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ANALYSIS OF THE INFLUENCE OF PHOTOGRAMMETRY MARKETING IMPLEMENTATION, INTERNAL COORDINATION AND EXTERNAL POLICIES ON MONTHLY CERTIFICATE TIME PERFORMANCE BASED ON THE DECISION OF THE TOLL ROAD EARTHWORKS PROJECT MANAGER

Risky Setiawan[1], Agus Suroso[2]

[1,2]Fakultas Teknik Universitas Mercu Buana

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ABSTRACT

Earthwork activities in toll road construction require accurate volume calculations and effective coordination so that Monthly Certificates can be issued on time. This study aims to analyze the influence of photogrammetry implementation, internal coordination, and external policies on project manager decision-making, and their impact on the time performance of Monthly Certificates. The research approach used is quantitative with regression analysis method. The results show that the implementation of photogrammetry, internal coordination, and external policies together have a positive influence on project manager decision-making, with external policies being the most dominant factor. Furthermore, project manager decision-making is proven to have a positive influence on the time performance of Monthly Certificates. These findings confirm that appropriate technological support, effective internal coordination, and clear external policies can improve the quality of project manager decision-making, which ultimately contributes to the acceleration of the preparation and issuance of Monthly Certificates in toll road earthworks.

Corresponding Author:

Risky Setiawan
Fakultas Teknik
University Mercu Buana
kikiksetiawan1@gmail.com

1. INTRODUCTION

According to Sutandi & Wilwin (2021), infrastructure is all tangible and intangible facilities built by the government and individuals to meet the basic needs of society and support social life. Another definition of infrastructure can be defined as a set of physical facilities and infrastructure generally required by the wider community to support various social, economic, and daily activities. These facilities include basic services such as transportation, energy, clean water, sanitation, communications, and public buildings that directly and indirectly facilitate the smooth running of people's lives.

In the course of transforming national infrastructure development, Indonesia has recorded several significant achievements during the 2020-2024 period. From the construction of strategic dams to the expansion of the toll road network, from the modernization of drinking water supply systems to the development of

sustainable residential areas, various infrastructure projects have made a significant contribution to improving the quality of life of the community. However, a comprehensive evaluation indicates fundamental challenges to equitable development in the world's largest archipelagic nation [1], [2].

One infrastructure development that has attracted national attention is the Trans-Java Toll Road, which stretches from Merak in Banten Province to Banyuwangi in East Java Province. This toll road is approximately 1,167 kilometers long and connects major cities on Java Island, including Jakarta and Surabaya. This project is a crucial part of efforts to improve regional connectivity and accelerate national economic growth.

However, during implementation, several obstacles remain, particularly related to delays in submitting monthly certificates for earthworks by some contractors. These delays not only impact project administration and reporting but also hamper the payment disbursement process from the employer to the contractor. One factor contributing to these delays is project managers' decision-making, which is often difficult to implement quickly. This slow decision-making is influenced by the accuracy and speed of soil volume calculations, which still require verification processes and complex documentation flows. Furthermore, suboptimal internal coordination among contractor management also slows down the validation and report preparation process. Furthermore, external policies, including regulations and procedures for implementing new technologies such as BIM and photogrammetry, also pose challenges in accelerating the process. This combination of factors contributes to a buildup of problems that ultimately lead to delays in the earthwork billing process on toll road projects [3].

As work volumes increase, the need for prompt and timely payments becomes crucial to maintaining contractor cash flow. If delays in the progress calculation process and bill submission are not immediately addressed, there is a risk of causing further delays in the overall project implementation, which could ultimately affect the target completion of the toll road construction.

2. RESEARCH METHODS

This research uses a quantitative approach with field studies. The data used in this study are primary data obtained from questionnaire distribution in numerical form. In addition, secondary data obtained from journals, books, and other references are also utilized. This research plan will utilize a survey method with descriptive and exploratory survey types. Therefore, this study will target a specific population with the aim of investigating and drawing conclusions by linking variables related to the problem to be investigated in this study. Data collection in this study was conducted through questionnaires and direct interviews. The questionnaires were distributed to stakeholders involved in the project, including internal contractors, supervisory consultants, and project owners. These questionnaires contained questions relevant to the research variables, such as the influence of photogrammetry, internal contractor coordination, and external policies. In addition, direct interviews with stakeholders were conducted to gain a deeper understanding of the field practices encountered during the monthly certificate preparation process. The data obtained from these questionnaires and interviews will be used to analyze the relationships between the research variables and to test the formulated hypotheses [4].

