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Prolongation Cost Claim in Extension of Time (EOT) Under Construction Contracts: A Comparative Framework for Effective Evaluation and Management in Saudi Arabia and India

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ABSTRACT: Construction projects are often delayed due to complex coordination, design revisions, and external uncertainties, resulting in claims for Extension of Time (EOT) and associated prolongation costs. These claims are among the most disputed in construction contract administration. This study develops a comparative and validated framework for evaluating prolongation cost claims under FIDIC-based contracts in Saudi Arabia and India, focusing on how delay analysis, cost quantification, and documentation interact in determining entitlement. A mixed-method approach was employed—combining literature review, expert interviews with eight industry professionals, and comparative case analysis. The findings reveal regional variations in claim substantiation practices and emphasize the importance of contemporaneous documentation, structured delay analysis, and transparent cost records. The proposed framework integrates time, cost, and evidence dimensions into a single evaluation model validated through expert consensus, offering a practical guide for equitable and defensible prolongation claims.

KEYWORDS: Extension of Time (EOT); Prolongation Cost; Delay Analysis; FIDIC Contracts; Comparative Study; Construction Claims; Project Management; Central Public Works Department(CPWD)

I. INTRODUCTION

Delays are an unavoidable feature of modern construction projects, often arising from coordination failures, late approvals, design changes, or unforeseen conditions. When these delays are excusable, the contractor may claim an Extension of Time (EOT) to avoid liquidated damages and, in some cases, claim prolongation costs to recover time-related expenses. However, substantiating prolongation cost claims remains one of the most contentious areas in contract management due to the challenges of proving causation, entitlement, and quantification.

In regions such as Saudi Arabia and India, the prevalence of large-scale infrastructure and public works projects amplifies the complexity of delay claims. While Saudi Arabia predominantly applies FIDIC 2017 Red Book conditions, Indian contracts often adapt CPWD and FIDIC 1999 variants. Both regions face challenges in delay documentation, notice compliance, and cost validation.

Studies (Alnuaimi & Mohsin, 2022; Braimah, 2013) show that over 30% of construction disputes globally are linked to EOT and associated costs. Despite abundant research on delay analysis techniques, few studies present a comparative framework validated through real expert input that bridges contractual theory with on-ground practice.

A major complicating factor in prolongation cost claims is concurrent delay, where both employer and contractor activities contribute to the overall delay. Determining compensation in such cases requires clear apportionment of responsibility, consistent with the Society of Construction Law (SCL) Delay and Disruption Protocol (2017). Many claims are rejected due to inadequate demonstration of concurrency or lack of evidence distinguishing excusable from



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non-excusable delays. Addressing concurrency is therefore essential to ensure that the prolongation cost framework proposed in this study remains contractually fair and technically defensible.

This paper fills the identified gaps by introducing a comprehensive model that integrates delay causation, entitlement verification, cost quantification, and concurrency assessment within a single evaluation framework tested across Saudi and Indian projects.

II. LITERATURE REVIEW

2.1 Extension of Time (EOT) Provisions

EOT clauses are fundamental to risk allocation under standard forms of construction contracts. The FIDIC 2017 Red Book, Clause 8.5, permits extensions for causes beyond the contractor's control, such as variations, late drawings, or force-majeure events. The purpose of an EOT is to adjust the completion date and relieve the contractor from liquidated damages; however, any associated costs are recoverable only through a separate prolongation-cost claim (FIDIC, 2017).

Regional contract conditions, such as the Central Public Works Department (CPWD) contract in India, adopt similar logic but often lack clarity on documentation and notice periods (Kumar & Srinivasan, 2024). Consequently, contractors must demonstrate entitlement through strict procedural compliance and contemporaneous records.

2.2 Prolongation Costs: Definition and Components

Prolongation costs represent additional time-related expenses incurred because the project continues beyond its original completion date (Pickavance, 2022). Typical cost heads include:

- Site overheads (supervision, utilities, security etc.)
- Head office overheads (administrative and indirect costs)
- Plant and equipment depreciation
- Financing charges and loss of opportunity

Quantifying these costs requires proof that the delay was both compensable and caused by the employer's actions. Failure to distinguish employer-caused from contractor-caused delays leads to rejection or partial awards (Brahmah & Ndekugri, 2023).

2.3 Delay Analysis Techniques

Several analytical methods are used to evaluate EOT and prolongation claims (SCL, 2017):

1. **As-Planned vs. As-Built Analysis:** Compares original and actual progress to identify delay periods.
2. **Impacted As-Planned:** Introduces delay events into the baseline schedule to simulate their effect.
3. **Time Impact Analysis (TIA):** Models the impact of each event contemporaneously, preferred under FIDIC contracts.
4. **Window Analysis:** Divides the schedule into periods for cumulative delay attribution.

