The Impact of Land Acquisition Delays on Time and Cost Performance in Construction Projects: A Case Study of the Bekasi River Flood Control Project Package 6

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ABSTRACT

The delays in land acquisition are frequently an obstacle to the execution of construction projects in Indonesia, particularly the ones involving large-scale national infrastructure. This study examines the impact of land acquisition delays on the time and cost performance of construction project implementation, using the Bekasi River Flood Control Project, Package 6, as a case study. A quantitative approach was employed utilizing an explanatory sequential design that integrated primary and secondary project data collected from 32 respondents via a questionnaire. The results from the Simple Linear Regression (SLR) analysis indicate that the land acquisition delays have a strong, significant effect on the project duration with $R^2 = 0.380$ and $p < 0.001$, and a moderate, significant effect on the project cost with $R^2 = 0.181$ and $p = 0.015$. In practice, a 16 month delay in land acquisition led to a 454 day extension in project duration and an increase in costs by approximately IDR 7.5 billion, which is the 2.304% of the original contract value.

Keywords-land acquisition delays; time deviation; cost deviation; construction project

I. INTRODUCTION

Although the infrastructure development is a top priority in Indonesia's national agenda, aimed at enhancing the regional connectivity, environmental protection, and disaster resilience, it faces non-technical obstacles, with the most prominent being the delays in the land acquisition process. The Bekasi River Flood Control Project, Package 6, is one of the national strategic projects that have experienced significant delays due to the incomplete land acquisition at several locations.

Previous studies have identified various factors contributing to the delays in construction projects, including funding constraints, weak project management, and administrative as well as technical disruptions [1]. Among these factors, the land acquisition is considered a critical determinant of delay, particularly in large-scale infrastructure projects. According to [2], the delays in the land handover by the landowners are a main cause of the setbacks in major construction projects.

In the Indonesian context, authors in [3, 4] found that the land acquisition process has a significant impact on the timely completion of strategic irrigation network projects in Aceh. In alignment with these findings, authors in [5] is underscored that the operational effectiveness of the land acquisition teams at the field level plays a significant role in determining the performance outcomes of the toll road projects in Indonesia. In an international context, authors in [6] indicate that the weaknesses in the land governance, including the delays in compensation payments, multi-layered bureaucracy, and low public participation, contribute significantly to the project delays and cost overruns in infrastructure projects in Nepal. These findings confirm that the land acquisition is not only an administrative process, but also a strategic element that

determines the project success, especially that of large-scale, land-intensive projects at a national level. In Indonesia, authors in [7] identified the social resistance from the affected communities and the obstacles in land ownership verification as the main causes of the delays in the land acquisition for the Bagong Dam project, which ultimately led to significant construction time deviations. Similar findings were reported in [8], where a case study of a road project in West Sumatra was performed. In that project, the delays in the land acquisition not only shifted the implementation schedule, but also drove up the overall project costs. The regional context is further highlighted in [9], where it is noted that the land acquisition is among the five most critical factors causing delays in commercial construction projects in Malaysia, such as poor contract management and delays in the technical drawing preparation. However, most existing studies are still limited to identifying the factors causing delays, while few have simultaneously quantified the impact of the land acquisition delays on the project time and costs in a measurable way.

The present study aims to fill this gap, deploying a quantitative approach that combines two main sources of information: actual project data and the perceptions of field professionals. By utilizing statistical analysis, it aims to empirically measure the extent to which the delays in land acquisition contribute to schedule deviations and construction cost overruns. The case study focuses on the Bekasi River Flood Control Project Package 6, which has a high level of land acquisition complexity. This research is expected to provide theoretical and practical contributions to the risk management in land acquisition for similar infrastructure projects in the future.

