

Factors Affecting Project Performance and Project Control Measures for Road Construction Projects at PT. X

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Article Information	ABSTRACT
Article History Received : September 01, 2026 Revised : September 25, 2026 Published : October 02, 2026	The performance of construction projects is a key factor in the success of modern infrastructure development, particularly in achieving cost, quality, and schedule targets. Road improvement projects at PT X face operational challenges, including delays in the delivery of prefabricated materials and extreme weather conditions, which may reduce daily work productivity. This study aims to identify the dominant factors affecting project performance, determine their relative importance using the Relative Importance Index (RII) method, and formulate appropriate control strategies. A quantitative approach was employed using questionnaires distributed to 30 project personnel, of which 28 valid responses were returned and analyzed. The questionnaire consisted of 15 variables related to factors affecting project performance. The RII values were classified into three importance levels: high, moderate, and low. Although three classification levels were used, the results showed that the analyzed variables fell only into the high and moderate categories. The two most dominant factors were the suboptimal internal quality management system, with an RII of 0.700, and the lack of coordination among parties in quality control, with an RII of 0.686. The proposed control strategies include conducting periodic quality audits, assigning dedicated supervisors at critical project stages, and strengthening integrated materials supply chain management. These strategies are expected to improve project implementation efficiency at PT X and provide a useful reference for future road infrastructure projects.
Keywords: <i>Control strategies; Project control; Project performance; Quality management; Relative Importance Index (RII).</i>	

INTRODUCTION

Infrastructure development is one of the top priorities in supporting national economic growth (Waris et al., 2025). Land transportation infrastructure, particularly roads, plays a vital role in connecting regions, facilitating the distribution of goods, and enabling public mobility (Nizam & Sastra, 2020). According to the regulations of the Minister of Public Works, A road includes all parts of a road, along with its ancillary structures and facilities intended for traffic, whether above ground, underground, or over water, except for railways, tramways, and cableways (Menteri Pekerjaan Umum, 2023).

PT. X is a company engaged in road construction and involved in various infrastructure improvement projects in several areas with high traffic density (Kominfo, 2025). One example of an improvement project undertaken by PT X is the upgrade of Road A, which serves as the main access route for industrial vehicles. The current condition of the road which is damaged and lacks

sufficient capacity requires improvements through road widening, concrete paving, and asphalt overlay to enhance traffic service quality (Pago et al., 2023).

The main problem that arose during project implementation was a delay in the delivery of U-ditch materials from the fabrication contractor (Trianshy et al., 2022). This disrupted daily productivity, which was supposed to reach 40–45 units per day but fell short, with only 30 units delivered in the fifth week, resulting in a three-day delay in the work. In addition, weather conditions also had a significant impact on project performance (Pujiastuti et al., 2023). Heavy rainfall during the seventh week of September caused flooding and slowed down the construction process, while the intense heat led to a decline in worker productivity on-site. Based on field observations, these extreme weather conditions can affect worker performance by approximately 10–20%, as evidenced by a decrease in work speed, increased fatigue, and longer rest periods (Fatchurrohman et al., 2024).

Delays in material delivery, compounded by weather conditions, have caused the volume of work to fall short of the planned target, thereby posing the risk of project delays and increased implementation costs. In addition to material and weather issues, external challenges have also arisen due to the condition of Road A, which serves as the main route with no alternative access (Said, 2023). The construction process for rigid pavement takes a considerable amount of time and requires a complete road closure. This situation causes traffic congestion, disrupts public mobility, and has the potential to reduce public satisfaction with the project's implementation (Puteri et al., 2021). Furthermore, as noted by Puteri, time overruns caused by stakeholder dynamics, material issues, and external factors severely impact overall project delivery. Therefore, strategies for material control, weather risk mitigation, and proper traffic management are essential to ensure the project's performance is maintained without causing significant social impacts.

In addition, field observations also revealed other issues that affect project performance (Widiasanti et al., 2024). These challenges include a lack of communication among parties when changes to the work occur, limited availability of heavy equipment during certain hours which prevents equipment and workers from operating and daily fluctuations in labor productivity. This indicates that project performance is not only influenced by materials and weather conditions, but also depends on management, work scheduling, and coordination among the parties involved throughout the construction process (Amun & Waty, 2024).