Although each technique has merit, their reliability depends on the availability of contemporaneous data and consistent logic ties in the programme (Ghanem et al., 2023). In practice, TIA remains dominant in Saudi projects, whereas As-Planned vs As-Built is still common in India because of limited digital planning systems.

2.4 Concurrency in Delay Analysis

The issue of concurrent delay where employer and contractor responsible events overlap in time significantly influences entitlement to prolongation costs. According to the SCL Delay and Disruption Protocol (2017), concurrency should be analyzed using a "true concurrency" test that identifies the critical-path periods in which both parties' delays operate simultaneously.

The general principle, reaffirmed by Keane and Caletka (2020), is that contractors may receive time relief (EOT) but not necessarily cost compensation for periods of concurrency. In FIDIC-governed contracts, engineers are expected to perform a causation-apportionment exercise, assigning responsibility based on the extent to which each event affects the critical path (Latham & El-Adaway, 2023).



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Recent empirical studies (Al-Humaidi & Braimah, 2024) highlight that poor concurrency analysis is a leading reason for claim rejections in Gulf infrastructure projects. This underscores the need for frameworks—such as the one developed in this paper—that explicitly integrate concurrency assessment within prolongation-cost evaluation.

2.5 Previous Research on Prolongation Claims

Prior investigations (Alzahrani & Emsley, 2020; Doloi et al., 2022) emphasize that the majority of failed claims stem from inadequate record-keeping and the absence of structured analytical justification. While many models describe delay analysis or cost calculation separately, few integrate both aspects alongside documentary substantiation. Moreover, comparative studies between different contractual environments, such as the Gulf Cooperation Council (GCC) and the Indian subcontinent, remain limited. These gaps justify the need for a validated, region-specific framework that combines entitlement assessment, causation analysis (including concurrency), and quantification of prolongation costs.

III. METHODOLOGY

3.1 Research Design

This study adopts a mixed-method research approach that combines qualitative and quantitative elements to develop, refine, and validate a comprehensive framework for evaluating prolongation cost claims under FIDIC-based contracts. The design integrates:

1. Systematic literature review to establish theoretical foundations.
2. Comparative case analysis of two projects—one in Saudi Arabia and one in India—to identify contextual differences; and
3. Expert interviews to validate and refine the proposed evaluation framework.

This hybrid approach ensures both theoretical rigor and practical relevance, addressing the limitations of prior conceptual studies that lacked empirical grounding.

3.2 Data Collection

The Data were gathered from three main sources:

1. Documentary Review:

Contractual records, extension-of-time (EOT) submissions, cost claim registers, and correspondence from two projects were reviewed.

- Case A (Saudi Arabia): A public project governed by FIDIC 2017 Red Book.
- Case B (India): A mixed-use development executed under CPWD-based FIDIC 1999 conditions.

2. Expert Interviews:

Semi-structured interviews were conducted with eight industry professionals representing both regions. The participants included:

- 2 Senior Planning Managers (NEOM, KSA and L&T Construction, India)
- 2 Contract Administrators (MINT and MCC)
- 2 Project Managers
- 2 Delay Analysts (Independent Consultants from Riyadh and Mumbai)

Each interview lasted 60–90 minutes, focusing on three main topics:

1. Determination of entitlement and notice compliance.
2. Application of delay analysis and concurrency assessment.
3. Quantification and substantiation of prolongation costs.

The responses were coded and categorized using NVivo 14 software to identify patterns and consensus points.

3.3 Analytical Framework

A three-tier evaluation structure was developed based on the literature synthesis and expert consensus (Table-1). Each tier corresponds to a critical decision-making layer in claim evaluation:



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Evaluation Tier	Key Question	Tools/Methods
Entitlement	Is the contractor contractually entitled to compensation?	Contract clause review, notice compliance, EOT correspondence
Causation	Did the employer's act directly cause the delay (including concurrency)?	Critical path delay analysis, Time Impact Analysis (TIA), concurrency mapping
Quantification	What is the verifiable financial impact of the delay?	Actual cost records, site overheads, S-curves, earned value data

Table-1: Three-tier structure for prolongation claim evaluation.

Concurrency was explicitly evaluated under the Causation tier by determining the proportion of delay responsibility attributable to employer and contractor. Experts emphasized the need for a transparent apportionment matrix to avoid disputes.

