# The Effect Of Building Information Modelling (BIM) Method Implementation On The Effectivenes Of Building Construction Implementation Management In The Construction Industry

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# THE EFFECT OF BUILDING INFORMATION MODELLING (BIM) METHOD IMPLEMENTATION ON THE EFFECTIVENES OF BUILDING CONSTRUCTION IMPLEMENTATION MANAGEMMENT IN THE CONSTRUCTION INDUSTRY

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**Abstract**

The aim of this study is to analyze the impact of Building Implementation Information Modeling (BIM) on the efficiency of building construction management quantitatively. It has become a significant method in the construction industry with the potential to improve collaboration, coordination and information management in the implementation of construction projects. The research method uses simple linear regression analysis with data from construction professional respondents. The study involved 52 contractor companies in the construction industry. The selection of these samples is aimed at obtaining representative and adequate data for simple linear regression analysis. With large sample sizes, the results are expected to be more accurate and reliable. In addition, the selection of 52 respondents is also carried out to cover a variety of perspectives and professional experience of construction, making the data obtained more representative, and more reliable for the analysis performed. Implementation of BIM has a significant and positive impact on building construction management, demonstrated by a count t value = 12.217 greater than the table t value of 2.00856. The determination coefficient (R-square) of 0.749 or 74.9% suggests that 74.9 percent variation in building management efficiency can be explained by the implementation of BIM. This finding emphasizes the importance of using BIM to improve management effectiveness in building construction in the construction industry. The implications of this research provide a basis for encouraging the adoption of BIM as an effective tool in the management of construction projects.

**Keywords:** Building Construction Efficiency, BIM Implementation, Effectiveness, Building Construction Projects, BIM

## Introduction

Technological progress in the construction sector is very rapid regarding coordination problems in construction project implementation. In today's competitive construction industry, actors must complete projects quickly, with high quality and at low costs (Ramdani et al., 2022). The construction industry is revolutionary: increase productivity, efficiency and sustainability through effective collaboration, cutting life cycle costs and lead times (Liu et al., 2017). A project is considered good if it is efficient in terms of time, costs and efficiency of human work and tools (Ningsih & Fardila, 2024).

The development of digital methods has raised collaboration as a main topic. In the construction sector, Building Information Modeling (BIM) plays a key role with information-rich 3D digital building models, enabling the storage and use of critical information throughout the project. BIM has become a vital tool in improving work processes and communication, as well as strengthening collaboration (Farhana & Abma, 2022). According to Sardroud et al. (2018) increasing implementation of BIM in various countries and challenges that need to be overcome to take full advantage of it . According to Awwad et al. (2022) the study assessed the way of BIM adoption and grouped the factors into four categories: human, organizational, process, and external.

This encouragement encourages continuous innovation in the construction industry to increase work effectiveness and efficiency (Pratama & Halimah, 2023). BIM can be viewed as a virtual process that involves the integration of all aspects, disciplines and building systems into one model. All design team members, including owners, designers, engineers, contractors, subcontractors, and suppliers, can work collaboratively with more accuracy and efficiency than traditional methods (Azhar, 2011). BIM provides real visualization and complete information about the object to be built, allowing discussion and resolution of all construction-related matters in advance. This optimizes the construction process to be effective and efficient (Wibowo, 2021). In addition, the application of BIM in construction allows cost estimation and cross-dimensional analysis through the integration of 3D models (Ramdani et al., 2022). Since the early 2000s, certain countries have made it mandatory to use BIM applications. The United States noted that in 2007, approximately 50% of the construction industry had adopted BIM, increasing to 75% in 2009. In Asia, BIM implementation began in early 2010 by several countries such as China, South Korea, Singapore, Vietnam and Malaysia. Singapore, in particular, was recognized in a UK government report in 2015 (Heryanto et al., 2020). Usage *BIM* can produce savings of up to 50% in design requirements, reduce construction work by 33%, and save operational costs by 20% (Berlian et al., 2016). According to Awwad et al. (2022) BIM factors have a significant effect on construction project performance. Wu et al. (2021) provides an evaluation of critical factors in BIM implementation globally, including organizational changes and management support, as well as BIM adoption in prefabricated construction. Khosrowshahi & Arayici (2012) identified the concept of BIM maturity and three approaches to addressing problems in implementation, including a focus on culture, education, and information management; build a strong foundation; implement a systematic approach and ensure organizational readiness.