These various challenges indicate that project performance is influenced by many factors, both internal and external (Bagale & Bohara, 2024). Failure to identify the dominant factors affecting project performance can lead to serious risks such as delays, cost overruns, and a decline in work quality (Magdalena & Citra, 2025). Therefore, an analysis is needed that can measure the relative importance of each factor so that control priorities can be set more accurately and effectively, ensuring that construction can be completed on time, within the budget, and in accordance with expected quality standards (Rasa & Handayani, 2023).

One method that can be used to analyze the level of importance of these factors is the Relative Importance Index (RII), which allows for a comprehensive assessment of the dominant factors that most influence project performance (Noviyarsi et al., 2023). The RII method enables the evaluation of factors affecting project performance based on the perceptions of respondents, such as contractors, consultants, and other stakeholders. Through the RII calculation, it is possible to identify which factors are most dominant and should be prioritized in project management. Thus, the results of this analysis can serve as the basis for project management decision-making to ensure that the construction process proceeds more optimally (Faustine & Waty, 2022).

Regarding this approach, several previous studies have demonstrated the effectiveness of the RII method and project performance analysis. In a study on identifying the key factors in the success of the Bank Indonesia West Java project, Sanggor used a questionnaire analyzed via the RII method to determine the key success factors and identified 10 key success factors (Sanggor et al., 2024). Similarly, Faustine & Waty investigated the ranking of factors influencing labor productivity in construction projects using a quantitative approach, validity and reliability tests

conducted with IBM SPSS, and RII analysis to determine the highest-ranking factors affecting labor productivity.

Furthermore, Rafki, in their study analyzing the factors influencing project implementation performance on the quality of national road construction in West Sumatra Province, used a closed-ended questionnaire and Pearson Product-Moment Correlation analysis, which showed that the coordination and communication capabilities of human resources (HR) and materials significantly influence project implementation performance and quality (Rafki et al., 2024). On the other hand, Bagale & Bohara used a survey method validated through the Content Validity Test, Criterion Validity Test, and Cronbach's Alpha Test, and analyzed using RII, concluding that the main factors influencing project performance include project manager leadership, cost management, resource availability, and communication among stakeholders (Bagale & Bohara, 2024).

However, most previous studies using the RII method have focused on general success factors, labor productivity, or specific aspects such as occupational health and safety in building or metro projects. Few studies have specifically examined road construction projects implemented by a single local contractor under high-traffic conditions. This study differs from prior work by focusing on PT X's road improvement projects in Sidoarjo, where factors related to quality management, inter-party coordination, logistics and material supply, and extreme weather conditions are analyzed together. By integrating these context-specific factors within an RII-based framework, this research not only identifies the dominant hindering factors but also translates the findings into targeted project control strategies tailored to PT X's operational conditions.

Accordingly, the objective of this study is threefold: (1) to identify the factors that most significantly hinder the performance of road construction projects at PT X; (2) to determine the relative importance level of each factor using the Relative Importance Index (RII) method; and (3) to formulate project control strategies that address the dominant hindering factors, thereby supporting the achievement of cost, quality, and schedule targets.

In this study, "factors hindering project performance" refer to internal and external conditions that negatively affect cost, time, and quality outcomes, such as suboptimal quality management, poor coordination, and material or weather-related disruptions. In contrast, "project control strategies" refer to targeted managerial and technical measures designed to mitigate the impact of these dominant factors, such as periodic quality audits, dedicated supervision at critical stages, and improved supply chain management.

RESEARCH METHODS

This study employs a quantitative approach using descriptive methods to systematically measure respondents' perceptions and assessments of various complex factors that hinder the performance of road construction projects, while also objectively ranking all of these variables based on their respective levels of importance. This descriptive quantitative approach was chosen because it has the advantage of facilitating the detailed collection, processing, and analysis of numerical data obtained directly from the distribution of structured questionnaires in the field. By applying this method, the researcher can accurately identify the dominant inhibiting factors, factually describe the actual conditions of the phenomena occurring in the project, and provide a strong empirical basis for formulating targeted and effective risk mitigation and control strategies.