3. RESULT AND ANALYSIS

Based on the analysis that has been carried out in this study, the results of the identification of the influence of Photogrammetry Implementation (x1), Internal Coordination (x2) and External Policies (x2) on Project Manager Decision Making y (Equation 1) and its impact on Report Time Performance were obtained. Monthly Certificatez (Equation 2) on toll road earthworks [5].

Implementation of Photogrammetry in Toll Road Earthworks

The discussion begins by outlining the application of photogrammetry as a technology for collecting earthwork volume data. Photogrammetry plays a crucial role in providing rapid and visual spatial data, thus assisting the project team in monitoring work progress regularly and more objectively than conventional methods.

Time Efficiency and Reliability of Photogrammetry Data

The results of the study indicate that photogrammetry can significantly improve the time efficiency of field data acquisition. This speed provides a strategic advantage in preparing weekly progress reports, although in certain conditions, such as vegetated areas, caution is required in interpreting volume accuracy.

The Role of Internal Coordination in Project Data Management

Internal coordination between divisions, particularly between the survey, engineering, and contract administration teams, has proven to be a crucial factor in the smooth processing and utilization of data. Good coordination prevents delays due to differing perceptions or asynchronous information.

The Impact of Team Communication on Decision-Making Speed

The results of the study indicate that effective internal communication accelerates the process of data clarification and the resolution of technical issues. This directly impacts the project manager's ability to make timely decisions based on mutually agreed-upon data.

External Policies as a Determining Factor in the Administrative Process

External policies, including project owner approvals and consultant directives, are a dominant factor in the decision-making process. Clarity of policies and approval procedures significantly impacts the smooth validation of work and the issuance of monthly certificates.

Relationship between Project Manager Decisions and Monthly Certificate Time Performance

The discussion shows that the quality of project manager decisions is directly proportional to the time performance of monthly certificates. Fast, accurate decisions based on valid field data can minimize document revisions and expedite the payment administration process.

Hybrid Approach as a Technology Implementation Strategy

In practice, this study found that a hybrid approach was the most optimal solution. Photogrammetry was used for progress monitoring and early detection, while conventional measurement methods were retained as the basis for final validation to ensure compliance with contractual provisions.

Consistency of Findings with Previous Research

This study's results reinforce previous findings regarding the importance of technology, internal coordination, and external policies in construction project management. However, there are differences in photogrammetric accuracy, indicating that the field context significantly influences the effectiveness of the methods used.

Managerial Implications for Toll Road Project Management

Overall, the results and discussion confirm that the integration of survey technology, strengthening internal coordination, and external policy support are key to improving the performance of monthly certificate time. These findings provide practical implications for project managers in optimizing decision-making strategies to ensure smooth timelines, costs, and administration of toll road projects.

The results of Equation 2 explain that the variable y (Project Manager Decision Making) has a positive influence of 0.395 on the variable z (Report Time Performance). Monthly Certificate). This proves that the better the decision-making process carried out by the project manager, such as decisions related to handling field deviations or approving work volumes, the better the timeliness of report preparation. Monthly Certificate. Fast and accurate decisions prevent delays in the billing administration process, so that the payment cycle and progress reporting are smoother.

Effect of Photogrammetry Implementation

For variable x1, with the identity variable being Photogrammetry Implementation, a positive regression coefficient of 0.155 was obtained. This indicates that the use of photogrammetry technology makes a significant contribution to the decision-making process. This technology helps provide a more objective and accurate picture of field conditions through data. Digital Elevation Model (DEM) and faster, more precise volume calculations. With valid visual and quantitative data from photogrammetry, project managers have a stronger basis for making technical decisions, reducing the uncertainty caused by longer manual data processing times [1], [2].

