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A STUDY ON EFFICIENCIES AND HINDRANCES TO BIM IMPLEMENTATION IN INDONESIAN CONSTRUCTION PROJECTS

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ABSTRACT

BIM is an integrated system where processes are conducted seamlessly, influencing information exchange not only among software but also among stakeholders. BIM is identified as a method that can be employed to enhance the efficacy and efficiency of construction projects, along with the quality of construction projects. The research aims to evaluate the effectiveness, challenges, and overall performance of BIM in the construction industry in Indonesia, providing insights into the extent to which BIM is utilized and its impact on construction projects in Indonesia. The research uses a literature review method to identify the BIM implementation process and its correlation with BIM maturity. The research results demonstrate the continued high demand for BIM resources among Indonesian construction projects. The use of BIM has been utilized in the construction, design, and planning phases of projects. The maturity of BIM utilization is predominantly associated with collaboration, team building, communication, and clash detection. BIM adoption is still quite low in Indonesia, particularly concerning legality, the availability of BIM requirements, supply chain participation, stakeholder involvement, and standard setting.

Keywords: *BIM; Performance; Project.*

1. Introduction

The initiation of BIM implementation in Indonesia dates back to 2017, marked by the release of the Indonesian Digital Construction Roadmap. Through collaboration with multiple entities, including academia, practitioners, and various internal institutions, the Indonesian government has taken preliminary steps to establish a conducive environment, fostering conditions for expediting the adoption and implementation of BIM [13]. The significance of BIM lies in its ability to enhance project performance at every stage. By enabling seamless integration of all project elements, BIM creates an environment where collaboration and information exchange among stakeholders can occur more efficiently. The application of BIM not only influences the relationships between software used in a project but also facilitates better information exchange among stakeholders, including architects, engineers, and project owners.

BIM's effectiveness in construction projects is multifaceted. One of its key strengths lies in its capacity to streamline processes, reduce errors, and improve overall project coordination. Through a comprehensive digital representation of the project, BIM enables stakeholders to visualize the construction process before it commences, identifying potential issues and optimizing workflows. This effectiveness extends to project timelines and resource utilization, contributing to the timely delivery of high-quality construction projects.

While BIM offers numerous advantages, its implementation is not without challenges. One significant challenge is the need for skilled professionals who can navigate and utilize BIM tools effectively. The industry must overcome a learning curve to harness the full potential of BIM.

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Additionally, there may be resistance to change among stakeholders accustomed to traditional construction methods. Addressing these challenges requires strategic planning, training initiatives, and a cultural shift within the industry toward embracing technological advancements.

The performance of BIM in construction projects is a critical aspect that determines its overall success. BIM enhances project performance by fostering collaboration, improving communication, and providing a centralized platform for information exchange. Stakeholders can work concurrently on a shared model, minimizing the chances of errors and discrepancies. The real-time updates and insights provided by BIM contribute to informed decision-making throughout the project life cycle, ultimately enhancing performance and project outcomes.

BIM is not just a technical tool but a strategic solution that establishes a foundation for operational efficiency and the enhancement of construction project quality. Its presence has a positive impact on the construction industry's ability to adapt to technological advancements and cope with the increasing complexity of project demands.

As we delve deeper into this research, we will explore the effectiveness of BIM in Indonesian construction projects, analyze the challenges encountered during its implementation, and assess its overall performance in contributing to successful project outcomes. Through a thorough examination of these facets, this study aims to provide valuable insights into the intricacies of BIM adoption in the Indonesian construction context, offering recommendations for further improvement and advancement within the industry.

2. Material and Methods

BIM is characterized as a concept designed to enhance collaboration among all stakeholders involved in a construction project, aiming to manage project-related risks and attain project objectives successfully [10]. According to McGraw Hill (2009), the utilization of BIM spans across Throughout a construction project's design, construction, operation, and maintenance phases [11]. Regarding the design phase, BIM is described as an intelligent three-dimensional (3D) virtual building model created digitally, encompassing all building information aspects. It is presented in an intelligent format that allows the development of optimized building solutions with reduced risk and increased value before committing to a design proposal [12].

Building Information Modeling (BIM) represents the evolution of collaboration and integration concepts within the construction sector. The formal introduction of this concept in Indonesia took place in 2017 through the Ministry of Public Works and Public Works and Public Housing (PUPR). Following its introduction, the PUPR ministry established a Roadmap for BIM in alignment with the Indonesian government's initiatives [13].