Population and Samples

The population in this study comprises all personnel or experts directly involved in the management and implementation of road construction projects at PT. X, totaling 30 individuals from four road section improvement projects (Road Section Projects A, B, C, and D). The sample size was determined using the Simple Random Sampling technique, in which every member of the population has an equal chance of being selected (Sugiono et al., 2021). Although the total population of project personnel directly involved in the road construction projects at PT. X consists of only 30 individuals, this technique was chosen because it ensures equal probability of selection

for every individual in the population, regardless of their job title or level of experience, thereby minimizing selection bias and enhancing the representativeness of the sample. Furthermore, despite the small population size, applying a probability-based sampling method such as Simple Random Sampling maintains methodological rigor and allows for generalization of findings within the studied population. Given the accessible and well-defined population of 30 project personnel across four road section improvement projects (Road Section Projects A, B, C, and D), Simple Random Sampling was also practically feasible to implement without compromising data quality.

Based on calculations using the Slovin formula with an error tolerance level (α) of 10% (0.10), the minimum sample size was determined to be 23 respondents (Sundara et al., 2024). To account for potential invalid responses and improve the accuracy of the analysis, this study involved 28 respondents out of a total population of 30, representing 93,3% of the population. While this proportion approaches a near-census coverage, the Simple Random Sampling technique was still applied during the initial selection process to ensure that the sample was drawn without bias. Respondent characteristics included job titles (Project Manager, Team Leader, Supervising Engineer, Quantity Surveyor, Quality Control Specialist, Inspector, Occupational Safety and Health Officer), educational background (D4, S1, S2), and work experience in the construction field.

Instruments

The primary instrument used to collect primary data in this study was a closed-ended questionnaire. This questionnaire was developed based on the results of a literature review and the identification of issues in the field. Before the questionnaire was widely distributed to respondents, the instrument underwent data quality testing using statistical software (SPSS and Microsoft Excel). Validity testing was conducted using the Pearson product-moment correlation technique. A statement item was deemed valid if the calculated r-value was greater than the table r value (with a table r value of 0.374 at $N=28$ and a 5% significance level). Items that did not meet the criteria were removed from the instrument. Reliability was measured using Cronbach's alpha (α). An instrument is considered reliable if its coefficient is above the minimum standard (above 0,60 or between 0,70 and 0,90).

Validity and Reliability Test Result

The validity test using Pearson Product-Moment correlation was conducted on all 15 variables with a sample size of 28 respondents. The critical r-table value at $\alpha=0.05$ with $df=26$ ($n-2$) is 0,374. All variables demonstrated r-values exceeding this threshold, ranging from 0,31 to 0,59, indicating that all items are valid and suitable for further analysis.

Table 1. Instrument Validity Test Results

Research Variable	Item Code	r-calculated	r-table ($\alpha = 5\%$)	Validity Status
Quality Management (A)	A1	0,54	0,26	Valid
Quality Management (A)	A2	0,48	0,26	Valid
Quality Management (A)	A3	0,48	0,26	Valid
Quality Management (A)	A4	0,57	0,26	Valid
Quality Management (A)	A5	0,56	0,26	Valid
Risk & Conflict Management (B)	B1	0,55	0,26	Valid
Risk & Conflict Management (B)	B2	0,57	0,26	Valid

Risk & Conflict Management (B)	B3	0,31	0,26	Valid
Risk & Conflict Management (B)	B4	0,49	0,26	Valid
Risk & Conflict Management (B)	B5	0,50	0,26	Valid
Finance / Cost Overrun (C)	C1	0,54	0,26	Valid
Finance / Cost Overrun (C)	C2	0,57	0,26	Valid
Finance / Cost Overrun (C)	C3	0,47	0,26	Valid
Finance / Cost Overrun (C)	C4	0,47	0,26	Valid
Finance / Cost Overrun (C)	C5	0,46	0,26	Valid
Project Management (D)	D1	0,39	0,26	Valid
Project Management (D)	D2	0,40	0,26	Valid
Project Management (D)	D3	0,48	0,26	Valid
Labor Productivity (E)	E1	0,59	0,26	Valid
Labor Productivity (E)	E2	0,48	0,26	Valid
Labor Productivity (E)	E3	0,59	0,26	Valid
Labor Productivity (E)	E4	0,50	0,26	Valid
Labor Productivity (E)	E5	0,57	0,26	Valid
External Factors (F)	F1	0,54	0,26	Valid
External Factors (F)	F2	0,54	0,26	Valid
External Factors (F)	F3	0,54	0,26	Valid
External Factors (F)	F4	0,54	0,26	Valid
External Factors (F)	F5	0,53	0,26	Valid

The reliability test using Cronbach's Alpha yielded a coefficient value of α is 0,843, which exceeds the minimum standard threshold of 0,60 and falls within the acceptable range of 0,70–0,90. This indicates that the questionnaire instrument is highly reliable and produces consistent responses from the respondents.