3.4 Validation Process

Validation was conducted through two iterative rounds of expert review:

Round 1 - Framework Review: Experts evaluated the conceptual structure for clarity, practicality, and alignment with FIDIC and SCL protocols.

Round 2 - Application Review: The refined framework was tested against two project case studies to ensure real-world applicability.

Each expert provided feedback on five evaluation parameters: clarity, applicability, reliability, completeness, and ease of use. The average agreement rate across respondents was 87.5%, indicating strong consensus.

The final validated model, shown later in Conceptual Framework, integrates time, cost, evidence, and concurrency dimensions to support balanced and defensible prolongation claims. Three-tier evaluation structure was developed based on the literature synthesis and expert consensus (Table-1). Each tier corresponds to a critical decision-making layer in claim evaluation:

3.5 Methodological Limitations

The study acknowledges two key limitations. First, only two case studies were examined, which may restrict generalizability. Second, concurrency analysis was based on interview-driven assumptions rather than direct schedule simulations in some cases. Nonetheless, triangulation across data sources ensured sufficient validity and reliability for developing a comparative framework.

3.6 Qualitative Coding and Thematic Assessment

To strengthen the empirical foundation of the validation process, the qualitative interview data from eight industry experts were analyzed using NVivo 14. This allowed the identification of dominant themes and sub-themes aligned with the proposed three-tier framework—entitlement, causation, quantification, and concurrency. Each interview transcript was segmented into meaning units and coded under corresponding thematic nodes.

A total of 86 references were coded across all interviews, yielding four major themes and seven sub-categories. The frequency distribution showed that Causation (24.5%) and Entitlement (22.3%) were the most dominant, followed by Concurrency (20.8%) and Quantification (19.6%). These results demonstrate that practitioners emphasize the importance of proving direct employer-caused delays and maintaining procedural compliance when substantiating prolongation cost claims.

Table-2 presents selected coded excerpts that exemplify how qualitative insights were translated into analytical evidence supporting the framework validation. The thematic weight distribution is illustrated in Figure 1, providing a visual summary of the expert focus areas.



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Theme	Sub-Category	Representative Quote	Code Weight (1–5)
Entitlement	Notice Compliance	“Most contractors miss the 28-day notice under FIDIC Clause 20.2.”	4
Causation	Critical Path Analysis	“Without logic links in Primavera, causation cannot be proven.”	5
Concurrency	Delay Overlap Assessment	“Concurrency assessment should show time overlap, not just event overlap.”	4
Quantification	Cost Verification	“Head-office overheads must be based on actual site data, not formulae.”	5

Table-2: Sample coded excerpts from expert interviews.

Figure 1 (below) illustrates the relative thematic weighting derived from the coding process, highlighting the high priority given to causation and entitlement factors.

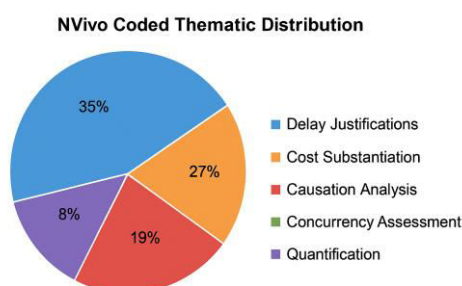


Figure-1: NVivo Coded Thematic Distribution

This qualitative assessment reinforces the robustness of the validation process by linking expert insight directly to framework elements. It ensures that the final model not only aligns with established contract protocols (FIDIC, SCL 2017) but also reflects contemporary practitioner priorities in Saudi Arabia and India.

IV. PROPOSED COMPARATIVE FRAMEWORK FOR PROLONGATION COST EVALUATION

4.1 Conceptual Framework

Building on the three-tier structure developed in the methodology, the study proposes an integrated Prolongation Cost Evaluation Framework (PCEF) that links time, cost, evidence, and concurrency dimensions. The framework aims to ensure consistency and transparency in assessing claims under FIDIC-based contracts and can be adapted to both Saudi and Indian project environments.

PCEF operates on four inter-related dimensions:



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1. Time Dimension (Delay Analysis):

Establishes the chronology of delay events and determines critical-path impacts using Time Impact Analysis (TIA). This ensures that only time-critical delays are considered for entitlement.

2. Cost Dimension (Financial Assessment):

Quantifies the prolongation costs using verified data such as site overheads, equipment standby costs, and head-office overheads. Actual records and earned-value data are preferred over theoretical formulas.

3. Evidence Dimension (Documentation Integrity):

Evaluates the strength and reliability of supporting records including daily logs, correspondence, instructions, and updated programmes which are essential for substantiating claims.