Effect of Internal Coordination

In the variable x2 with the variable identity, namely Internal Coordination, a positive regression coefficient of 0.396 was obtained. Effective internal coordination, including smooth communication and synchronization of work between departments, encourages project managers to make faster and more informed decisions. With a clear flow of information between divisions (engineering, field, and survey), the risk of miscommunication can be minimized, so that decisions regarding approval of progress or technical changes can be taken without unnecessary delay [6].

Influence of External Policy

For variable x3, with the identity variable being External Policy, a positive regression coefficient of 0.869 was obtained. This variable has the largest coefficient value, indicating a very strong influence. External policies include clear instructions from the project owner, work change procedures, and direction from the supervising consultant. When external guidelines are structured and communicated in a timely and clear manner, project managers can establish administrative and technical steps with certainty, reducing the uncertainty that often hinders decision-making in infrastructure projects.

This variable becomes dominant due to the structural and regulatory aspects of external parties (Ownerand Consultants) play a crucial role in toll road projects. Project managers' decisions are highly dependent on clear approval and direction from the project owner (such as work instructions or design change approval). Without conducive external policy support, technology (photogrammetry) and internal coordination alone are insufficient to ensure the swift execution of strategic decisions, particularly those related to payment legality and contract administration.

Experimental Test Discussion

Based on comparative tests in experimental tests, there are differences but complementarities in the Photogrammetry Implementation variable (x1). On the one hand, this technology has been proven to significantly reduce data acquisition time (>95%), which greatly supports the time efficiency aspect. However, on the other hand, there is a volume deviation (fill: 12.35%) that exceeds the tolerance [7].

This deviation is indicated to occur due to the limitations of the passive sensor (passive sensor) on the drone camera in penetrating dense vegetation, which is different from the principle of discrete point measurement onTotal StationThis condition emphasizes that although photogrammetry excels in speed, its absolute accuracy still requires manual verification for certain areas [8]. These findings have direct implications for the Project Manager's Decision (y). The Project Manager decided to implement a hybrid strategy: using photogrammetry for weekly progress monitoring (internal monitoring) to speed up deviation detection, while still maintainingTotal Stationas a final measuring tool for submissionMonthly CertificateThis tactical decision proved effective in maintaining trust. Owner (comply with External Policy x3) without sacrificing the overall speed of project monitoring.

Comparison of Previous Research

Overall, the results of this study reinforce the theoretical model that the synergy between technology, coordination, and policy significantly impacts project time performance. This finding aligns with studies by Sentosa et al., 2023 and Yin et al., 2023, which assert that UAV-based photogrammetry technology can revolutionize construction monitoring efficiency by drastically reducing data acquisition time compared to conventional methods. In this study, time efficiency was proven to reach over 95% (30 minutes of flight time compared to 2 days of manual measurement). However, there are interesting divergent findings regarding volume accuracy when compared to the study (Ardiansyah & Irbah, 2024). In their study on the Meninting Dam project, they found that the photogrammetry method had a higher level of accuracy (error 0.26%) compared to the previous study. Total Station (error 0.41%). On the other hand, in this study, the photogrammetry method actually produced a larger volume deviation (12.35%) in embankments and -8.11% in excavations compared toTotal Station.

4. CONCLUSION

Based on the analysis and discussion, it can be concluded that the implementation of photogrammetry, internal coordination, and external policies collectively play a crucial role in improving the quality of project managers' decision-making in toll road earthworks. The combination of rapid survey technology, effective cross-team communication, and clear regulatory support from the owner or consultant has been shown to accelerate and strengthen the decision-making process. Among these three factors, external policies are the most dominant, as approvals, instructions, and clarity of regulations from external parties are crucial for smooth project administration and operations. Furthermore, strong internal coordination ensures smooth data flow between divisions, allowing timely decisions based on integrated information [9]. Furthermore, accurate and responsive decision-making by project managers has been shown to significantly impact the timely delivery of progress reports and the issuance of monthly certificates. Decisions supported by valid field data can accelerate the work volume validation process and directly impact project cash flow. In this context, the study recommends implementing a hybrid mechanism, utilizing photogrammetry for rapid progress monitoring and early detection, while using conventional methods as a final validation tool for payment purposes. These findings are in line with previous studies that emphasize the importance of technology, internal communication, and external policy support in construction management, while also emphasizing that the quality of data-based decisions is the main key to improving monthly certificate time performance [10].

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