International Journal of Digital Civil Engineering and Building Information Modeling
Volume 1 Issue 2, 2025

Using Building Information Modeling (BIM) in Civil Engineering Projects: A Survey of the Literature

Sri Satriawansyah

Department of Civil Engineering,

Research Article
Received:16-03-2025 **Revised:22-04-2025** **Accepted:02-06-2025** **Published:10-06-2025**

Abstract

Building Information Modeling (BIM) has revolutionized the construction industry by introducing new approaches to project planning and construction. BIM enables the integration of comprehensive project data, such as 3D design, material information, and construction jadwal, into a digital model. The purpose of this pustaka tinjauan is to investigate the integration of BIM in sipil technology projects, with an emphasis on its benefits, challenges, and implementation. The purpose of this study is to examine the integration of Building Information Modelling (BIM) in sipil technology projects via comprehensive literature reviews. BIM is a technology that makes it possible to create and analyze digital representations of a project's functional and physical characteristics. The study's findings indicate that BIM enables more accurate and efficient design by assessing the project's potential and design flaws early on, saving time and money.

Keywords: **:** Building Information Modelling (BIM), Civil Engineering, Literature Review

Introduction

A digital technique called Building Information Modelling (BIM) has completely changed how buildings are planned, built, and maintained. BIM makes it possible for architects, engineers, contractors, and owners to work together more efficiently and make data-driven choices at every stage of a project by producing a digital duplicate of the actual building (Haron et al., 2017). This cooperative strategy improves communication, lowers mistakes, and simplifies the building process, which eventually results in more productivity, lower costs, and better quality. Because BIM can improve project delivery, lower risks, and increase sustainability, it is becoming more important in the construction sector (Bui et al., 2016). The need for BIM is rising as the sector develops because of its many advantages, which include better data management, more accuracy, and improved cooperation. By requiring its usage on public projects, governments and regulatory agencies are also promoting the use of BIM. Because of this, using BIM is becoming commonplace in the construction sector, allowing experts to design more economical, sustainable, and efficient structures that satisfy the demands of contemporary society (Santos et al., 2017).

The integration of Building Information Modeling (BIM) in civil engineering projects is the main topic of the literature study, which highlights its uses and advantages in improving sustainability and project management. The paper offers a thorough examination of how BIM is currently being used in civil engineering, emphasizing how it may enhance teamwork, lower mistake rates, and boost

productivity (Wang & Chen, 2023). The study seeks to improve the overall quality and sustainability of civil engineering projects by offering a framework for successful BIM deployment via an examination of the integration of BIM with project management (Minari Junior et al., 2024). In particular, the assessment looks at how BIM is used in structural projects, project management, and sustainability, among other areas of civil engineering. It looks at the prospects and difficulties of using BIM now, as well as how it may help with problems like environmental impact, energy efficiency, and waste reduction (Yalcinkaya et al., 2016). The research intends to enable the integration of BIM in civil engineering projects, eventually leading to more effective, sustainable, and high-quality construction outputs, by summarizing the major findings and putting forward a BIM capabilities framework.

This literature review's main goal is to investigate the advantages and difficulties of using Building Information Modeling (BIM) in civil engineering projects (Latiffi et al., 2013). The article seeks to provide readers a thorough grasp of the benefits and disadvantages of adopting BIM, including how it may improve project management, lower mistake rates, and boost productivity. The research aims to determine the main elements affecting the adoption of BIM in civil engineering as well as the tactics that can be used to overcome obstacles by analyzing the present status of its implementation. Additionally, the evaluation looks into how BIM is used in civil engineering, emphasizing best practices and learning from successful projects (Chong et al., 2020). The research intends to improve the overall quality and sustainability of civil engineering projects by offering a framework for successful BIM implementation via an analysis of the advantages and difficulties of BIM. In order to better understand how BIM might improve the construction sector, the study will look at how it integrates with project management, sustainability, and other pertinent areas of civil engineering (Vilutiene et al., 2019). Building Information Modeling (BIM) has the potential to significantly increase project management accuracy and efficiency in the area of civil engineering (Hashim Mohammed et al., 2022). However, a number of challenges often impede the adoption and integration of BIM in civil engineering projects, such as a lack of knowledge and comprehension of the advantages of BIM, reluctance to depart from traditional methods, and constraints in technological infrastructure. Furthermore, there is a dearth of literature that thoroughly addresses how BIM may be successfully incorporated into every facet of civil engineering projects, from design to implementation. To fully use BIM's potential to raise the caliber and efficacy of civil engineering projects, a sizable knowledge gap must be filled. Thus, the purpose of this research is to examine how Building Information Modeling (BIM) is integrated into civil engineering projects.