The literature review method used for evaluating the implementation of Building Information Modelling (BIM) in construction projects in Indonesia involves a comprehensive search across reputed academic publishers. The investigation delves into the literature that specifically focuses on BIM implementation in construction projects within the Indonesian context. To ensure a thorough examination, our literature review method involves a comprehensive search across reputable academic publishers, ensuring the inclusion of quality research that has undergone rigorous evaluation and scrutiny by experts in the field. This meticulous approach is instrumental in establishing the credibility and reliability of the literature under examination.

Throughout the literature review process, a key component involves a detailed exploration of final projects, theses, and dissertations. Additionally, the inclusion of materials from construction science journals, book chapters, dissertations, and conference proceedings is deemed crucial for achieving a well-rounded perspective. These academic outputs, particularly final projects, theses, and dissertations, offer valuable insights into the practical application of BIM methodologies in the Indonesian construction context. By considering works emerging from educational institutions and research initiatives, our literature review gains a multifaceted perspective on the challenges and successes of BIM implementation. Construction science journals contribute scholarly articles that delve into specific aspects of BIM implementation, while book chapters offer comprehensive insights from authoritative sources. Dissertations and conference proceedings, on the other hand, provide the latest research findings and innovative practices in the field of BIM.

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Maintaining a steadfast focus on BIM, the literature review concentrates on publications directly addressing BIM implementation in the Indonesian construction sector. This targeted approach aims to build a cohesive narrative that synthesizes diverse perspectives, ensuring that the evaluation is finely tuned to the unique challenges, opportunities, and contextual factors influencing the adoption of BIM methodologies in construction projects within Indonesia.

Moving forward, the paper employs a statistical approach to analyze the selected literature. Descriptive statistics are employed to derive meaningful quantitative insights, enabling the extraction and presentation of key data points related to BIM adoption in Indonesian construction projects. By quantifying trends, patterns, and variations, our literature review seeks to offer a nuanced understanding of the current state of BIM implementation, identifying areas of success and potential areas for improvement.

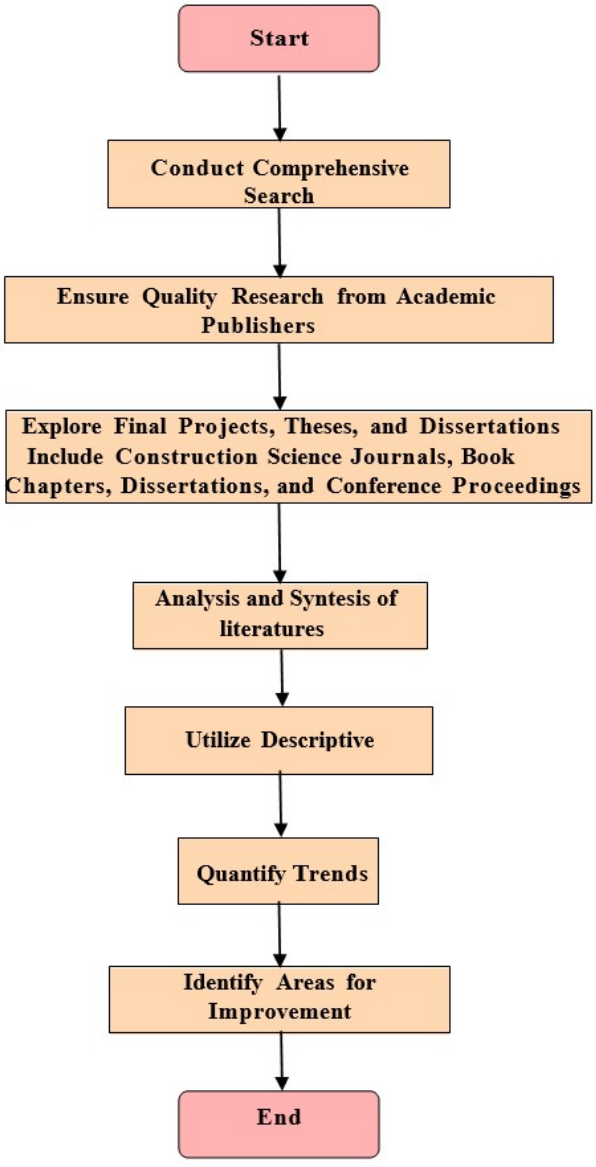

Figure 1. In Research Methodology Review

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3. Result and Discussion

Based on the identification of the driving forces, they include top management support, technology and personnel readiness, government requirements, the belief that BIM may increase performance, and the belief that BIM is superior to the current way [2]. Construction projects that use BIM can have lower construction risk, more reliable information, more accurate cost estimates, improved coordination and communication, and faster project completion times [3]. The performance of BIM projects in terms of time tends to be on schedule or even ahead of schedule [5]. Utilizing BIM in projects can make it easier to implement projects that follow the Design-Build (DB) methodology [6].