In-depth research is needed to understand the views of individuals, groups and companies in the construction industry on the use of building information (BIM). This research aims to explore the perceptions, responses and impact of the use of BIM in construction practice. The results will form an important basis for further research on how BIM implementation affects building construction management in the construction industry. This research shows that BIM application significantly improves the effectiveness of building building management in construction industry, demonstrated through linear regression analysis with construction professional data. This clarifies the relationship between BIM and construction project efficiency, encouraging further adoption of the BIM as an effective management tool.

Previous Research

Table 1. Previous research

| Title | Year | Researcher | Results |
|---|---|---|---|
| Delphi Study of Building Information Modeling, Integrated Project Delivery, and Lean Construction Maturity Attributes.. | 2023 | (Rashidian et al., 2023) | Increasing the productivity of human resources in the organization |
| Study of Implementation Levels and Barriers to Building Use Information Modeling (BIM) | 2022 | (Purnomo et al., 2022) | Guidance and collaboration between stakeholders is needed |
| Assessment of the effectiveness of the implementation of Building Information Modeling (BIM) in building construction projects | 2022 | (Asmarayani & Kresnanto, 2022) | This study recommends that BIM implementation can benefit from improved organizational management and business models in the construction sector. |
| Acceptance on Building Information Modeling (BIM) Training in Selangor Construction Industry: Current Trends and Impediments | 2022 | (Ang et al., 2022) | Study finds barrier to adoption of BIM training: lack of qualified professionals. |
| Implementation Study Building Information Modeling (BIM) in the Indonesian construction industry. | 2021 | (Pantiga & Soekiman, 2021) | Key obstacles to implementing BIM include processes, such as a lack of specialized staff, cultural changes, and low levels of knowledge and understanding. |
| Perceived benefits of and barriers to Building Information Modeling (BIM) implementation in construction: The case of Hong Kong | 2019 | (Chan et al., 2019) | These barriers consist of cultural barriers (resistance to change), organizational structures that do not support BIM , lack of industry standards, adequate computer software interoperability , and difficulty in measuring the impact of BIM |
| Building Application Study Information Modeling (BIM) in the Indonesian Construction Services Industry | 2020 | (Heryanto et al., 2020) | BIM implementation in the construction services industry is only carried out by state-owned contractor companies |
| Building Information Modeling (BIM) uptake : Clear benefits , understanding its implementation , risks and challenges | 2017 | (Ghaffarianhoseini et al., 2017) | interoperability , and low demand |

| Title | Year | Researcher | Results |
|---|---|---|---|
| Building Adoption Information Modeling (BIM) for Construction Project Effectiveness: An Overview of the Benefits of BIM | 2016 | (Doumbouya et al., 2016) | BIM produces better quality construction output and increases process efficiency during all stages of a project |
| Building Information Modeling : Protocols For Collaborative Design Processes | 2014 | (Kassem et al., 2014) | Further research is needed to develop performance indicators to assess improvements in project design efficiency. |
| Building Information Modeling And Project Information Management Framework For Construction Projects | 2018 | (Olawumi & Chan, 2018) | Identify and define three sub-criteria of the BIM -PIMF model |
| Factors Affecting Building Implementation Information Modeling ( Bim ) in the Pre-Construction Stages of Multi-Storey Buildings | 2019 | (Sekarsari, 2019) | More accurate design visualization.<br>Estimating costs during the design stage.<br>Makes it easier to check the design<br>Improve energy efficiency and sustainability |
| Application of Building Information Modeling (BIM) in the Malaysian Construction Industry: A Story of the First Government Project | 2015 | (Latiffi et al., 2015) | The journal also highlights the importance of BIM in reducing waste and improving project quality. |

Table 1 presents previous research related to Building Information Modelling (BIM) and building management, gives an overview of previous studies, benefits: (1) Gives information relevant to current research topics; (2) Demonstrates research results that can be the basis of advanced research; and (3) Describes trends and findings in literature related to BIM and development management. The link with this research is to provide context and background, helping researchers understand their contributions and their added value.

Building Information Modeling (BIM)

Building information modeling (BIM) is a digitalization process that involves the use of software to generate and store data and information that supports buildings from the conceptual design stage to the manufacturing, construction, operation and maintenance, and even demolition stages of the building. BIM includes its solution capabilities , delivering this information to users in a simple and convenient format. According to Yudi et al. (2020) Building Information Modeling ( BIM ), also known as "Integrated Project Delivery" (IPD), models the design, design, and delivery of buildings through collaboration, integration, and productive team organization of project implementation management systems. BIM models are useful tools for planning, designing, constructing and managing building structures.