Table 2. Instrument Reliability Test Result

Research Variable	Item Code	Cronbach's Alpha	Reliability Status
Quality Management (A)	A1	0,813	Reliable
Quality Management (A)	A2	0,813	Reliable
Quality Management (A)	A3	0,813	Reliable
Quality Management (A)	A4	0,813	Reliable

Quality Management (A)	A5	0,813	Reliable
Risk & Conflict Management (B)	B1	0,742	Reliable
Risk & Conflict Management (B)	B2	0,742	Reliable
Risk & Conflict Management (B)	B3	0,742	Reliable
Risk & Conflict Management (B)	B4	0,742	Reliable
Risk & Conflict Management (B)	B5	0,742	Reliable
Finance / Cost Overrun (C)	C1	0,778	Reliable
Finance / Cost Overrun (C)	C2	0,778	Reliable
Finance / Cost Overrun (C)	C3	0,778	Reliable
Finance / Cost Overrun (C)	C4	0,778	Reliable
Finance / Cost Overrun (C)	C5	0,778	Reliable
Project Management (D)	D1	0,161	Unreliable
Project Management (D)	D2	0,161	Unreliable
Project Management (D)	D3	0,161	Unreliable
Labor Productivity (E)	E1	0,843	Reliable
Labor Productivity (E)	E2	0,843	Reliable
Labor Productivity (E)	E3	0,843	Reliable
Labor Productivity (E)	E4	0,843	Reliable
Labor Productivity (E)	E5	0,843	Reliable
External Factors (F)	F1	0,821	Reliable
External Factors (F)	F2	0,821	Reliable
External Factors (F)	F3	0,821	Reliable
External Factors (F)	F4	0,821	Reliable
External Factors (F)	F5	0,821	Reliable

Data Collection

The primary data collection process in this study was conducted comprehensively through the distribution of questionnaires in person (offline) to field practitioners, experts, the contractor's management, and the supervising consultants who are actively involved in the implementation of PT. X's road construction project located in Sidoarjo, specifically at the four project sites: the road improvement projects for Road A, Road B, Road C, and Road D. To measure respondents' perceptions and evaluations in a structured manner, this questionnaire uses a 1 to 5 Likert scale ranging from "strongly disagree" to "strongly agree". In addition to collecting primary data through the distribution of the questionnaire, the data collection process for this study was further strengthened and thoroughly validated through a review of relevant project documents and the conduct of in-person interviews to ensure the accuracy of supporting information gathered in the field.

Data Analysis

Data analysis in this study was conducted meticulously through several systematic stages to ensure that the results obtained were accurate and well-structured. The first stage began with the application of descriptive analysis, which was specifically designed to comprehensively describe and map the demographic characteristics of the respondents based on their job titles or positions, educational backgrounds, and levels of work experience in the construction field (Bagale & Bohara, 2024). The second stage involves the use of the Relative Importance Index method, which aims to determine the ranking or level of importance of each variable that hinders project performance based on the respondents' subjective yet measurable perceptions.

$$RII = \frac{\sum W}{A \times N} \quad (1)$$

The RII value is calculated mathematically by dividing the total weight assigned by all respondents (W) by the product of the highest scale weight (A) and the total number of respondents

(N), where the final RII value is then classified into several importance levels, ranging from low, moderate, to high. The classification thresholds used in this study are as follows:

Table 3. Ranking of Factors Hindering Project Performance Based on RII Scores

Scale	Importance level		RII	
1	Very Low	00.00	RII	00.02
2	Low	0.2 <	RII	00.04
3	Moderate	0.4 <	RII	00.06
4	High	0.6 <	RII	00.08
5	Very High	0.8 <	RII	01.00

Although three classification levels were defined, the analysis results showed that all 15 variables fell within the High and Moderate categories, with no variables classified as Low importance. This indicates that all identified factors are considered relevant and worthy of consideration in project management decision-making. Next, in the third stage, an in-depth frequency and probability analysis is conducted to determine response priorities or formulate appropriate risk mitigation strategies based on the findings of the dominant factor analysis generated through the RII method in the previous stage.