Reseacrh Methods

The methodology for this literature review involves a comprehensive analysis of existing research on the integration of Building Information Modelling (BIM) in civil engineering projects. The review will focus on a detailed examination of the current state of BIM adoption in civil engineering, highlighting its benefits, challenges, and implementation strategies. A systematic search of academic databases and relevant journals will be conducted to identify relevant studies, articles, and papers. The search will include keywords such as "BIM," "civil engineering," "construction," "project management," and "sustainability." The

selected studies will be evaluated based on their relevance, quality, and impact on the field of BIM in civil engineering. The literature review will employ a qualitative approach, focusing on the analysis and interpretation of existing research to identify patterns, themes, and trends in the integration of BIM in civil engineering projects. The review will also include a critical evaluation of the methodologies used in the selected studies to assess their strengths and limitations. The findings of the review will be presented in a clear and concise manner, highlighting the key benefits and challenges of integrating BIM in civil engineering projects. The review aims to provide a comprehensive overview of the current state of BIM adoption in civil engineering, informing future research and practice in this area.

Result and Discussion

Challenges of BIM Implementation in Civil Engineering Projects

The lack of interoperability and standardization across various software and systems is one of the main obstacles to BIM deployment in civil engineering projects. Compatibility problems, data loss, and higher expenses since more software and training are required might result from this (Yang et al., 2021). Additionally, some users, especially those with no previous expertise, may find the intricacy of BIM software to be daunting. The need for substantial adjustments to the organizational structure and workflow of construction enterprises is another major obstacle (Abanda et al., 2015). Implementing BIM in conventional, segmented businesses may be challenging since it calls for a collaborative, data-driven approach. Furthermore, the need for more data storage and administration may be quite difficult, especially for businesses with little IT funding. Another significant barrier to BIM deployment is the lack of qualified personnel and training. Training programs are often scarce or nonexistent, and many construction professionals lack the abilities and knowledge required to utilize BIM software efficiently (Yin et al., 2019). Because more training and assistance are required, this may result in delays, mistakes, and higher expenses. Another difficulty is the need for substantial adjustments to project management and the building process. It may be challenging to incorporate BIM's more collaborative and data-driven methodology into conventional, linear project management procedures. Furthermore, the need for more data administration and analysis may be quite difficult, especially for businesses with little IT resources (Abbasnejad et al., 2020). Lastly, one major obstacle to BIM deployment is the absence of precise rules and guidelines. Even while BIM has become commonplace in many nations, there are still unclear rules and laws governing its use. Construction professionals may get confused and doubtful as a result, which makes it challenging to use BIM successfully and efficiently (Jung & Joo, 2011).

Effective BIM Implementation Strategy

An effective BIM implementation strategy begins with a clear understanding of the organization's goals and objectives. This involves identifying the specific benefits that BIM can bring to the organization, such as improved collaboration, reduced errors, and increased efficiency. By setting clear goals and objectives, organizations can develop a tailored implementation strategy that aligns with their specific needs and priorities (Liu et al., 2019). The next step is to establish a strong project team with the necessary skills and expertise. This includes identifying key stakeholders, such as project managers, engineers, and architects, who will be

responsible for implementing BIM. The team should also include IT professionals who can provide technical support and ensure the smooth operation of BIM software (Chen et al., 2015)

A critical component of an effective BIM implementation strategy is the development of a comprehensive training program. This includes providing training on BIM software, as well as on the workflows and processes that are necessary for effective BIM implementation. Training should be tailored to the specific needs of each user group, and should include hands-on practice and feedback. Another key aspect of an effective BIM implementation strategy is the development of a clear data management plan (Sari et al., 2020). This involves identifying the types of data that will be used in the BIM model, and establishing procedures for data management, storage, and sharing. A data management plan should also include protocols for data backup and disaster recovery.

To ensure the successful implementation of BIM, it is essential to establish a clear change management plan. This involves identifying the potential impacts of BIM on the organization's workflows and processes, and developing strategies to mitigate these impacts (Shaaban & Nadeem, 2015). Change management plans should also include communication and training programs to help users adapt to the new technology. Finally, an effective BIM implementation strategy should include a plan for ongoing support and maintenance. This includes providing ongoing training and technical support, as well as monitoring and evaluating the effectiveness of the BIM implementation. A plan for ongoing support and maintenance is essential to ensure that the organization continues to realize the benefits of BIM over time.