BIM Implementation

BIM provides various benefits, including 3D visualization, clash detection, increased productivity, reduced changes, and reduced construction time and costs (Mishra et al., 2024). Liu et al. (2017) emphasized that project managers manage physical construction with the support of BIM coordinators to facilitate virtual construction and improve project information flow. According to Asmarayani & Kresnanto (2022) BIM implementation can help in overcoming the problem of fragmented delivery processes and reliance on paper-based documentation in the construction industry. Implementing BIM can increase the effectiveness of building construction project implementation by speeding up the construction process, optimizing resource use, and reducing project work costs (Pantiga & Soekiman, 2021). The creation, communication, and analysis of building models is part of the modeling technology known as Building Information Modeling (BIM). BIM is a digital representation of the physical and functional characteristics of facilities used in project management. BIM reduces the cycle duration of construction projects. The implementation of its principles improves visualisation, reduces waste, and streamlines communication within the project, helping to increase efficiency, reduce costs, and improve collaboration between stakeholders (Nabila, 2021). Wijaya et al. (2024) BIM uses 3D models for all aspects of construction, increasing efficiency for projects. Obstacles pf using BIM include licence fees and lack of understanding. Support from employers and government is important. Break even point analysis helps overcome barriers (Zhafirah et al., 2023).

### Effectiveness of BIM Implementation

According to Nainggolan, et al. (2021) effectiveness is the ability to achieve predetermined goals by using available resources effectively and efficiently in the context of organizational communication. Alyssa et al. (2022) stated that proper planning and supervision increases productivity, effectiveness and efficiency in construction. According to Aliran & Progo (2011), the effectiveness of building implementation management is the level of success in achieving the goals set in the building construction process. Effectiveness can be seen from the aspects of cost, time and quality in achieving predetermined goals/targets. The research Zhafirah et al. (2023) found that the main enablers for BIM adoption by contractors were ease of design modelling, improved communication, and assistance in decision-making. However, the main inhibiting factors included lack of HR skills, perception of software adequacy, old work habits, lack of education on BIM, and difficulties in data exchange. This study is relevant for improving BIM implementation in Aceh's construction industry.

## Research Methodology

This research uses a quantitative approach based on the philosophy of positivism. The quantitative approach allows statistical testing of hypotheses using empirical data obtained through data collection through measurement. In this research, quantitative research methods are used to test the established hy-potheses. The hypothesis in this research is as follows:

($H_0$): There is no significant influence between BIM implementation and the effectiveness of building implementation management in the construction industry.

($H_a$): There is a significant influence between the implementation of BIM and the effectiveness of building implementation management in the construction industry.

In this research, primary and secondary data were used. explains that primary data refers to data sources obtained and collected directly from the object being researched. For primary data collection, a questionnaire technique was used which was filled out by contractor companies that had the potential to use Building Information Modeling (BIM) in the construction industry. By using this technique, primary data is obtained indirectly through questionnaires delivered to respondents. The researchers used the simple random sampling method to select 52 samples from 60 contractor companies using or potentially using BIM. The samples met the simple linear regression test requirements, including normality, heterocadasthesity, and linearity.

The decision in the t test is guided by the significance value (Sig t) and the calculated t value as shown in Table 2 and Table 3.

Table 2. Decision making criteria t test, partial test (Widana & Muliani, 2020)

| ***Sig* t value** | **Information** |
|---|---|
| If the significance value of t <0.05 | $H_0$ is denied, and Ha is approved |
| If the significance value of t> 0.05 | $H_0$ is approved, and H a is denied |

Table 3. Decision making criteria t test, partial test (Widana & Muliani, 2020)

| **Calculated t and t table values** | **Information** |
|---|---|
| If the calculated t0 value is more than the table t value | $H_0$ is denied, and $H_a$ is approved |
| If the calculated t value is less than the table t value | $H_0$ is approved, and $H_a$ is denied |

Research Variables

The research variables are divided into two: Implementation of BIM (X) as an independent variable and Building Development Management Effectiveness (Y) as a dependent variable. Implements of the BIM are chosen for their significant impact in the construction industry, while Management Efficiency is chosen because of its crucial role in building smoothness. Variable selection is carried out based on research purposes, literature, and theoretical considerations to ensure relevance, severity, and a clear relationship between variables.