RESULTS AND DISCUSSION

Respondent Characteristics and Instrument Quality

The RII value is calculated mathematically by dividing the total weight assigned by all respondents (W) by the product of the highest scale weight (A) and the total number of respondents (N), where the final RII value is then classified into several importance levels, ranging from low, moderate, to high. Next, in the third stage, an in-depth frequency and probability analysis is conducted to determine response priorities or formulate appropriate risk mitigation strategies based on the findings of the dominant factor analysis generated through the RII method in the previous stage, as illustrated in Figure 1.

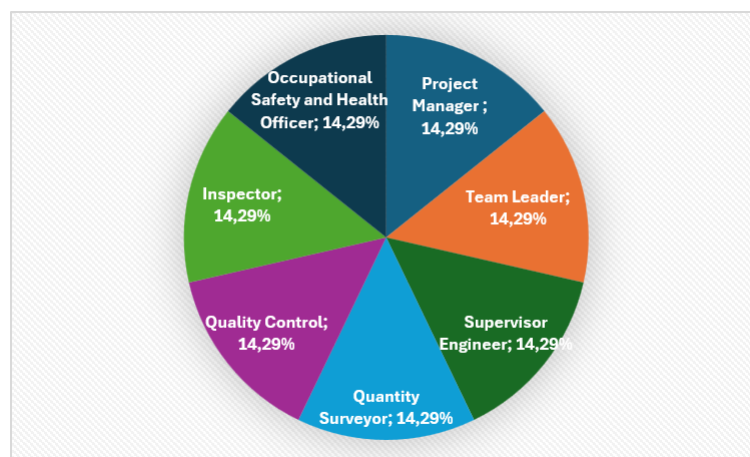


Figure 1. Distribution of respondents by professional position

Before the data was further analyzed to determine the ranking of operational barriers to the project, the questionnaire items first underwent a rigorous data quality testing phase. This testing included a validity test using the Pearson product-moment correlation technique and a reliability test using Cronbach's alpha coefficient. Based on the results of this statistical evaluation, the items that did not meet the specified threshold were removed from the instrument to ensure that only research indicators that are truly valid and reliable are included in the subsequent evaluation process.

Analysis of the Relative Importance Index (RII) Regarding Performance Constraints

Using the Relative Importance Index method, the constraint variables affecting the performance of PT. X's project were ranked based on respondents' perceptions. This analysis classified these factors into the importance levels of High and Moderate.

Table 4. Ranking of Factors Hindering Project Performance Based on RII Scores

Code	Variables and Sub-Variables Affecting Project Performance	RII Score	Importance Level	Rank
A1	Lack of quality control in the field	0,643	High	7
A2	Discrepancies between the working drawings and on-site conditions	0,671	High	4
A3	Workers' lack of concern for quality and occupational safety and health	0,621	High	13
A4	Lack of coordination among parties in quality control	0,686	High	2
A5	A suboptimal internal quality management system	0,700	High	1
B1	Differences in decision-making among owners, contractors, and consultants	0,550	Moderate	22
B2	Design changes without proper coordination	0,557	Moderate	21
B3	Delays in payment by the project owner	0,543	Moderate	25
B4	Lack of communication among the implementing parties	0,593	Moderate	15
B5	Failure to identify risks early in the planning process	0,550	Moderate	22
C1	Errors in the initial estimation of material and labor costs	0,593	Moderate	15
C2	Delays in payments to subcontractors and suppliers	0,643	High	7
C3	Design changes and additional work (variation orders)	0,664	High	5
C4	Lack of financial transparency in the project	0,600	Moderate	14
C5	Inadequate cost oversight and insufficient evaluation	0,643	High	7
E1	Low motivation and work discipline among employees	0,579	Moderate	19
E2	Unfavorable working conditions (bad weather / inadequate facilities)	0,586	Moderate	18
E3	Delays in the delivery of materials (e.g., U-ditches) and heavy equipment	0,593	Moderate	15
E4	Workers' lack of technical skills for specific jobs	0,579	Moderate	19
E5	Lack of motivation among field workers	0,550	Moderate	22
F1	Extreme weather (prolonged rain, flooding, high temperatures)	0,650	High	6
F2	Changes in government policies or regulations	0,636	High	10
F3	Changes in material prices due to unstable economic conditions	0,629	High	12