II. RESEARCH METHODOLOGY

A. Approach and Types of Research

A mixed-methods approach was adopted, which begins with the collection and analysis of quantitative data, followed by a qualitative inquiry to support and clarify the initial results [10]. This approach was selected to gain a more holistic understanding of the impact of the land acquisition delays on the time and cost variances in the implementation of construction projects. The quantitative phase focuses on analyzing secondary data from the Bekasi River Flood Control Project (Package 6), including implementation schedules, actual progress, changes in contract values, and other relevant documents. This analysis follows a positivist paradigm, as outlined in [11], which emphasizes the testing relationships between the variables using statistical techniques, and more specifically, simple linear regression. The qualitative phase was undertaken to complement and validate the quantitative findings. A descriptive approach was applied, utilizing a closed-ended questionnaire based on a five-point Likert scale, which was distributed to a sample of 32 respondents, comprising representatives of the project owner, supervising consultants, and contractors. The sample size was determined in accordance with parametric statistical guidelines, which propose a minimum number of respondents for the SLR and validity testing [12, 13]. This mixed-method design was used to capture the subjective and operational dimensions in the field that cannot be fully explained by statistical analysis alone. It enabled the integration of objective numerical data with contextual insights drawn from real-world project experience and it is expected to yield a more comprehensive and representative understanding of the land acquisition delays in public infrastructure projects.

B. Location and Object of the Study

The research area is the Bekasi River Flood Control Project, Package 6, located in Bekasi Regency, West Java Province, Indonesia. Administratively, the project spans four villages across three districts: Babelan District, Sukawangi District, and Tambun Utara District. Spatially, the project alignment extends from the coordinates of 6°10'09" S and 107° 02'53" E to 6°08'45" S and 107° 02' 50" E (Figure 1).

Fig. 1. Project location map.

The location selection was carried out purposively with the consideration that this project experienced significant delays during the land acquisition phase, which directly impacted the time and cost deviations in implementation. The choice of the location meets the following criteria:

- The project experienced documented delays in land acquisition, as noted in official progress reports and contract addenda.
- Complete historical data were available and accessible for quantitative analysis.
- The location enabled primary data collection through field observation, questionnaire distribution, and interviews with the project stakeholders.

C. Data Collection Techniques

Secondary and primary data were obtained to ensure a comprehensive coverage and enable the triangulation of the findings.

1) Secondary Data

The secondary data were collected from official documents and archives related to the case study area, and included:

- Planned and actual project implementation schedules
- Initial contract value and subsequent modifications
- Physical and financial progress reports
- Land acquisition documents, involving acquisition schedules and reports on the implementation constraints encountered in the field

These data were used to identify and analyze the deviations between the planned and actual implementation in terms of both the time and cost performance.

2) Primary Data

Primary data were collected through a closed-ended questionnaire distributed to 32 respondents, who played key roles in the project implementation. The respondents included representatives from the implementing contractor, the supervisory consultant, and the project owner, namely the Commitment Making Officer (PPK) or technical staff from the implementing agency.

The questionnaire was developed based on three main variables:

- X: Land acquisition delays
- Y_1: Impact on project implementation time
- Y_2: Impact on project implementation cost

Each variable was measured using a five-point Likert scale to capture the respondents' perceptions regarding the magnitude and direction of the impact of land acquisition delays on the two key indicators of the project performance. The primary data were analyzed using descriptive statistics and SLR to examine the relationships between them.

D. Data Analysis Techniques

The analytical approach followed the mixed-method design, combining the quantitative analysis of the actual project data with descriptive analysis of the stakeholder perceptions. This integration of objective (empirical) and subjective (perceptual) information provided an understanding of the influence of the land acquisition delays on the time and cost performance in construction projects. The entire research process is illustrated in the flowchart in Figure 2.

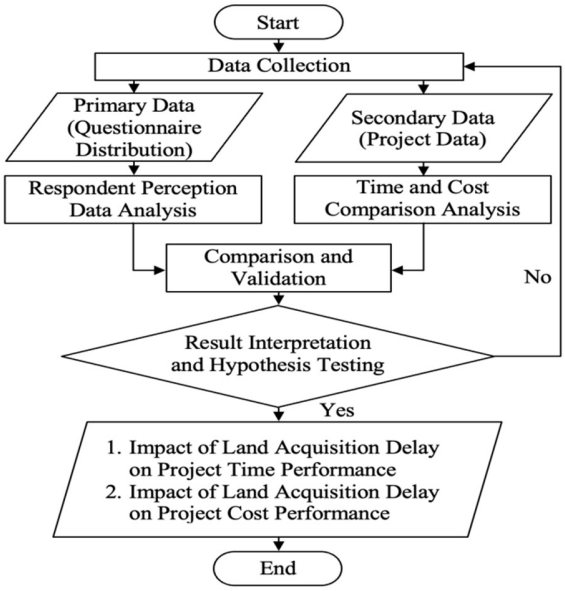

Fig. 2. Research flowchart.

