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Delays in Construction Projects: Causes, Effects, and Mitigation — A Thematic Literature Review

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Abstract - Construction project delays remain one of the most persistent problems confronting owners, contractors, and consultants worldwide. This literature review synthesizes findings from ten selected studies (1987–2023) to develop a coherent picture of the principal causes of delay, their effects on cost and quality, the interrelationship between delays and conflicts, and current mitigation strategies. Using a thematic synthesis approach, the review identifies recurring drivers — design changes, poor communication, financial constraints, contractor capability, and supply-chain issues — and highlights promising mitigation measures including improved early-stage planning, enhanced supervision, integrated stakeholder coordination, and quantitative modelling tools. The review concludes with gaps in the literature and directions for future research.

Key Words: Construction Delay, Causes, Mitigation Strategies, Schedule Management, Stakeholder Coordination, Critical chain, DEMATEL, System Dynamics

1. INTRODUCTION

Timely completion of construction works is a core performance indicator for project success. Beyond schedule, delays impact cost, quality, stakeholder relationships, and the economic viability of projects. The studies selected for this review span empirical surveys, methodological contributions, modelling studies, and thematic reviews from diverse geographic contexts. Together they provide both breadth and depth: classic theoretical treatments of concurrent delays and contemporary empirical analyses that leverage quantitative ranking methods and systems modelling. This review integrates these contributions to offer practitioners and researchers an organized understanding of what causes delays, how delays interact with conflicts and other project outcomes, and which mitigation approaches show empirical or conceptual promise.

2. Methodology of Review

This review applies to a qualitative thematic synthesis methodology based on the following steps:

The methodology adopted for this literature review follows a structured, qualitative, and analytically rigorous approach designed to synthesise research spanning more than three decades. To ensure depth, clarity, and academic robustness, the review process was conducted through multiple sequential stages, each contributing a distinct layer of analytical value (Figure 1).

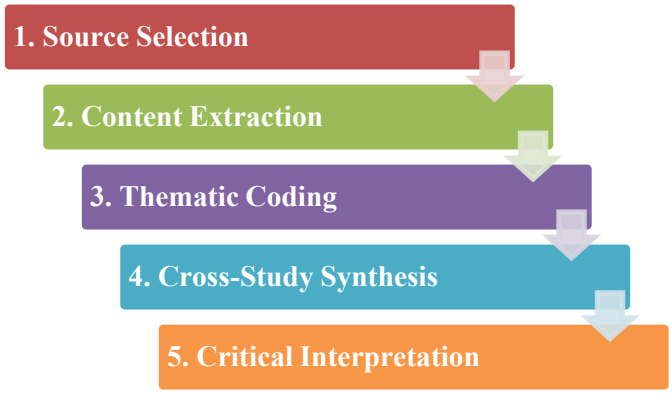

Fig. 1: Flowchart - Methodology of Review

2.1 Selection of Sources

A targeted selection strategy was applied to identify ten foundational and contemporary studies published between 1987 and 2023. The inclusion criteria focused on research relevance, methodological diversity (empirical, simulation-based, jurisprudential, and review-based), geographic variation, and influence within the field of construction delay research. Priority was given to peer-reviewed studies that offered substantial contributions to

understanding delay causation, effects, conflict dynamics, contractor-related issues, and mitigation strategies.

2.2 Systematic Content Extraction

Each selected study was examined in detail to extract information on delay causes, classification frameworks, modelling approaches, effects on project outcomes, and recommended mitigation measures. Extraction also captured the methodological foundations—such as DEMATEL, system dynamics, RII, CCPM, and concurrent delay frameworks—to provide insight into how different analytical tools shape research outcomes.

2.3 Thematic Coding and Categorisation

Using qualitative coding techniques, extracted content was grouped into coherent thematic clusters. These clusters included design-phase deficiencies, communication challenges, financial constraints, contractor capability, supervision quality, supply-chain reliability, planning and scheduling weaknesses, and legal/contractual considerations. Coding enabled identification of patterns, interrelationships, and recurring insights across diverse studies.

2.4 Cross-Comparative Synthesis

A cross-study comparison was then performed to identify convergences and divergences in findings. This step enabled the detection of systemic themes, contextual variations (e.g., region-specific challenges), and methodological complementarities. The comparison also provided clarity on which delay factors consistently rank high across literature and which factors tend to be context dependent.

2.5 Integrative Interpretation and Critical Evaluation

The final stage involved synthesising patterns into a cohesive narrative supported by critical interpretation. Here, each study's contributions were evaluated for robustness, practical relevance, limitations, and applicability to broader construction management theory. Special emphasis was placed on understanding how methodological approaches influence findings—for example, how simulation-based models reveal factor interactions that surveys alone cannot capture.

