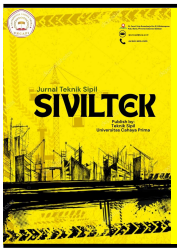

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Dominant Factors Causing Construction Project Delays in Indonesia and Their Mitigation Strategies: A Literature Review

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ABSTRACT

Construction project delays remain a persistent issue in Indonesia, resulting in cost overruns, reduced productivity, and disruption of the intended economic benefits of projects. The increasing complexity of national infrastructure development over the past decade has further intensified challenges related to schedule control. This study aims to identify the dominant factors contributing to construction project delays in Indonesia, classify them into principal dimensions, and formulate mitigation strategies based on a synthesis of the literature. This research employs a qualitative approach using a narrative literature review method, synthesizing approximately ten key national and international studies published between 1997 and 2025. The analysis was conducted through thematic categorization to map causal factors into technical, managerial, financial, and external dimensions. The findings indicate that design changes, weak schedule control, delayed payments, as well as weather-related and regulatory factors constitute the dominant causes of project delays in Indonesia. Effective mitigation strategies include comprehensive technical planning, early-stage implementation of risk management, strengthened coordination among stakeholders, cash flow stability, and anticipation of external risks through contingency planning. The main contribution of this study lies in the development of an integrated conceptual framework linking dominant delay factors with corresponding mitigation strategies, providing a conceptual foundation for improving construction project management practices and enhancing time performance in Indonesian infrastructure projects.

INTRODUCTION

The construction sector plays a strategic role in supporting national development, particularly in the provision of public infrastructure, economic facilities, and social service amenities. Over the past decade, the Government of Indonesia has accelerated infrastructure development through numerous National Strategic Projects, including toll roads, dams, ports, airports, and other public facilities. This surge in infrastructure investment has significantly increased the complexity of construction project management from technical, managerial, and administrative perspectives (BPS, 2023; Ministry of Public Works and

Housing, 2022). Such complexity necessitates more effective project management systems to ensure that time, cost, and quality objectives are achieved optimally. Nevertheless, project delay remains a dominant issue, frequently resulting in cost overruns, decreased labor productivity, and disruption of the anticipated economic and social benefits of planned projects.

Globally, construction project delays have long been recognized as one of the principal challenges in project management. Classical studies indicate that delays are commonly associated with deficiencies in initial planning, weak schedule control, and ineffective coordination among project stakeholders (Odeh & Battaineh, 2002; Assaf & Al-Hejji, 2006). Sambasivan and Soon (2007) categorized delay factors into internal and external dimensions, including design changes, financial difficulties, shortages of skilled labor, and communication barriers. Doloi et al. (2012) further emphasized that inadequate project management and ambiguity in project scope constitute dominant factors directly affecting time performance. Within the Southeast Asian context, Haseeb et al. (2011) demonstrated that bureaucratic complexity, contractor cash flow instability, and external influences such as regulatory and socio-political conditions significantly increase the risk of delays. More recent studies also highlight that planning inefficiencies, stakeholder coordination, and risk management practices remain critical determinants influencing construction project delays in many countries (Aldammak et al., 2025; Nyaga Githae et al., 2024)).

In Indonesia, research on project delays has been conducted since the late 1990s. Kaming et al. (1997) identified delayed payments and design changes as primary causes of building project delays in Jakarta. Subsequently, Wiguna and Scott (2006) underscored the importance of risk management in anticipating potential delays from the planning stage. More recent studies indicate that unrealistic planning, ineffective coordination, and regulatory and weather-related dynamics consistently affect project duration (Santoso & Soeng, 2016; Marzouk & El-Rasas, 2014; Jamal & Ian, 2025) . Indonesia's geographical condition as a tropical country with high rainfall intensity, coupled with administrative complexities in project permitting processes, also represents significant external risk factors that cannot be overlooked. Recent systematic literature reviews also emphasize that risk management and project governance play an important role in improving time and cost performance in large-scale infrastructure projects (Zhasmukhambetova et al., 2025).