The analysis was conducted from two complementary perspectives: The technical, where actual project data reflecting field conditions were evaluated, and the managerial, where stakeholders' perceptions were assessed based on the direct experience of the project. This dual-perspective framework enabled cross-validation, thereby enhancing the reliability and interpretability of the findings.

1) Analysis of Actual Project Data

The first phase focused on the quantitative descriptive analysis of the study area, with an emphasis placed on two key project performance indicators: the deviation in the project implementation time and cost. The procedure entailed measuring the land acquisition delays; that is, the difference between the actual and planned acquisition schedules. The former also involved calculating the time deviation as the difference between the total actual project duration (post-delays) and the initial contract duration, and calculating the cost deviation as the difference between the final contract value and the initial contract value, expressed in both nominal terms (IDR) and as a percentage of the original contract value. Since the analysis was conducted based on a single case study design, inferential statistical techniques, such as regression or hypothesis testing were not applied. Instead, the relationships between the variables were examined using proportional and ratio-based comparison methods, which provide a logical and quantitative representation of the extent to which the land acquisition delays affected the project's performance.

2) Analysis of Stakeholder Perception Data

To complement the findings derived from actual project data, the second phase involved analyzing the primary data obtained through the closed-ended questionnaire, using a five-point Likert scale, which was distributed to the 32 project stakeholders. The analysis was conducted quantitatively and preceded through the following stages:

- Descriptive statistics: Calculation of the mean, standard deviation, range, and frequency distributions for the three study variables: land acquisition delays (X), impact on project implementation time (Y_1), and impact on project implementation cost (Y_2). This initial step provides a context regarding the response patterns and the degree of homogeneity in the assessments.
- Validity testing: Each questionnaire was tested using the Pearson Product-Moment Correlation and was deemed valid if its p-value was less than 0.05.
- Reliability testing: Items that were found to be valid were then checked for reliability using Cronbach's alpha, where a score of $\alpha \geq 0.70$ shows that the items are consistently measuring the same thing [14].
- SLR analysis: It is used to test the direction, strength, and significance of the influence based on the respondents' perception scores [15]. Two regression models were constructed, model 1: $X \rightarrow Y_1$, estimating the effect of the perceived land acquisition delays on the perceived time extensions, and model 2: $X \rightarrow Y_2$, estimating the effect of

the perceived land acquisition delays on the perceived cost increases.

Additionally, classical assumption testing was conducted to ensure the statistical validity of the regression models. They were tested for normality of residuals using the Shapiro-Wilk test, whereby a p-value greater than 0.05 indicates a normal distribution. Also, to verify the assumption of homoscedasticity, two tools were employed: visual assessment, which was conducted using a scatter plot that displays the standardized residuals against the standardized predicted values, and statistical assessment, using the Glejser test, where if the significance p-value exceeds 0.05, it can be concluded that there is no indication of heteroscedasticity.

III. RESULTS AND DISCUSSION

This study employed two complementary analytical approaches: the analysis of actual project data, and the analysis of respondent perception data. This combination enabled a comprehensive assessment of the impact of land acquisition delays on the project schedule and cost performance.

A. Actual Project Data

The analysis of the actual project data indicates that a 16-month delay in land acquisition resulted in a project time deviation of 454 calendar days. This corresponds to a delay ratio of 0.94 months of project delay for every month of delay in land acquisition, signifying that the land acquisition activities are a critical part of the project. At the same time, the project cost experienced an increase of IDR 7.5 billion, equivalent to 2.304% of the original contract value and corresponding to IDR 500 million per month (Table I).

TABLE I. IMPACT OF LAND ACQUISITION DELAYS

Indicator	Actual value	Impact ratio
Land acquisition delay	16 months	-
Project time deviation	454 days (15 months)	0.94 month of delay per month of land delay
Project cost overrun	IDR 7.5 billion	2.304% of the initial contract value

B. Respondent Perception Data

1) Descriptive Statistics

A total of 32 respondents provided data on the three key variables X, Y_1, and Y_2. The mean scores ranged from 33.44 to 34.78, with standard deviations of around 4, indicating consistent perceptions of the significant delay impacts (Table II).