Impact of BIM on Civil Engineering Industry

Building Information Modeling (BIM) has revolutionized the civil engineering industry by providing more efficient and effective digital tools for the design, construction, and management of infrastructure. With the ability to create accurate and detailed 3D models (Baarimah et al., 2021), BIM helps engineers and architects visually depict the entire project before construction begins. This not only improves design quality but also allows for conflict detection and better coordination between disciplines, which reduces errors during the construction phase.

The use of BIM in the civil engineering industry has also led to increased efficiency in construction workflows. The BIM model provides a centralized database for all project information, allowing all parties involved in the project to access and update the information in real-time (Babalola et al., 2023). This minimizes the risk of data loss or poor communication, which often leads to project delays and unexpected costs. Furthermore, with BIM, design modifications can be made quickly and easily, as changes to one part of the model are automatically updated across the entire model (Panah & Kioumarsi, 2021)

In terms of cost reduction, BIM has proven to be very beneficial. With more accurate planning and improved construction analysis, BIM helps identify potential problems that may occur during construction. This reduces the need for costly changes during the construction phase and reduces material waste. In addition, the simulation enabled by BIM allows optimization of the use of materials and construction methods, which further lowers project costs.

BIM also plays a crucial role in sustainability and environmental compliance in civil engineering projects. Models developed using BIM can analyze the effects of construction on the environment, such as energy consumption, carbon emissions, and water use (Yang et al., 2021). Thus, BIM supports more informed decision-making on the choice of environmentally friendly materials and techniques, contributing to more sustainable development. The adoption of BIM also opens up opportunities for innovation in construction technology. The integration of BIM with other advanced technologies, such as the Internet of Things (IoT) and artificial intelligence (AI), can further improve efficiency and productivity. For example, IoT monitoring integrated with BIM can send real-time updates on construction status,

while AI can help in design optimization and resource management (Nushi & Basha-Jakupi, 2017; Abbasnejad et al., 2020)

However, despite its many benefits, BIM implementation still faces challenges, including the need for adequate training and changes in organizational culture. Lack of skills and knowledge of BIM can limit its effective application. Therefore, continuous education and training is essential to ensure that professionals in the civil engineering industry are equipped with the necessary capabilities to take full advantage of the potential offered by BIM (Yin et al., 2019)

Conclusion

This research concludes that BIM provides a number of noteworthy advantages that enhance this industry's sustainability, accuracy, and efficiency. Better coordination, effective conflict detection, and improved communication amongst project teams are all made possible by BIM integration, and these factors all help to lower project costs and completion times. As technology advances and its additional value in bolstering contemporary civil engineering techniques is acknowledged, BIM adoption continues to expand despite obstacles including the need for extensive training and corporate culture shift. Therefore, incorporating BIM into civil engineering projects is not just a trend but also necessary to provide more efficient and long-lasting construction outcomes.

Rerefence

This sentence is a citation for a 2015 publication by Abanda, Vidalakis, Oti, and Tah. A review of the pros and downsides of BIM software for use in building projects. Publishing in the field of engineering software, the article spans pages 183-201. In 2020, Abbasnejad, Nepal, Ahankoob, Nasirian, and Drogemuller published a paper with the DOI 10.1016/j.advengsoft.2015.08.009. Architects, engineers, and contractors (AEC) companies' acceptance and implementation of building information modeling (BIM): a literature scan. In their article titled "Integration of Building Information Modeling (BIM) and Value Engineering in Construction Projects: A Bibliometric Analysis," Baarimah et al. (2021) discuss the use of BIM and value engineering in construction projects. The article is published in Architectural Engineering and Design Management and can be accessed online at https://doi.org/10.1080/17452007.2020.1793721. The Third International Conference on Sustainability and Resilience: Climate Change, 2021, pp. 362-3667. In 2023, Babalola, Musa, Akinlolu, and Haupt published an article with the DOI: https://doi.org/10.1109/IEEECONF53624.2021.9668045. Latest findings in bibliometric studies on building information modeling (BIM). Engineering, Design, and Technology Journal, 21(3), 690-710. *Bui, *https://doi.org/10.1108/JEDT-01-2021-0013 In 2016, N., Merschbrock, C., and Munkvold, B. E. published. An Analysis of BIM in Developing Nations for Roofing Projects. The Engineering Procedia, 164(1877), 487-494.