapting the existing workforce to incorporate BIM practices has deterred widespread adoption. This may partially explain the low percentage of respondents with experience in handling high-rise building projects using BIM. To further promote BIM adoption in high-rise projects, it is crucial for the construction industry to address these challenges and invest in resources, training, and support systems that can help overcome the initial cost barriers. By doing so, the industry can unlock the full potential of BIM, improve project efficiencies, enhance collaboration, and ultimately reap the benefits of this advanced technology in the context of high-rise building projects. Subsidizing the price of BIM software is ranked fifth, with a mean value of 4.29, this result indicates that cost considerations play a role in facilitating BIM adoption, and providing financial incentives can help promote its implementation. Lastly, the provision of legislation on BIM usage is ranked the lowest, with a means value of 4.16 which may suggest that while legislation may play a role, it is perceived as a less effective method compared to other strategies mentioned above.

The findings of this study align with research by Daoor (2018), who also highlighted the effectiveness of workshops on the importance of applying BIM as a means of promoting its implementation. The highest mean value obtained for this approach further strengthens the comparability of the results. In short the respondents identified workshops, provision of trial software, training programs, client mobilization, subsidization of software costs, and legislation as effective ways to implement BIM specifically for high-rise building projects. These findings provide valuable insights for industry stakeholders and policymakers to facilitate the successful implementation of BIM in the Malaysia construction industry.

Implication of BIM Application

Figure 4 illustrates the range of mean values for various aspects of BIM application as reported by the respondents. The highest mean value of 4.46 is attributed to the improvement of communication and collaboration among construction players,

ranking it at the top. This indicates that the respondents recognized the significant impact of BIM in enhancing communication and collaboration within the construction industry. The second-highest mean value of 4.38 corresponds to the use of BIM software for cost estimating, resulting in reduced errors and shorter estimation durations. This suggests that the respondents perceive BIM as a valuable tool for improving the accuracy and efficiency of cost estimation processes.

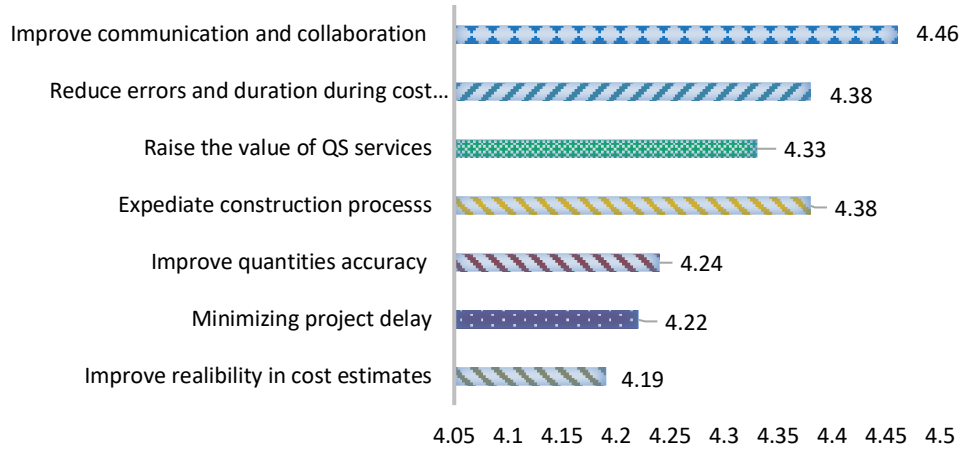

Figure 4: Mean score - Implication of BIM Application for High Rise Building Project in Quantity Surveyor's Consultant Practices

Following closely in the third lace with the same mean value of 4.38 is the improvement of the construction project process. This indicates that the respondents acknowledge the positive impact of BIM on streamlining and enhancing overall project processes. In fourth place, with a mean value of 4.33, is the implication that BIM raises the value of Quantity Surveyors' services. This finding suggests that the respondents recognize the value of BIM in empowering Quantity Surveyors and elevating their role in construction projects. The findings from this study align with previous research by Latiffi et al. (2014), which also emphasized the positive implications of BIM application. The highest mean value obtained for improving communication and collaboration among construction players supports their findings. Overall, the mean values indicate that the respondents recognize the potential benefits of BIM in terms of enhancing communication, improving cost estimation and project processes, raising the value of Quantity Surveyors' services, and increasing accuracy in quantity calculations. These findings highlight the perceived importance of BIM in driving efficiency and effectiveness in construction projects, reinforcing the value of its implementation.