TABLE II. STATISTICS OF RESPONDENTS' PERCEPTIONS

Variable	N	Minimum	Maximum	Mean	Standard deviation
Land acquisition delay (X)	32	26	40	33.44	3.999
Project implementation time (Y_1)	32	25	40	34.78	3.965
Project implementation cost (Y_2)	32	28	40	34.59	3.732

2) Validity and Reliability Tests

Validity and reliability testing were implemented using eight questionnaire items. The validity testing showed that all items had p-value less than 0.05, confirming measurement accuracy, while the reliability testing using Cronbach's α, produced values greater than 0.70 for all variables, indicating an acceptable to high internal consistency (Table III).

TABLE III. VALIDITY AND RELIABILITY TEST RESULTS

Variable	N	Valid number N of items (p<0.05)	Cronbach's alpha	Interpretation
Land acquisition delay (X)	8	8	0.726	Reliable
Project implementation time (Y_1)	8	8	0.870	Highly reliable
Project implementation cost (Y_2)	8	8	0.838	Highly reliable

3) Simple Linear Regression

Two models were tested to analyze the effect of the perceived land delays on the perceived time and cost deviations (Table IV).

TABLE IV. RESULTS OF SLR ANALYSIS

Regression model	Regression equation	R2	p-value	Interpretation
$X \rightarrow Y_1$	$Y_1=14.345+0.611X$	0.380	< 0.001	Strong and significant influence
$X \rightarrow Y_2$	$Y_2=21.331+0.397X$	0.181	0.015	Moderate and significant influence

The regression equation of the first model $X \rightarrow Y_1$ is:

$$Y_1=14.345+0.611X \quad (1)$$

The regression coefficient of 0.611 indicates that one unit increase in the perception of the land acquisition delays will increase the perception of the project delays by 0.611 units, which shows a positive and fairly strong relationship between the two variables. The coefficient of determination $R^2 = 0.380$ indicates that 38% of the variation in the project time delays can be explained by the land acquisition delays, while the remainder is explained by other factors not included in this model. The very small level of significance ($p < 0.001$) confirms that the influence of variable X on Y_1 is statistically significant at the 95% confidence level. Thus, the hypothesis that the delays in land acquisition have an impact on the project delays can be empirically accepted. The regression equation of the second model $X \rightarrow Y_2$ is:

$$Y_2=21.331+0.397X \quad (2)$$

The regression coefficient of 0.397 indicates that one unit increase in the perception score of the land acquisition delays will increase the project cost perception score by 0.397 units, which shows a positive relationship, with a moderate strength,

as reflected in the correlation coefficient R of 0.425. Meanwhile, the R^2 value of 0.181 indicates that 18.1% of the variation in the project cost perception can be explained by the land acquisition delay variable. The remaining 81.9% comes from other variables outside this model. The significance value $p = 0.015$, which is smaller than $\alpha = 0.05$, indicates that the relationship between the land acquisition delays and project implementation costs is also statistically significant. With these results, it can be concluded that the land acquisition delays not only affect the time, but also have a real impact on the costs of the construction projects that exceed the budgets. While the relationship between the land acquisition delays and cost performance is statistically valid, its predictive strength remains moderate. This suggests that other factors may also play a significant role in the cost overruns, and thus, generalizations should be made with caution.

4) Classical Assumption Test

Classical assumption tests were applied before interpreting the regression results to ensure the validity of the SLR model. The residual normality test was performed using the Shapiro-Wilk method, which is suitable for small to medium sample sizes. The results of this test show that the residuals of both regression models for the time (Y_1) and cost (Y_2) variables are normally distributed and do not violate the normality assumption, as indicated by the p-values, which are greater than 0.05. Also, the homoscedasticity was verified visually via scatterplots and statistically via the Glejser test. These results indicate that the regression assumptions were met.