## Research Results and Discussion

Validity Test

Validity testing is a way to ensure how precisely a measuring device can actually measure something (Novikasari, 2017). If the calculated r value exceeds the table r value, then the measurement instrument is considered valid, valid validity test results indicate that the measurement instrument is reliable for measuring interest rates (Janna & Herianto, 2021). To determine item reliability, this study used the Pearson product-moment correlation coefficient using SPSS V26. The product – moment correlation formula is as follows:

$$r_{xy} = \frac{n\sum xy-(\sum x)(\sum y)}{\sqrt{(n\sum x^2-(\sum x^2)(n\sum y^2-(\sum y)^2}}$$

Information:

r = correlation coefficient

n = number of samples

X and Y = variable X and variable Y

$\overline{X}$ and $\overline{Y}$ = means of variables X and variable Y

Σ = number of observations

ΣX and ΣY = number of observations variable X and variable Y

The results $r_{xy}$ are then compared with the r value in the critical price table of r product moment correlation. If $r_{xy} \geq r_{table}$ the question item is considered valid (α; n or df = n – 2) where n is number of samples. In this context the number of respondents is 52, to determine validity it can be calculated as (α; n or df = 52 – 2) = 50. So the r table for the 52 respondents used in this study was 0.279. The conclusion of the validity test results using *SPSS* V 26 can be seen in Table 4.

Table 4. Conclusion of X validity test

| No | Rx count | R table | Condition: Rx count > R table | Information |
|---|---|---|---|---|
| 1 | 0.728 | 0.279 | OK | Valid |
| 2 | 0.751 | 0.279 | OK | Valid |
| 3 | 0.632 | 0.279 | OK | Valid |
| 4 | 0.657 | 0.279 | OK | Valid |
| 5 | 0.841 | 0.279 | OK | Valid |

| No | Rx count | R table | Condition: Rx count > R table | Information |
|---|---|---|---|---|
| 6 | 0.782 | 0.279 | OK | Valid |
| 7 | 0.808 | 0.279 | OK | Valid |
| 8 | 0.749 | 0.279 | OK | Valid |
| 9 | 0.783 | 0.279 | OK | Valid |
| 10 | 0.768 | 0.279 | OK | Valid |
| 11 | 0.827 | 0.279 | OK | Valid |
| 12 | 0.761 | 0.279 | OK | Valid |
| 13 | 0.563 | 0.279 | OK | Valid |
| 14 | 0.512 | 0.279 | OK | Valid |
| 15 | 0.649 | 0.279 | OK | Valid |
| 16 | 0.721 | 0.279 | OK | Valid |
| 17 | 0.733 | 0.279 | OK | Valid |
| 18 | 0.468 | 0.279 | OK | Valid |
| 19 | 0.474 | 0.279 | OK | Valid |

Based on the conclusions from the test results in Table 4 above, there are 19 questionnaires containing variable X which have been filled in by 52 respondents. The first step to assess the validity of the questionnaire: find the r table value using the formula df = N-2, with N as the sample size, namely 52 respondents so that df = 52 - 2 = 50. From this calcu-lation, the r table value is 0.279. From the validity analysis using the table provided, it was revealed that the calculated r value exceeded the table r value. This shows that a total of 19 questionnaires have met the validity criteria.

Table 5. Conclusion of Y validity test

| No | Rx count | R table | Condition: R count > R table | Valid |
|---|---|---|---|---|
| 1 | 0.551 | 0.279 | OK | Valid |
| 2 | 0.608 | 0.279 | OK | Valid |
| 3 | 0.698 | 0.279 | OK | Valid |
| 4 | 0.487 | 0.279 | OK | Valid |
| 5 | 0.779 | 0.279 | OK | Valid |
| 6 | 0.714 | 0.279 | OK | Valid |
| 7 | 0.845 | 0.279 | OK | Valid |
| 8 | 0.679 | 0.279 | OK | Valid |
| 9 | 0.737 | 0.279 | OK | Valid |
| 10 | 0.760 | 0.279 | OK | Valid |
| 11 | 0.792 | 0.279 | OK | Valid |
| 12 | 0.725 | 0.279 | OK | Valid |
| 13 | 0.780 | 0.279 | OK | Valid |
| 14 | 0.824 | 0.279 | OK | Valid |
| 15 | 0.646 | 0.279 | OK | Valid |
| 16 | 0.759 | 0.279 | OK | Valid |
| 17 | 0.647 | 0.279 | OK | Valid |
| 18 | 0.583 | 0.279 | OK | Valid |
| 19 | 0.623 | 0.279 | OK | Valid |
| 20 | 0.810 | 0.279 | OK | Valid |
| 21 | 0.747 | 0.279 | OK | Valid |