By following these structured steps, the review ensures methodological transparency, academic coherence, and a comprehensive understanding of construction delay research. This approach moves beyond summary to deliver a richly integrated and analytically grounded literature synthesis.

3. Thematic Findings

3.1. Principal Causes of Delay

Across the reviewed literature, several causes recur persistently:

a) Design-related issues and frequent design changes. Multiple authors identify design changes — both those originating in early-stage design errors and those requested by owners during construction — as a leading cause of delay (Lokeshwaram & Bharath, 2023; Ajayi & Chinda, 2022; Chibuikem, 2018). Ajayi & Chinda (2022) particularly emphasise that design phase mistakes initiate cascading effects that magnify later in execution.

b) Poor communication and weak stakeholder coordination. Studies consistently point to communication breakdowns and adversarial relationships as catalysts for both delays and conflict (Tariq & Gardezi, 2023; Lokeshwaram & Bharath, 2023; Kamandang et al., 2018). Where coordination and transparency are strong, projects tend to meet schedules more reliably.

c) Financial problems and payment delays. Owner-side funding constraints, slow payments to contractors, and inadequate cash flow planning feature prominently in the empirical rankings (Ojoko et al., 2016; Tariq & Gardezi, 2023; Kamandang et al., 2018). Financial stress impacts labour retention, procurement, and contractor capacity to mobilise resources promptly.

d) Contractor capability and supervision. Poor site supervision, inexperienced contractors, and lack of skilled labour are repeatedly flagged as critical factors that degrade productivity and extend schedules (Frimpong et al., 2011; Ojoko et al., 2016).

e) Material and supply-chain issues. Late deliveries, material shortages, and broader supply-chain disruptions appear across contexts as both direct causes and amplifiers of delay (Lokeshwaram & Bharath, 2023; Ojoko et al., 2016).

f) Planning and scheduling weaknesses. Inadequate planning, unrealistic schedules, and failure to anticipate risks are common precursors to delays (Kamandang & Casita, 2018; Ghaffari & Emsley, 2015).

3.2. Effects of Delay

The reviewed studies show that delay effects are multi-faceted (Figure 2) :

a) Cost overruns — Delays increase direct costs (prolonged site overheads, labour escalation) and indirect costs (penalties, financing costs). Chibuikem (2018) and Ojoko et al. (2016) document explicit links between schedule slippage and budget growth.

Fig.2 : Effects of Delay

b) Quality and rework — Time pressure caused by previous delays can degrade workmanship, increase rework and undermining final quality (Ajayi & Chinda, 2022).

c) Contractual disputes and conflicts — Tariq & Gardezi (2023) and Kraiem & Diekmann (1987) discuss how delays escalate into disputes, particularly when multiple concurrent delays complicate responsibility attribution.

d) Project abandonment and reputational damage — Severe delays can threaten project continuation or damage the reputations of contractors and clients, affecting future opportunities (Kamandang & Casita, 2018).

3.3. Interrelationship between Delays and Conflicts

Tariq & Gardezi (2023) explicitly explore the mutual reinforcement between delays and conflicts. Their synthesis suggests overlapping root causes — financial issues, design changes, and poor stakeholder relations — which both produce delays and trigger disputes. The implication is that interventions addressing these overlapping drivers can reduce both schedule slippage and conflict incidence.

3.4. Modelling and Analytical Approaches to Understanding Delays

Several studies employ quantitative or systems approaches that offer richer diagnostic or predictive power:

a) DEMATEL and system dynamics. Ajayi & Chinda (2022) combine DEMATEL to identify causal interrelations among delay factors and system dynamics to simulate their temporal impact. This combination highlights leverage points (e.g., design quality, change order management) where interventions can produce outsized benefits.

b) Relative Importance Index (RII). Kamandang et al. (2018) apply RII to rank causes in a local context — an approach useful for prioritising managerial attention.

c) Jenks natural breaks classification. Tariq & Gardezi (2023) use this statistical classification to group causes and reveal clusters of factors shared between delays and conflicts, aiding targeted policy responses.

d) Critical Chain and Theory of Constraints. Ghaffari & Emsley (2015) examine CCPM as an alternative scheduling philosophy, identifying conceptual benefits but practical barriers to adoption in construction settings.

e) Concurrent delay analysis. Kraiem & Diekmann (1987) provide frameworks for apportioning responsibility where multiple delays overlap — a contribution with direct legal and contractual relevance.