Effective Ways to Implement BIM

Figure 5 presents the mean values and ranks for effective ways to implement BIM in Quantity Surveyor consultant practices for high-rise building projects. The range of mean scores which falls between 4.16 and 4.64, indicates a very high level of agreement among the respondents. These mean scores suggest that the respondents recognize the significance of the effective implementation of BIM in their practices.

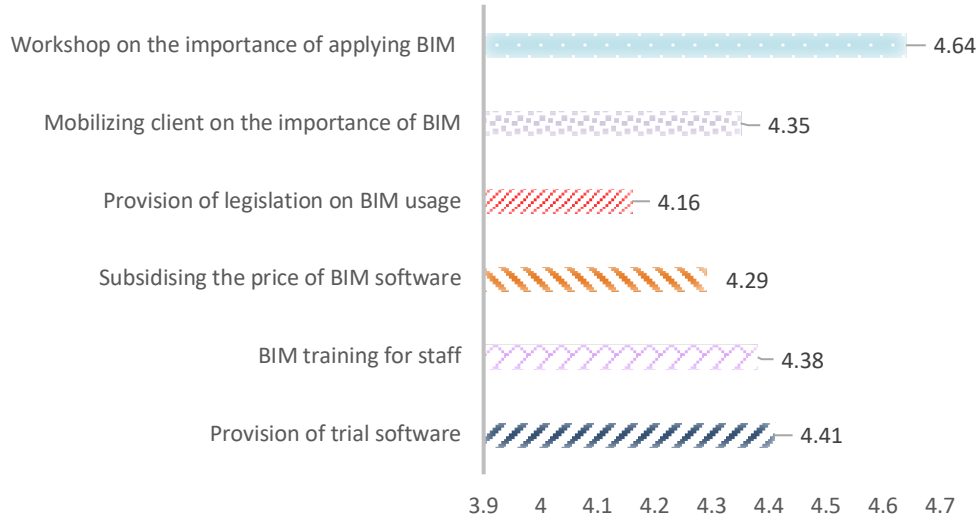

Figure 5: Mean Score - Effective Ways to Implement BIM for High Rise Building Project in Quantity Surveyor's Consultant Practices

According to the findings, the most effective way to implement BIM with the highest mean value of 4.64, is through conducting workshops that emphasize the importance of applying BIM. This result highlights the value of educational initiatives that promote awareness and understanding of BIM among Quantity Surveyors consultants. The second most effective approach, as indicated by a mean value of 4.41 is the provision of trial software. This suggests that allowing practitioners to experiment with BIM software before making a full commitment is seen as a valuable strategy for facilitating its implementation. The third-ranked method with a mean value of 4.38 is training construction staff. This finding underscores the importance of providing comprehensive training programs to enhance the skills and knowledge of professionals involved in BIM implementation. Mobilizing clients on the importance of BIM received a mean value of 4.35, placing it in the fourth position. This suggests that engaging and educating clients about the benefits and value of BIM can significantly contribute to its successful implementation.

CONCLUSION

In conclusion, the implementation of BIM has profound implications for the roles of consultants and Quantity Surveyors in high-rise building projects, primarily focusing on enhancing communication and collaboration within the construction ecosystem. BIM serves as a powerful tool that empowers Quantity Surveyors to actively contribute to the overall success particularly for high-rise building projects by leveraging its capabilities in accurate cost estimation, risk mitigation, and efficient resource management. On top of it, the BIM implementation transforms the roles of consultant Quantity Surveyors in high-rise building projects by emphasizing accurate cost estimation, risk mitigation, and efficient resource management, Quantity Surveyors can contribute significantly to project success. As BIM continues to evolve, the construction industry can expect improved project outcomes, and increased efficiency, driving positive change and innovation throughout the industry. As a recommendation for future research, some potential avenues for this title can be explored in measuring technology adoption barriers specifically for BIM with high-rise buildings and also BIM implementation strategies in order to delve deeper into aspects of this topic.

ACKNOWLEDGMENT

The authors express their heartfelt gratitude to all the respondents and expert panels who participated in this research, especially to the consultants' Quantity Surveyors in Kuala Lumpur. Their valuable contributions and insights have been instrumental in enriching this study and providing a deeper understanding of the implication of BIM in the construction industry. The authors are truly grateful for their time, effort, and invaluable contributions, which have significantly contributed to the success of this study.

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