Based on the conclusions from the test results in Table 5 above, there are 21 questionnaires containing variable Y which have been filled in by 52 respondents. The first step to assess the validity of the questionnaire: find the r table value using the formula df = N-2, with N as the sample size, namely 52 respondents so that df = 52 - 2 = 50. From this calculation, the r table value is 0.279. From the validity analysis using the table provided, it was revealed that the calculated r value exceeded the table r value. This shows that as many as 21 questionnaires have met the validity criteria.

## Reliability Test

Every statement that has been proven valid in this research aims to ensure the consistency of the use of the instru-ment as a measuring tool. This is important so that the level of instrument reliability can show consistent results. The number of respondents in this study was 52 people, and reliability testing can be carried out using the SPSS V26 pro-gram. Reliability testing in this research uses the internal consistency method, where the instrument is tested once and measured using Cronbach's coefficient alpha. If the alpha coefficient exceeds 0.70, then this research tool is considered reliable. The results of the reliability test for Variables X and Y are as shown in Table 6.

Table 6. Variable X reliability test

| **Reliability Statistics** | | |
|---|---|---|
| Variabel | Cronbach's Alpha | N of Items |
| X | .935 | 19 |
| Y | .945 | 21 |

Reliability analysis of variable X in Table 6 using the Cronbach's Alpha technique confirmed that of the 19 ques-tion items, the Cronbach's Alpha value reached 0.935, exceeding the expected threshold of 0.70. The same is true for vari-able Y, which has 21 question items with a Cronbach's Alpha value of 0.945, also exceeding the expected threshold. Thus, based on these data, it can be concluded that the reliability of variable Y can be categorised as excellent.

## Simple Linier Analysis

This study uses simple linear regression to evaluate the relationship between the independent variable (x) and the dependent variable (y) (Humpage, 2000). This test aims to determine whether there is a linear relationship between the independent variable and the dependent variable, as well as to measure the strength and significance of this relationship. The variables to be correlated are variables X and Y. In the journal Supardi et al. (2023) there is a simple linear regression equation as follows:

$Y = a + bX$

Where,

Y = dependent variable

X = independent variable

a = intercept

b = regression coefficient

Table 7. Simple liner analysis

| **Coefficients** [a] | | | | | | |
|---|---|---|---|---|---|---|
| | | Unstandardized Coefficients | | Standardized Coefficients | | |
| Model | | B | Std. Error | Beta | t | Sig. |
| 1 | (Constant) | 11.420 | 6.295 | | 1.814 | .076 |
| | *BIM* implementation | .954 | .078 | .865 | 12.217 | .000 |
| a. Dependent Variable: Effectiveness of Building Implementation Management | | | | | | |

Coefficient Model Table 7 above shows that the simple linear regression equation is Y = 11.420 + 0.954. This is based on the Coefficients table above the numbers used in column B where constant indi-cates the constant value (a). Meanwhile, variable X shows the value of the regression coefficient (b). Based on the simple linear regression equation from the given test, Y = 11.420 + 0.954, it can be conclud-ed that every one unit increase in the independent variable (X) will cause an increase of 0.954 in the de-pendent variable (Y). This shows that variable X has a positive influence on variable Y.

T Test (Partial Test)

Coefficients Model in Table 7 above shows that testing with SPSS V26 shows that the influence of BIM on the effec-tiveness of building construction implementation management shows that the calculated t is 12.217 which is greater than the t table = 2.00856 with a significance of 0.000 which is smaller than 0.05 comparing the calculated t with the t table. It can be stated that there is a partially significant influence between BIM implementation and the effectiveness of building implementation management in the construction industry, $H_0$ is rejected and $H_a$ is accepted, in tables 2 and 3.