Table 1. Challenges in Implementing BIM in Indonesia: A Comprehensive Overview

Finding	Criteria
The current challenges include the low utilization of software tools, a lack of data exchange and interoperability, and the absence of mobile-ready hardware for field use.	Technology
The accuracy level of BIM usage is quite high, with a good performance in terms of accuracy at an average model accuracy rate of 85%. However, the initial costs of software and hardware for BIM usage are high. [6]	Technology
The quality of the BIM model influences the project timeline, with increased accuracy in the model contributing to shorter construction durations. Prolonged project durations may lead to higher overall project costs. Therefore, the precision of the BIM model is a crucial factor in enhancing project performance. [9]	Technology
The roles of BIM engineers and BIM modelers are not well-structured, with BIM roles often overlapping with other responsibilities.	Process
There is also a lack of specialized working environments that can support productivity and optimize the use of BIM.	Process
The lack of skills and capabilities of human resources (Personnel) related to the use of BIM (Professional Workforce) is a significant challenge.	Process
The absence of clear regulations and standards regarding documentation and modeling standards is a notable challenge.	Policy
The absence of clear statements and requirements regarding the use of BIM in projects is a challenge, especially in contract documentation.	Policy
The lack of BIM standardization for integrating models and management across various fields of expertise is a significant challenge	Policy
The majority of projects employ the design and build system.	Management Project

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Finding	Criteria
The use of BIM tends to be pilot projects since the majority of projects follow the design and build system, where the selection of BIM is determined by the contractor.	Management Project
The majority of projects still exhibit a "lonely BIM" nature, leading to limited BIM usage.	Management Project
In the organizational structure, BIM managers generally cannot make decisions regarding the use of BIM. This is due to the informal nature of the procedure for making decisions.	Management Project
The use of BIM is still dispersed/fragmented, both in the overall project and during the construction stage.	Management Project
Utilizing BIM technology has the potential to enhance the competitiveness of domestic companies, enabling them to rival foreign counterparts that have been implementing BIM for an extended period. [8]	Management Project

Source: Literature review, 2024

Lack of worker training is the biggest obstacle to BIM deployment in projects [2]. Since BIM use is still dispersed, maturity has no bearing on how quickly and well BIM performs. The majority of multiyear projects in Indonesia valued at over 100 billion have reached level 4 BIM maturity, which is connected to project scheduling [2]. The reason for the lack of training can be the high upfront expenses associated with setting up relevant technology and software for adopting BIM, in addition to the high expense of employee training. BIM is usually exclusively used in medium- to large-scale projects in Indonesia that have contracts worth more than 100 billion IDR [2]. The accuracy level in the researched data cannot be directly correlated with BIM maturity to assess the overall project process. This is because the accuracy level is not capable of representing the overall accuracy of BIM. In Indonesia, BIM is typically employed during the design and construction phases, primarily aimed at augmenting the generation of drawings and calculation materials. This implies that the utilization of BIM in the project remains restricted [9].

There is a need for better goal setting from the beginning so that the use of BIM can be planned as a system, not just as a tool. With systematic preparation, it is assumed that it can drive BIM maturity towards improvement in projects. During the construction phase, the majority of projects use BIM for cost estimation and volume calculations. While BIM utilization is dominant in architectural and structural elements (3D level), its application for building energy is limited in Indonesia, indicating a low maturity level. [7]. Furthermore, a major obstacle to introducing BIM in Indonesia is the reluctance to shift from traditional bureaucratic systems. This resistance stems from a negative perception of BIM, which is still perceived as a novel concept by many construction stakeholders in Indonesia. Companies find it challenging to implement BIM, considering it a complex system. The primary difficulty lies in the insufficient competence among individuals in the construction industry who lack the necessary skills and knowledge to fully integrate this new concept into their practices [8].

On the flip side, a significant challenge encountered is the limited awareness of BIM within the construction sector. This issue results in an inefficient process as stakeholders require time for adoption, stemming from the low capacity of BIM Engineers and an inadequate level of BIM maturity. Furthermore, insufficient awareness among stakeholders regarding BIM utilization can lead to communication gaps during project implementation phases. Therefore, initiatives are

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necessary to enhance engineer capacity, elevate the maturity level of BIM utilization, and increase awareness among stakeholders through activities like pre-construction project training [9].