3.5. Mitigation Strategies Reported

The literature proposes a variety of mitigation measures, which can be grouped into proactive (planning, design) and reactive (monitoring, dispute resolution) categories:

a) Early-stage improvements. Strengthening design processes, using experienced designers, and applying design-quality control reduce downstream changes (Ajayi & Chinda, 2022; Chibuikem, 2018).

b) Enhanced planning and risk forecasting. Detailed scheduling, realistic buffers, and scenario analysis help projects absorb shocks without cascading delays (Lokeshwaram & Bharath, 2023; Ghaffari & Emsley, 2015).

c) Stakeholder integration and communication. Shared project goals, transparent communication channels, and collaborative decision-making reduce misunderstandings and align incentives (Lokeshwaram & Bharath, 2023; Frimpong et al., 2011).

d) Contractual and financial safeguards. Timely payments, clearer contract terms for change management, and incentives for on-time performance address financial root causes (Ojoko et al., 2016).

e) Analytical and simulation tools. DEMATEL–system dynamics models and RII-based prioritisation allow managers to focus limited resources on high-impact issues (Ajayi & Chinda, 2022; Kamandang et al., 2018).

f) Supervision and capacity building. Improved site supervision, contractor selection based on capability, and on-site training raise productivity and reduce errors (Frimpong et al., 2011; Ojoko et al., 2016).

4. Discussion

The reviewed literature demonstrates strong consensus on certain causal themes (design changes, poor communication, financial problems, contractor capability). Nonetheless, the field shows methodological diversity: survey-based ranking studies identify perceptions and frequency of causes; modelling studies expose dynamic mechanisms and potential leverage points; and legal/forensic contributions deal with apportioning responsibility. Combining these perspectives yields practical insights: addressing early-stage design quality and strengthening stakeholder communication are likely to be high-return interventions, while advanced modelling tools can be used for diagnostics and scenario planning.

The synthesis of findings across the reviewed literature demonstrates that construction delays emerge from a complex interplay of technical, managerial, financial, behavioural, and external factors. Rather than functioning independently, these factors frequently interact in ways that amplify their individual impacts, creating compounding effects on schedule performance. This multifaceted nature of delays underscores the importance of interpreting them not as isolated project events but as systemic outcomes of broader organisational and industry dynamics.

One prominent theme across studies is the interdependence between early-stage planning and downstream project performance. Poor front-end planning—manifested through unclear scope definitions, incomplete designs, and unrealistic scheduling—creates vulnerabilities that propagate throughout the construction lifecycle. Ajayi and Chinda (2022) demonstrate through system-dynamics modelling that early errors or oversights trigger ripple effects that intensify during execution. This highlights that mitigation strategies are most effective when implemented at the project's inception rather than during crisis-driven responses.

Another insight concerns the central role of communication in shaping project outcomes. Communication failures were identified not only as direct contributors to delays but also as catalysts that exacerbate other issues such as rework, design misinterpretation, labour inefficiencies, and conflicts. Studies such as those by Tariq and Gardezi (2023) show that weak communication pathways magnify the impact of financial and managerial shortcomings, suggesting that improving communication can have a multiplier effect in reducing several delay categories simultaneously.

The literature also emphasises the critical influence of financial and cash-flow stability. Owner-side payment delays constrain contractor performance, reduce labour retention, and impede timely procurement—all of which slow progress on critical path activities. Financial uncertainty interacts with material price fluctuations and supply-chain instability, revealing that economic conditions exert both direct and indirect pressure on project schedules.

Contractor capability, supervision quality, and workforce productivity also emerge as significant determinants of timely completion. Weak supervision and inadequate labour skills not only prolong activity durations but also increase error rates and accidents, which in turn cause additional delays. This aligns with findings by Frimpong et al. (2011) and Ojoko et al. (2016), who indicate that managerial inefficiencies often outweigh technical constraints.

Another pattern observed is the difference in how various research methodologies frame delay causation. Survey-based and RII-based studies tend to highlight immediate, experience-based issues such as material shortages, labour inefficiency, or payment delays. In contrast, modelling-oriented studies such as system dynamics or DEMATEL focus on causal interrelationships, revealing deeper structural issues like

design-stage weaknesses or delayed managerial decision cycles. Legal analyses, such as those by Kraiem and Diekmann (1987), further expand the discussion by demonstrating how contractual frameworks influence delay assessment, responsibility allocation, and dispute outcomes.

Together, these methodological perspectives provide a more holistic understanding of delays: while some factors are operational and visible, others are embedded within structural, organisational, or contractual systems. This highlights the need for integrated mitigation strategies that combine planning accuracy, communication enhancement, financial governance, skilled supervision, and data-driven decision support tools.