C. Cross-Validation

A comparison was conducted between the actual quantitative project data and the respondents' perceptions of the land acquisition delays and their impact on the implementation time and costs to strengthen the research results. The real data analysis results were consistent with the perception data analysis results, where the regression model shows that the delays in land acquisition significantly affect the project implementation time with $R^2 = 0.380$ and costs with $R^2 = 0.181$. These values reflect the fact that the respondents' perceptions align with the actual on-site conditions, indicating that the delays in land acquisition are indeed the primary cause of the time deviations (Figure 3) and cost overruns (Figure 4).

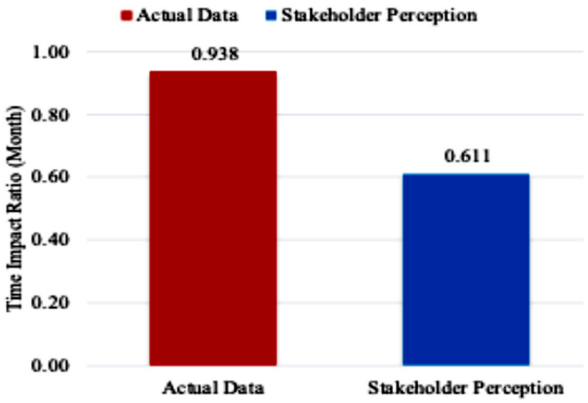

Fig. 3. Comparison of time impact ratios.

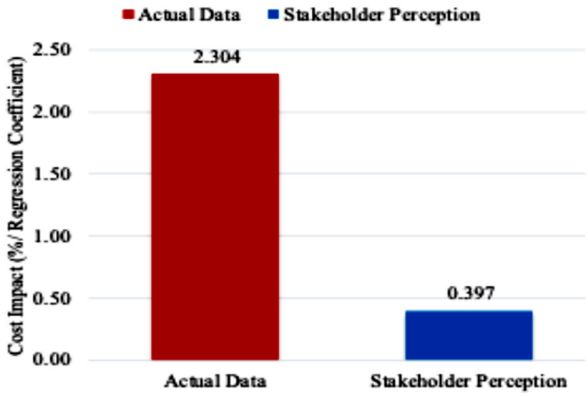

Fig. 4. Comparison of cost impacts.

The alignment between the empirical quantitative findings and the perceptual data reinforces the internal validity of this study. It confirms that, from both technical and managerial standpoints, the delays in the land acquisition process exert a tangible and measurable impact on the project performance. This comparison highlights the importance of integrating actual data with stakeholder perceptions to gain a deeper understanding of the complex challenges faced in the construction projects, particularly in nationally significant projects, where the timely land acquisition is critical.

Despite the strength of this alignment, the study has several limitations that should be acknowledged. It focuses solely on the effects of the land acquisition delays and does not incorporate other variables that may influence the project performance, such as extreme weather events, regulatory permit delays, or contractor-related inefficiencies. These un-modeled factors could also contribute to deviations in the project time and cost. Future research is proposed to include a broader range of determinants in order to develop a more comprehensive and predictive framework for infrastructure project performance analysis.

IV. CONCLUSIONS

The current study provides empirical evidence, according to which the land acquisition delays are a critical determinant of the project performance deviations in the Bekasi River Flood Control Project Package 6. The analysis of actual project data revealed that a 16-month land acquisition delay resulted in a project duration extension of 454 days, corresponding to a ratio of 0.94 months of project delay for each month of land acquisition delay, while the project incurred a cost overrun of IDR 7.5 billion, equivalent to 2.304% of the initial contract value.

The perception-based analysis using Simple Linear Regression (SLR) further confirmed these findings. The land acquisition delays (X) were found to have a strong and statistically significant influence on the project implementation time (Y_1), with values: $R^2 = 0.380$ and $p < 0.001$, and a moderate, yet, statistically significant effect on the project implementation cost (Y_2), with values: $R^2 = 0.181$ and $p = 0.015$.

These results demonstrate that the land acquisition delays represent not only administrative challenges, but also strategic risks with measurable impacts on both the schedule and financial performance, and highlight the importance of prioritizing early, coordinated, and adaptive land acquisition strategies. The outcomes of this study can serve as a practical reference for policymakers, project owners, and practitioners in designing mitigation measures to reduce the risk of delays and cost overruns in future infrastructure projects.

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