The T-test shows a partially significant influence between BIM Implementation and the Effectiveness of Building Construction Management in the Construction Industry. The calculated t value is 12.217 with a significance of 0.000 (less than 0.05), and the regression coefficient is 0.954 (positive), confirming the hypothesis Ha. This supports the theory that BIM Implementation has a significant influence in explaining variations in Building Construction Management Effectiveness (Ali et al., 2022). The use of BIM in the construction industry can result in time, cost, and labour savings, supported by other research (Pantiga & Soekiman, 2021). BIM also improves planning confidence, documentation, communication, and co-operation. However, research has also highlighted shortcomings in training plans, budget allocation, training offerings, and participation in related BIM events (Sarju et al., 2022).

Test of the Coefficient of Determination $R^2$

$R^2$ measures the model explaining the variation in the independent variable, the value is between 0 and 1. A low R 2 indicates that the model cannot properly explain the variation in the independent variable, indicating that the independent variable does not make a significant contribution in explaining the variation in the dependent variable. The coefficient of determination ($R^2$) is used to measure the extent to which changes in the independent variable can explain its effect on the dependent variable. The higher the value of the coefficient of determination, the better the independent variable ex-plains the variance of the dependent variable. When conducting a t-test, the following formula is used:

$D = R^2 \times 100\%$

R = correlation value

100% = percentage

$R^2$ test is listed in Table 8.

Table 8. $R^2$ test

| Model Summary | | | | |
|---|---|---|---|---|
| Model | R | R Square d | Adjusted R Square | Std. Estimation Error |
| 1 | .865 [a] | .749 | .744 | 5.777 |
| a. Predictors: (Constant), *BIM Implementation* | | | | |

Model Summary in Table 8 shows the results of the $R^2$ from the output of SPSS above the Adjuste $R^2$ is 0.749 or 74.4%. The remaining 25.6% is influenced by other factors not included in the model. The coefficient of determination shows that the ability of the simple linear regression model used is quite good in explaining the relationship between the independent variable X and the dependent variable Y.

A comparison of the study results with research that has been conducted by other researchers shows that BIM implementation has a positive impact on building management efficiency, in line with the research of Sarju et al. (2022) supports the effectiveness of BIM in improving project coordination, communication and data management. The study's recommendations emphasise improving organisational management and construction business models (Wu et al., 2021). Evaluation of critical factors and recommendations for their resolution are also presented. This research emphasises the importance of BIM integration for global productivity and sustainability. The research Chan et al. (2019) shows barriers include cultural resistance, unsupportive organisational structures, lack of industry standards, lack of software interoperability, and difficulty in measuring the impact of BIM. Benefits include better cost estimates, improved design understanding, and reduced costs. Accurate visualisation, cost estimation, design checks and energy efficiency are improved (Pantiga & Soekiman, 2021). Key barriers to implementing BIM include processes, such as a shortage of specialised staff, cultural change, and low levels of knowledge and understanding (Sekarsari, 2019; Rashidian et al., 2023) Increasing the productivity of human resources in the organization. The research Hanifah (2016) found high awareness of BIM (around 70%), but low usage (less than 50%). The majority only use it for 3D Modelling. A mixed research method was used to understand the respondents' views. The results are expected to provide insights for academics and architectural practitioners in Indonesia.

## Conclusion

The implementation of BIM (Building Information Modelling) has a positive and significant influence on the effectiveness of building project implementation in the construction industry. The R-squared value of 0.749 indicates that 74.9% of the variation in building construction implementation effectiveness management can be explained by BIM implementation. Therefore, BIM implementation has a significant contribution in improving the effectiveness of building construction implementation management. Factors that significantly affect BIM Implementation include: the availability of skilled human resources in BIM, the use of appropriate and latest technology, as well as good cooperation and coordination between related parties. Meanwhile, factors that significantly affect delays in BIM implementation include: lack of understanding of BIM, high cost of BIM implementation, need for training on BIM, and lack of support from management. Therefore, BIM implementation needs to be well implemented and continuously improved by considering the factors that significantly affect BIM implementation and the existing inhibiting factors to ensure optimal use of BIM in the construction industry. A comparison of the study results with research that has been conducted by other researchers shows that BIM implementation has a positive impact on building management efficiency. Suggestions from this study are to improve the quality of the research, expansion of the sample of construction projects implementing BIM is required for more accurate data. Both quantitative and qualitative research methods should be used for better understanding. Data analysis should be done appropriately, by selecting appropriate variables such as cost, time, quality, and customer satisfaction. The use of good documentation is also important to ensure the accuracy and reliability of the data. With these steps, research can be conducted effectively to make valuable contributions to the construction industry.

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