From a theoretical standpoint, project management emphasizes control over three primary dimensions commonly referred to as the triple constraint: time, cost, and quality (PMI, 2021). These dimensions are interdependent and mutually influential. Time delays almost invariably lead to cost escalation due to extended resource utilization, material price increases, and additional indirect costs. Moreover, schedule compression resulting from delays often adversely affects work quality due to unplanned acceleration measures. Therefore, project delay is not merely a scheduling issue but a systemic problem within construction project governance.

Although numerous studies have examined project delays in Indonesia, most are based on surveys or case studies limited to specific projects or regions, rendering their findings partial and context-specific. There remains a lack of systematic literature synthesis to identify nationally dominant factors and integrate them with relevant mitigation

strategies. Furthermore, previous research has generally focused on identifying causal factors without comprehensively linking them to risk-based mitigation approaches and contemporary project management practices. This gap highlights the need for an integrated narrative review within the national construction management literature.

Accordingly, this study seeks to comprehensively identify the dominant factors contributing to construction project delays in Indonesia as documented in the scientific literature, classify these factors into technical, managerial, financial, and external dimensions, and formulate effective mitigation strategies based on a synthesis of prior findings. Through this approach, the research not only summarizes previous studies but also develops a conceptual framework that connects causal factors and control strategies within a unified analytical system.

The novelty of this study lies in the formulation of an integrated framework linking dominant delay factors and their corresponding mitigation strategies within the Indonesian context in a comprehensive manner. This framework is expected to provide a conceptual contribution to the advancement of construction project management practices that are more adaptive, systematic, and performance-oriented in improving time performance in future projects.

METHOD

This study employed a qualitative approach using a narrative literature review method to identify and synthesize the dominant factors causing construction project delays in Indonesia and their corresponding mitigation strategies. This approach was selected because the research aims to construct a comprehensive conceptual understanding based on prior studies without conducting direct field data collection. A narrative review enables the exploration of thematic developments, the integration of cross-study findings, and the examination of relationships between causal factors and control strategies within a systematic analytical framework (Snyder, 2019).

The literature search was conducted up to December 2025 through national and international scientific databases, including Scopus, ScienceDirect, Google Scholar, as well as the Garuda and SINTA portals for accredited national journals. The keywords used comprised combinations of English and Indonesian terms, such as “construction delay,” “project delay Indonesia,” “keterlambatan proyek konstruksi,” “delay factors,” “construction project management,” and “delay mitigation strategy.” Boolean operators (AND, OR) were applied to systematically broaden and refine the search results, as recommended in structured literature review procedures (Kitchenham, 2004).

The reviewed literature was limited to publications from 1997 to 2025 in order to capture the historical development of project delay research in Indonesia, from early foundational studies to recent findings. The inclusion criteria consisted of: (1) nationally and internationally indexed journal articles explicitly addressing causes of construction project delays; (2) studies identifying delay mitigation or control strategies; (3) relevant project management references and standards, such as the PMBOK Guide (PMI, 2021); and (4) publications in Indonesian and English. Popular articles, non-scientific reports, and publications not directly related to project time management were excluded from the

selection process.

The literature selection process was conducted in three stages: initial identification based on keywords, screening of titles and abstracts, and full-text review to ensure alignment with the research objectives. After applying these selection procedures, a total of 10 primary empirical studies were included in the core analysis, while additional references were used to support theoretical and contextual discussions. Eligible sources were analyzed to identify thematic patterns and consistency of findings across studies. This procedure was intended to ensure that the resulting synthesis was grounded in relevant and credible sources.

Data analysis was conducted using thematic analysis by categorizing delay factors into four principal dimensions: technical, managerial, financial, and external (Thomas & Harden, 2008). Each of the selected studies contributed to one or more of these analytical dimensions depending on the delay factors discussed in the respective research findings. Technical factors included issues such as design changes and planning inaccuracies, managerial factors involved coordination and project control problems, financial factors referred to payment delays and cash flow issues, while external factors covered weather conditions, regulatory dynamics, and administrative constraints. In addition, mitigation strategies proposed in the literature were examined to assess the alignment between identified causal factors and corresponding control approaches. This process facilitated the development of an integrated conceptual framework linking dominant delay factors with relevant mitigation strategies within the Indonesian context.

