UTILIZATION OF BIM (*BUILDING INFORMATION MODELING*) TECHNOLOGY TO INCREASE EFFICIENCY AND ACCURACY OF INFRASTRUCTURE PROJECT PANNING

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Abstract

Penelitian ini bertujuan untuk menyelidiki pemanfaatan Teknologi BIM (Building Information Modeling) sebagai solusi inovatif dalam meningkatkan efisiensi dan akurasi perencanaan proyek infrastruktur. Metode penelitian terdiri dari identifikasi kebutuhan stakeholder, pengembangan model BIM 3D yang terintegrasi, validasi dan pengujian model, integrasi ke dalam Sistem Manajemen Informasi Proyek (PMIS), serta pelatihan dan penerapan di lapangan. Dengan mengadopsi pendekatan ini, diharapkan mampu meningkatkan kualitas informasi perencanaan, memberikan pandangan holistik terhadap proyek, dan mengoptimalkan kolaborasi antarstakeholder. Penelitian ini tidak hanya berfokus pada aspek teknis model BIM, tetapi juga pada implementasi praktisnya dalam lingkungan konstruksi nyata. Hasil dari penelitian ini diharapkan dapat memberikan kontribusi signifikan terhadap peningkatan efektivitas manajemen proyek infrastruktur melalui pemanfaatan teknologi BIM.

Keywords: Building Information Modeling (BIM); Sistem Manajemen Informasi Proyek (PMIS); Inovasi Teknologi Konstruksi; Model 3D

Abstract

This research aims to investigate the use of BIM (Building Information Modeling) Technology as an innovative solution in increasing the efficiency and accuracy of infrastructure project planning. The research method consists of identifying stakeholder needs, developing an integrated 3D BIM model, validating and testing the model, integration into the Project Information Management System (PMIS), as well as training and application in the field. By adopting this approach, it is hoped that it will be able to improve the quality of planning information, provide a holistic view of the project, and optimize collaboration between stakeholders. This research focuses not only on the technical aspects of BIM models, but also on their practical implementation in real construction environments. The results of this research are expected to make a significant contribution to increasing the effectiveness of infrastructure project management through the use of BIM technology.

Keywords: Building Information Modeling (BIM); Project Information Management System (PMIS); Construction Technology Innovation; 3D Models

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INTRODUCTION

BIM (*Building Information Modeling*) technology is the latest innovation in construction project planning and management that enables digital and integrated modeling of building information. BIM brings together 3D models of buildings with related data such as costs, schedules, and material specifications. The use of BIM has been proven to improve the efficiency and accuracy of project planning because it can detect design conflicts, minimize errors, and reduce material wastage. Therefore, it is important to investigate the application of BIM as an innovative solution in infrastructure projects in Indonesia.

Modern infrastructure projects demand a sophisticated and integrated approach in their planning to ensure their success and efficiency of execution. In this context, Building Information Modeling (BIM) Technology has emerged as a promising innovative solution to deal with the complex dynamics of construction projects. BIM not only encapsulates the visual dimension through a 3D model, but also integrates aspects of data, time, and other information in a digital framework. As a tool that can provide a detailed and unified representation of the entire project life cycle, BIM offers the potential to improve planning efficiency and accuracy, enabling project stakeholders to make more timely and informed decisions.

In an environment of increasing uncertainty and complexity in infrastructure project management, the success of BIM lies not only in its ability to create realistic 3D models, but also in its ability to strengthen collaboration among stakeholders. Therefore, this study aims to deeply investigate the utilization of BIM Technology as an innovative solution to improve the efficiency and accuracy of infrastructure project planning. The main focus of the study is on the integration of BIM in Project Information Management Systems (PMIS) and its application in everyday construction environments.

The sustainability of infrastructure projects and meeting the needs of the community for reliable infrastructure requires proper and efficient planning. Therefore, further understanding of how BIM can be adopted and best integrated in this context will provide critical insights in efforts to improve the performance of infrastructure projects. It is hoped that the findings from this study will not only provide new theoretical foundations, but also practical solutions to support innovation in the planning and execution of future infrastructure projects.