F4	Social disruptions (citizen protests, land acquisition, conflicts)	0,636	High	10
F5	Limited supply of materials and logistics due to distribution disruptions	0,679	High	3

To illustrate the calculation of the Relative Importance Index, variable A5 (suboptimal internal quality management system) is taken as an example. Based on responses from $N = 28$ respondents, the frequency distribution is: 1 for Strongly Disagree (weight 1), 4 for Disagree (weight 2), 7 for Neutral (weight 3), 12 for Agree (weight 4), and 4 for Strongly Agree (weight 5). Total weight (W) is calculated, as shown in Equation 2.

$$\sum W = (1 \times 1) + (4 \times 2) + (7 \times 3) + (12 \times 4) + (4 \times 5) = 1 + 8 + 21 + 48 + 20 = 98 \quad (2)$$

Furthermore, using the formula to calculate RII where $A = 5$ represents the highest weight on the Likert scale and $N = 28$ is the total number of respondents, the RII score is obtained as shown in Equation 3.

$$RII = \frac{98}{5 \times 28} = \frac{98}{140} = 0.700 \quad (3)$$

With an RII score of 0.700, variable A5 is categorized into the High importance level and ranks 1st as the most dominant factor hindering project performance.

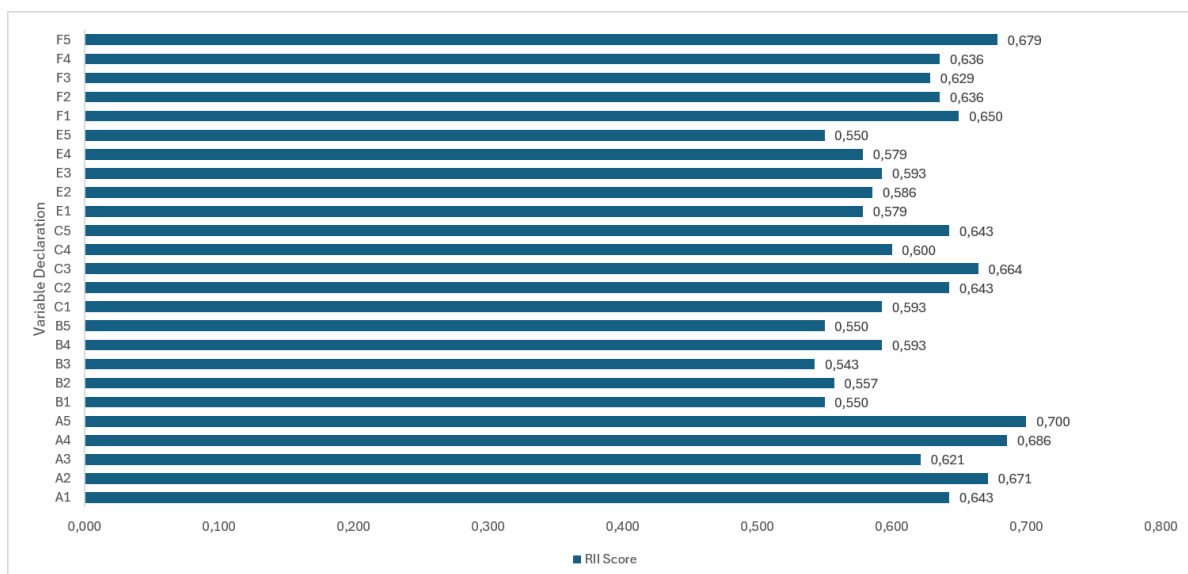


Figure 3. Distribution of RII scores for the variable "barriers"

Based on the evaluation of 28 respondents, project performance barriers are categorized into high and moderate levels of importance. Major barriers (high importance) are dominated by a suboptimal internal quality management system (A5) ranked 1st (RII 0.700), lack of quality control coordination (A4) with 0.686, and material/logistics supply limitations (F5) with 0.679, followed by drawing discrepancies, design changes, and extreme weather. Meanwhile, secondary barriers (moderate importance) range from lack of financial transparency (C4) at rank 14 to owner payment delays (B3) at rank 25. These findings indicate that while internal quality issues, miscommunication, and supply chain constraints require immediate attention, secondary issues still demand close monitoring to keep PT. X's projects on track.