5. Gaps and Directions for Future Research

Several gaps emerge from the synthesis:

i. Contextual comparative studies. Many empirical studies are geographically focused. Comparative research across regulatory, economic, and supply-chain contexts would clarify how transferable mitigation strategies are.

ii. Integration of digital construction tools. While authors discuss design quality and planning, few studies systematically evaluate the impact of BIM, digital supply-chain platforms, or real-time monitoring on delay incidence.

iii. Behavioral and contractual incentive research. More work is needed to test which contractual forms and behavioural nudges successfully align owner–contractor incentives to reduce change orders and disputes.

iv. Data-driven concurrent-delay forensic techniques. Advances in project data capture (schedules, daily reports, IoT) create an opportunity to refine concurrent-delay analysis and apportionment methods.

v. Longitudinal impact evaluations. Few studies track the long-term effects of mitigation policies across multiple projects to assess persistence of benefits.

6. Conclusion

The collective body of literature reviewed in this study makes it clear that construction delays are not isolated operational issues, but rather manifestations of deeper systemic weaknesses embedded within project planning, organisational structures, stakeholder relationships, and external environmental influences. Across regions and project types, delay causation consistently converges around several dominant themes: early-stage design deficiencies, fragmented communication networks, unstable financial flows, limited contractor capacity, labour and supervision challenges, and unpredictable supply-chain dynamics. These recurring patterns underline that improving schedule performance requires strategic interventions rather than reactive fixes.

A key insight emerging from the review is the significance of front-end project preparation. High-quality design development, accurate scheduling, risk anticipation, and complete documentation serve as cornerstones for avoiding downstream disruptions. Studies using modelling frameworks such as DEMATEL and system dynamics reiterate that early errors magnify over time, demonstrating the long-term value of investing in capable design teams, digital design verification, and structured planning reviews.

Furthermore, literature places strong emphasis on the human and relational dimensions of construction management. Weak communication, inadequate coordination, and inconsistent decision-making are found to escalate smaller issues into schedule-critical disruptions. These behavioural and managerial shortcomings often outweigh technical obstacles, suggesting that collaborative work cultures, transparent communication systems, and timely managerial responses are indispensable for delay mitigation.

Financial stability also emerges as a foundational requirement for timely project completion. When owner-side payments are delayed, contractors face material shortages, labour retention issues, and cash-flow constraints that directly impede progress. Strengthening financial governance, enforcing contractual payment schedules, and adopting contingency budgeting can reduce these risks.

The review further highlights that although analytical tools such as RII, CCPM, and concurrent delay frameworks provide valuable insights, real-world implementation remains limited by organisational resistance, rigid project structures, skill gaps, and inadequate digital adoption. Bridging this gap between theory and practice requires capacity building, digital transformation, and stronger data-driven decision-making environments.

In conclusion, achieving timely construction project delivery demands a comprehensive and integrated approach that strengthens design accuracy, enhances communication and stakeholder cohesion, stabilizes financial processes, and embraces modelling-based and digital tools for proactive decision-support. Addressing the identified research gaps—especially the need for digital monitoring technologies, cross-regional comparisons, behavioural studies, and longitudinal evidence—will pave the way for more resilient, predictable, and efficient construction project ecosystems in the future.

REFERENCES

1. Ajayi, B. O., & Chinda, T. (2022). Impact of construction delay controlling parameters on project schedule: DEMATEL–system dynamics modeling approach.
2. Chibuikem, I. F. (2018). A study of delays and cost overruns in construction projects.
3. Frimpong, S., Oluwuyide, O., & Alwi, S. (2011). Influence of supervision on labour productivity on construction sites.
4. Ghaffari, M., & Emsley, M. W. (2015). Research on critical chain project management.
5. Kamandang, Z. R., & Casita, M. (2018). Delays in construction project.
6. Kamandang, Z. R., Yang, J.-B., & Wijatmiko, I. (2018). An empirical study on analyzing schedule delays of construction project in Indonesia.
7. Kraiem, Z. M., & Diekmann, J. E. (1987). Concurrent delays in construction projects.
8. Lokeshwaram, & Bharath, A. (2023). A literature review on developing causes and mitigation strategies of delay in construction projects.
9. Ojoko, E. O., Tanko, B. L., Jibrin, M., Ojoko, O., & Enegbuma, W. L. (2016). Project delay causes and effects in the construction industry.
10. Baldonado, M., Chang, C.-C.K., Gravano, L., Paepcke, A.: The Stanford Digital Library Metadata Architecture. Int. J. Digit. Libr. 1 (1997) 108–121