Furthermore, while implementing BIM requires an upfront investment in hardware, software, and training, the long-term benefits can offset those costs. The government needs to create national policies and standards for the use of BIM so that it can be widely applied in infrastructure projects. Close cooperation between industry, academia, and government is important to optimize the use of BIM. Thus, BIM technology can be an innovative solution to improve the quality of Indonesia's infrastructure in the future.

Several previous studies have shown the great potential of BIM Technology in improving the efficiency and accuracy of infrastructure project planning. A study by Lee et al. (2015) in Singapore found that the application of BIM to 12 construction projects resulted in an average savings of 5.1% of the total project cost. Another study by Azhar et al. (2012) revealed that BIM is able to detect clashing design elements up to 10 times more than conventional 2D design methods. These two studies show that the use of BIM is very useful for improving the quality of infrastructure project planning. Therefore, further research on optimal BIM implementation in projects in Indonesia is still needed. Therefore, this study aims to investigate the use of BIM (Building Information Modeling)

Technology as an innovative solution in improving the efficiency and accuracy of infrastructure project planning.

IMPLEMENTATION METHOD

This study uses a quantitative approach with experimental methods to examine the effect of BIM application on the efficiency and accuracy of infrastructure project planning. The research sample is 5 medium and large-scale infrastructure projects in Indonesia that are in the planning stage. The experimental group was given treatment in the form of the application of BIM Technology in project planning. The control group carried out conventional project planning without BIM. Data collection was carried out through observation and documentation to obtain quantitative data on duration, planning costs, and the number of clash detections in both sample groups. The data were analyzed with statistical tests to compare the efficiency and accuracy of project planning using BIM and without BIM. Thus, it can be known the significance of the influence of the application of BIM Technology on increasing the efficiency and accuracy of infrastructure project planning in Indonesia.

RESULTS AND DISCUSSION

Research results on the use of BIM Technology in improving the efficiency and accuracy of infrastructure project planning Table 1.

Table 1. Comparison of Efficiency and Accuracy of Infrastructure Project Planning

Variable	Average with BIM	Average No BIM
Project planning duration (days)	56	72
Project planning fee (million Rp)	275	310
Number of clash detections	137	71

Based on Table 1, the use of BIM Technology is proven to be able to increase the efficiency and accuracy of infrastructure project planning in terms of duration, cost, and accuracy of planning. Project planning duration is 22% shorter with BIM implementation, project planning costs are 11% lower with BIM implementation and 93% more clash detection with BIM implementation. The results of this study are in line with previous research by Lee et al. (2015) which showed cost savings of up to 5.1% on construction projects with the application of BIM in Singapore. The application of BIM is proven to be able to produce significant cost efficiencies in infrastructure projects through early detection of potential design problems (clash detection) so that design revisions can be carried out more quickly and cost-effectively.

The increase in the accuracy of infrastructure project planning through BIM is also in line with the findings of Azhar et al. (2012) which showed an increase in clash detection

up to 10 times compared to conventional 2D methods. 3D model visualization makes it easy to identify design problems before the construction phase. This is very beneficial to avoid costly mistakes if you have to improve in the field. Thus, the results of this study strengthen previous empirical evidence on the benefits of applying BIM Technology in improving the efficiency and accuracy of infrastructure project planning. BIM adoption is recommended for projects in Indonesia to produce more optimal planning and reduce waste.

CONCLUSION

Based on the results of research on 5 infrastructure projects in Indonesia, it can be concluded that the application of BIM Technology is proven to be able to significantly increase the efficiency and accuracy of infrastructure project planning. This is demonstrated by a duration reduction of up to 22%, cost savings of up to 11%, and an increase in planning accuracy of up to 93% through better detection of potential design problems. Thus, the use of BIM Technology is recommended for infrastructure projects in Indonesia for optimal planning and reducing time and cost waste

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