Discussion and Research Contributions

The results of this comprehensive field data analysis successfully addressed the primary research objective by precisely mapping the various key operational obstacles that significantly impact road construction performance at PT. X. Through an in-depth and structured identification

process, this analysis was able to break down the various complex constraints that have long hindered the smooth execution of field operations, while also providing a strong theoretical and practical foundation for improving and optimizing project management in the future (Puteri et al., 2021).

In terms of addressing gaps in quality management, the identification of suboptimal internal quality management systems (A5) as the primary obstacle is consistent with and substantially expands the scope of previous literature. Although previous studies have tended to emphasize disruptions caused by external factors, the results of this analysis successfully fill a gap in the research by demonstrating that weaknesses in internal oversight such as the infrequent conduct of periodic quality inspections lead to rework, which is a critical driver of cost and schedule deviations in road construction projects (Widiasanti et al., 2024). Thus, this study successfully bridges the research gap previously identified by earlier researchers such as Wahyudi, which strongly reinforces the argument that the implementation of internal procedural controls is vital to maintaining stability and ensuring the success of project execution.

Meanwhile, regarding the challenges related to coordination and the supply chain, the high ranking of issues caused by coordination among parties (A4) and limitations in material supply and logistics (F5) as exemplified by the delay in the delivery of U-ditch materials from the fabrication contractor strongly supports and reinforces the findings of Rafki as well as Puteri regarding the vulnerability of infrastructure projects to logistical disruptions and poor communication among stakeholders (Rafki et al., 2024). Furthermore, this phenomenon clearly demonstrates that the smooth completion of a project does not depend solely on the technical aspects of on-site construction, but is also heavily determined by the effectiveness of cross-sectoral coordination and the precision of a sustainable material supply chain management system.

CONCLUSION

Based on the RII analysis of 28 respondents at PT. X, this study successfully identified three main factors that constitute the dominant operational constraints in road construction projects (Rasa & Handayani, 2023). The factor ranked first is the suboptimal internal quality management system (A5) with an RII score of 0,700, which triggers project deviations. This is followed by the lack of coordination among parties in quality control (A4) with an RII of 0,686, which highlights the need for closer communication between the project owner, contractor, and supervising consultant, as well as limited material and logistics supply (F5) with an RII of 0,679 due to delivery obstacles such as prefabricated U-ditch materials and field distribution disruptions (Faustine & Waty, 2022). As a concrete follow-up to these findings, a structured risk mitigation and control strategy has been formulated to ensure that future project implementation is managed effectively and efficiently. These strategic steps include conducting periodic internal quality audits, appointing dedicated Quality Control personnel, holding weekly coordination meetings, and implementing supplier diversification.

Although this study provides valuable insights, several limitations must be acknowledged. This study only involved 28 respondents out of a total population of 30 project personnel at PT. X, and although this represents 93,3% of the population, the small sample size limits the generalizability of the findings to other companies or regions. The study was also conducted exclusively on a road construction project in Sidoarjo, East Java, so the findings may not directly apply to projects in other regions with different environmental, regulatory, or socio-economic conditions. In addition, this study relied solely on the Relative Importance Index (RII) method for ranking factors, and although RII is effective for identifying dominant factors, this method does not capture complex relationships between variables or predict their combined impact on project performance. Finally, data collection was conducted during a specific period (2025-2026), and the findings may not reflect long-term trends or future changes in project management practices.

Based on the findings and limitations of this study, several suggestions are proposed for future research. Future studies should involve more respondents from multiple companies and various regions to improve the generalizability of findings, where a minimum sample size of 100-

200 respondents would enable stronger statistical analysis. Future researchers are also advised to use more sophisticated analytical techniques such as the Analytical Hierarchy Process (AHP) for more precise weighting and prioritization of factors through pairwise comparison, Structural Equation Modeling (SEM) to analyze the complex relationships among various factors and their combined impact on project performance, as well as Regression Analysis to develop predictive models that quantify the influence of each factor on cost, time, and quality outcomes. Future research needs to expand the geographic scope to road construction projects in various regions across Indonesia to enable comparative analysis and identification of region-specific factors. Subsequent studies could also examine other potential factors not covered in this research, such as occupational health and safety (K3), environmental sustainability, digital technology adoption (e.g., Building Information Modeling/BIM), and stakeholder management practices. Finally, a longitudinal approach that tracks project performance over several years would provide insights into long-term trends and the effectiveness of implemented control strategies.

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