BIM is only used by specific companies or in the form of lonely BIM, not adopted by other stakeholders [6]. Distinct companies often lack connections throughout the project cycle, for instance, between construction entities during the planning and construction phases or between construction participants during the development and operation stages. Such instances frequently lead to misunderstandings [8]. The current situation reflects the state of the construction industry in Indonesia, where the majority of project owners compartmentalize various activities such as project feasibility, planning, design, development, and operations and maintenance. This separation leads to a lack of connectivity or collaboration among project stakeholders at each stage [8]. Modeling standards are determined by BIM users themselves, and tailored to the specific project requirements in the field. When associated with BIM maturity, projects with the CM delivery system have better maturity in preparation, which relates to the individual or team's ability to use BIM due to the owner's involvement in BIM selection.

4. Conclusions

It can be inferred that Indonesian construction enterprises continue to have a high need for BIM resources. The performance of Indonesian construction projects can be enhanced using BIM. Finding a BIM expert is more difficult than improving the management structure within the organization, although opposition to change is BIM's least weak point. Project phases including design, planning, and construction have all made use of BIM. The primary factors that determine the maturity of BIM adoption are communication, teamwork, collaboration, and clash detection. BIM adoption is relatively minimal, particularly when it comes to standard-setting, supply chain engagement, legality, and availability of BIM needs. The most influential inhibiting factors are related to policies, preparatory measures, regulations, and contracts. A solution is needed to overcome obstacles affecting the implementation of BIM, especially related to Human Resources and standardization.

References

[1] A. Suryadinata Telaga., "A Review of BIM (Building Information Modeling) Implementation in Indonesia Construction Industry," J. Materials Science and Engineering., vol. 352, 2018 https://iopscience.iop.org/article/10.1088/1757-899X/352/1/012030/meta

[2] Riza Susanti et al, "Factor and Barrier Implementing Building Information Modelling (BIM) in Green Construction in Indonesia," IOP Conf. Ser.: Earth Environ. Sci. 1203 012018, 2023 https://iopscience.iop.org/article/10.1088/1755-1315/1203/1/012018/meta

[3] N.R. Puspita and F. Patriotika, "BIM Implementation in Public Construction Projects in Indonesia," IOP Conf. Ser. Mater. Sci. Eng. 1156, 012008, 2021

[4] C.K. Murti and F. Muslim, " Relationship between Functions, Drivers, Barriers, and Strategies of Building Information Modelling (BIM) and Sustainable Construction Criteria: Indonesia Construction Industry," *Sustainability, 15*(6), 5526, 2023 https://doi.org/10.3390/su15065526

[5] Y. Hanifah, "Evaluation Study of Building Information Modeling (BIM) Implementation in Construction Projects in Indonesia," ITB, 2019

[6] A. Pratama, "Study of Building Information Modeling (BIM) Implementation in Indonesia Based on the Perspective of Construction Executives," ITB, 2021

[7] A. Primasetra, D. Larasati, S. Wonohardjo"BIM Implementation in Public Construction Projects in Indonesia," IOP Conf. Ser. Earth and Environmental. Sci. V 1058, 012018, 2018

[8] J.U.D. Hatmoko, Y. Fundra, M.A. Wibowo, Zhabrinna, " Investigating Building Information Modelling (BIM) Adoption in Indonesia Construction Industry," MATEC Web Conf.. V 258, 2019 https://doi.org/10.1051/matecconf/201925802006

[9] D. Larasati, et al, " BIM Implementation to Improve Construction Work Performance," IOP Conf. Ser.: Earth Environ. Sci. 532 012024 2020 https://iopscience.iop.org/article/10.1088/1755-1315/532/1/012024/pdf

Vol. 5, No. 1, pp. 1-7, 2024
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Accepted: 08-02-2024 |
Publish: 08-02-2024 |

[10] D. Zuppa., Issa, R.R.A. and Suermann, P.C, "BIM's impact on the success measures of construction projects.," American Society of Civil Engineers. 2009 https://doi.org/10.1061/9780784410523.

[11] McGraw Hill, "The business value of BIM: Getting to the bottom line.,". 2009 http://www.bim.construction.com/research/2009

[12] Woo, J., Wilsmann, J. and Kang, D., "Construction Research Congress 2010: Innovation for Reshaping Construction Practice.,". American Society of Civil Engineers. 2010 https://doi.org/10.1061/41109(373)54.

[13] M P Sopaheluwakan1 and T J W Adi., "Adoption and implementation of building information modeling (BIM) by the government in the Indonesian construction industry.," IOP Conf. Ser.: Mater. Sci. Eng. 930 012020. 2020 https://iopscience.iop.org/article/10.1088/1757-899X/930/1/012020/pdf