To enhance the credibility of the review, source triangulation was performed by comparing findings from national and international studies and examining the consistency of identified patterns. Interpretation was conducted reflectively and analytically to ensure that the conclusions drawn were not merely descriptive but also contributed conceptually to the advancement of construction project management in Indonesia.

Through this methodology, the study is expected to produce a comprehensive literature synthesis on the dominant causes of construction project delays and their mitigation strategies, thereby providing a foundation for the development of more effective and adaptive project management practices in the future.

RESULT AND DISCUSSION

Based on the synthesis of national and international studies published between 1997 and 2025, construction project delays in Indonesia constitute a multidimensional problem influenced by a combination of internal and external factors. The literature indicates that no single factor serves as an absolutely dominant cause; rather, the interaction among multiple factors amplifies the risk of delay (Sambasivan & Soon, 2007; Doloi et al., 2012). In the Indonesian context, regulatory dynamics, bureaucratic characteristics, and geographical conditions further intensify the complexity of project time control (Santoso & Soeng, 2016; Ministry of Public Works and Housing, 2022).

Table 1 presents a synthesis of dominant delay factors identified in the reviewed studies and the corresponding mitigation strategies.

Table 1. Summary of Dominant Delay Factors and Mitigation Strategies

Dimension	Dominant Delay Factors	Supporting Studies	Proposed Mitigation Strategies
Technical	Design changes, incomplete drawings, planning errors, inaccurate time estimation	Kaming et al. (1997); Assaf & Al-Hejji (2006); Sambasivan & Soon (2007); Doloi et al. (2012)	Detailed design planning, early design validation, improved technical coordination
Managerial	Poor coordination among stakeholders, weak supervision, ineffective project control, unrealistic scheduling	Odeh & Battaineh (2002); Wiguna & Scott (2006); Haseeb et al. (2011); PMI (2021)	Strengthened project monitoring, integrated scheduling systems, improved stakeholder coordination
Financial	Delayed payments, contractor cash flow problems, financial management issues	Kaming et al. (1997); Assaf & Al-Hejji (2006); Doloi et al. (2012)	Transparent payment systems, financial risk planning, milestone-based payment systems
External	Weather conditions, regulatory approval delays, bureaucratic processes	Marzouk & El-Rasas (2014); Santoso & Soeng (2016); Ministry of Public Works and Housing (2022)	Contingency planning, regulatory coordination, adaptive scheduling

The thematic analysis categorizes delay factors into four principal dimensions: technical, managerial, financial, and external. These dimensions interact and collectively influence overall project time performance.

Technical Dimension

Technical factors represent one of the primary causes of construction project delays. The literature consistently identifies design changes during project execution as a recurring dominant factor (Assaf & Al-Hejji, 2006; Sambasivan & Soon, 2007). In Indonesia, previous studies reported that revisions to working drawings and unclear technical specifications frequently result in rework and extended project duration (Kaming et al. 1997; Jamal & Ian, 2025) .

Beyond design changes, inaccurate time estimation and insufficient detail in early-stage planning significantly contribute to delays (Doloi et al., 2012). Overly optimistic duration estimates that fail to incorporate field risks often lead to unrealistic project schedules. In practice, delays in material procurement and shortages of skilled labor further exacerbate technical challenges.

The analysis suggests that technical factors are often consequences of weak planning and insufficient design validation at the project's initial stage. Therefore, the quality of technical planning constitutes a fundamental basis for effective schedule control.

Managerial Dimension

The managerial dimension encompasses weak schedule control, inadequate coordination among stakeholders, and limited implementation of risk management practices. Odeh and Battaineh (2002) demonstrated that ineffective communication between project owners and contractors significantly contributes to delays. Wiguna and Scott (2006) further emphasized that projects characterized by weak risk management exhibit a higher probability of delay.

Within the triple constraint framework, failure to control time performance reflects deficiencies in core project management functions (PMI, 2021). Insufficient progress monitoring, delayed decision-making, and unstructured coordination processes render schedule deviations increasingly difficult to control (Syahputra et al., 2025). Similar findings have also been reported in studies on integrated information systems, which indicate that limitations in human resources, technological infrastructure, and coordination mechanisms can significantly affect organizational effectiveness and operational performance (Syahputra

et al., 2025) . Insufficient progress monitoring, delayed decision-making, and unstructured coordination processes render schedule deviations increasingly difficult to control. Haseeb et al. (2011) also found that ineffective project leadership directly affects time performance.

In Indonesia, administrative complexity and inter-agency coordination often prolong approval processes for work variations, thereby increasing the likelihood of delay.

Financial Dimension

Financial factors constitute a critical dimension affecting project continuity. Assaf and Al-Hejji (2006), as well as Kaming et al. (1997), identified delayed payments as a dominant cause of construction project delays. Contractor cash flow instability disrupts material procurement and labor payments, thereby hindering project progress.

In addition, fluctuations in construction material prices and cost escalation during project implementation can affect work duration (Doloi et al., 2012). In government-funded projects, lengthy administrative procedures for fund disbursement frequently slow contractors' cash flow. These findings indicate that financial stability is essential for maintaining project schedule performance.

External Dimension

External factors include weather conditions, regulatory changes, land acquisition conflicts, and socio-political dynamics. Marzouk and El-Rasas (2014) demonstrated that extreme weather conditions significantly disrupt construction schedules. In Indonesia, high rainfall intensity and exposure to natural hazards increase uncertainty in project duration.

Regulatory changes and lengthy permitting processes are also frequently reported in national studies. Bureaucratic complexity extends administrative approval timelines and directly affects project schedules.

These external factors are often beyond the direct control of project management, necessitating mitigation approaches grounded in risk management and contingency planning.

Comparative Analytical Discussion

Although technical factors such as design revisions and incomplete drawings were consistently identified across several studies, some research emphasizes managerial issues as the more dominant contributors to project delays. For instance, while early studies highlighted design-related problems as primary causes, more recent findings indicate that weak coordination and ineffective project control systems often exacerbate technical shortcomings. This suggests that technical problems may not operate independently but are frequently intensified by managerial deficiencies.

Similarly, financial factors such as delayed payments were strongly emphasized in earlier Indonesian studies, particularly in projects involving public funding. However, more recent literature points toward integrated risk management and governance mechanisms as critical in preventing financial disruptions from escalating into prolonged delays. This shift reflects an evolution in project management practices from reactive problem-solving toward proactive risk mitigation.

External factors, especially regulatory and bureaucratic processes, appear consistently across studies, indicating structural challenges within the national construction environment.

Unlike technical or managerial factors, which can be internally controlled, external risks require adaptive planning and stronger institutional coordination.

Integrated Mitigation Strategies

The literature synthesis indicates that mitigation strategies must be implemented integratively rather than in isolation. Within the technical dimension, comprehensive design planning, thorough document validation prior to construction, and systematic control of design changes are essential (Doloi et al., 2012). In the managerial dimension, early-stage risk management implementation, strengthened stakeholder communication, and the use of schedule control software represent key strategies (PMI, 2021).

From a financial perspective, transparent payment systems and effective cash flow management are crucial for maintaining project stability. Meanwhile, in addressing external factors, the allocation of buffer time, weather risk analysis, and proactive anticipation of regulatory changes constitute strategic measures.

Overall, construction project delays in Indonesia represent a systemic issue requiring an integrated management approach. The alignment of comprehensive technical planning, effective project governance, financial stability, and proactive external risk management is fundamental to sustainably improving project time performance.

CONCLUSION

Construction project delays in Indonesia are driven by the interaction of four principal dimensions: technical, managerial, financial, and external factors. The literature consistently highlights design changes and inadequate planning, weak coordination and schedule control, delayed payments and cash flow instability, as well as regulatory and environmental uncertainties as dominant contributors. These findings confirm that project delays are systemic rather than caused by isolated issues.

The study demonstrates that improving project time performance requires an integrated management approach. Strengthening early-stage design validation, enhancing schedule monitoring and stakeholder coordination, ensuring financial transparency, and implementing proactive risk and contingency planning are essential measures to mitigate delays effectively.

Conceptually, this study develops an integrated framework linking delay factors with corresponding mitigation strategies. Practically, the findings provide guidance for project owners, contractors, and policymakers in Indonesia to adopt more structured, risk-based, and adaptive project management practices aimed at improving construction schedule performance.

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