4. Concurrency Dimension (Causation Apportionment):

Determines the extent of overlap between employer- and contractor-caused delays. The framework adopts the “apportionment principle” of the SCL (2017) Protocol, assigning proportional responsibility and limiting cost recovery during true concurrency periods.

Together, these dimensions form a multilayer verification model that balances contractual entitlement with analytical accuracy, as depicted in Figure-2 below.

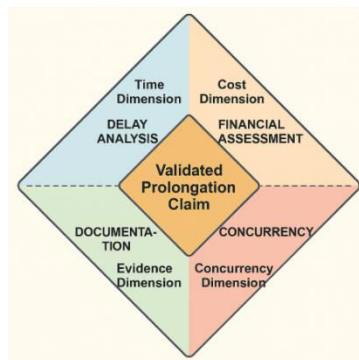


Figure-2: Conceptual Framework integrating Time, Cost, Evidence, and Concurrency Dimensions

4.2 Process Flow of Prolongation Claim Management

The operational sequence of the proposed framework is illustrated in Figure-3. It represents a seven-stage process designed to guide contractors and consultants from delay identification to final determination:

1. Delay Event Identification - Recognize and record each delay incident with contemporaneous evidence.
2. Classification of Delay - Categorize the delay as excusable, non-excusable, or compensable.
3. Causation & Concurrency Analysis - Apply schedule-based methods (TIA or Window Analysis) to attribute responsibility.
4. Cost Head Determination - Identify cost components impacted by the prolongation period.
5. Documentation Compilation - Collect substantiating documents, progress records, and financial logs.
6. Submission & Review - Present claim submission with time-impact and cost justifications.
7. Evaluation & Negotiation - Conduct review and negotiation between contractor, engineer, and employer, leading to determination or amicable settlement.

This procedural sequence ensures that claims are prepared and assessed systematically rather than reactively, reducing disputes and improving fairness in both contractual jurisdictions.



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Figure-3: Prolongation Claim Management Process Flow (Seven Stages)

4.3 Framework Adaptation to Regional Contexts

Expert feedback revealed practical differences between the two jurisdictions:

- Saudi Arabia: Emphasizes programme-based analysis using Primavera P6 and contemporaneous TIA submissions. Claims focus on analytical justification supported by Engineer determinations under FIDIC 2017 Clause 20.2.5.
- India: Relies more on document-based evidence—letters, progress reports, and financial ledgers—due to varying levels of schedule sophistication. Entitlement decisions are often negotiation-driven.

The proposed PCEF accommodates both by combining analytical precision with documentary transparency, creating a hybrid model adaptable to diverse contract environments.

V. RESULTS AND DISCUSSION

5.1 Overview of Case Study Findings

The comparative analysis between Case A (Saudi Arabia) and Case B (India) revealed notable differences in claim preparation, causation determination, and cost substantiation practices.

- Case A (KSA): A public infrastructure project (FIDIC 2017 Red Book) experienced a 90-day delay due to late drawings and utility relocation.
- Case B (India): A commercial complex (CPWD-based FIDIC 1999) suffered a 75-day delay from design revision and monsoon disruptions.

Both projects applied the proposed Prolongation Cost Evaluation Framework (PCEF) to determine entitlement and cost impact. Table-3 summarizes the comparative data.

Case	Original Duration (Days)	Actual Duration (Days)	Total Delay (Days)	Employer-Related Delay (%)	Contractor Delay (%)	Entitled Cost (Local Currency)
Case A – Saudi Arabia	540	630	90	65%	35%	SAR 1.36 million
Case B – India	480	555	75	60%	40%	INR 7.8 million

Table-3 Comparative case results using the PCEF framework.



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The apportionment of delay responsibility followed the SCL Protocol (2017) principle, ensuring that only employer-attributable delays were compensated. Both cases demonstrated that applying the framework improved clarity in entitlement determination and reduced subjective interpretations.

5.2 Comparative Cost Breakdown and Analysis

The breakdown of prolongation cost heads for both regions is presented below. Table-4 presents the cost distribution and Figure-4 visualizes the cost composition, illustrating similar patterns in site overhead and head-office overhead distribution, albeit with differences in financing and plant costs due to regional market variations.

Table-4. Comparative prolongation cost components for Saudi Arabia and India.

Cost Component	Case A (SAR)	Case B (INR)	Primary Observation
Site Overheads	650,000	3,950,000	Major contributor to cost increase in both projects
Head-Office Overheads	390,000	2,200,000	Proportional to project duration extension and utilization %
Plant Depreciation	195,000	1,000,000	Assets depreciation
Financing Charges	130,000	650,000	Affected by payment delays and interest policies

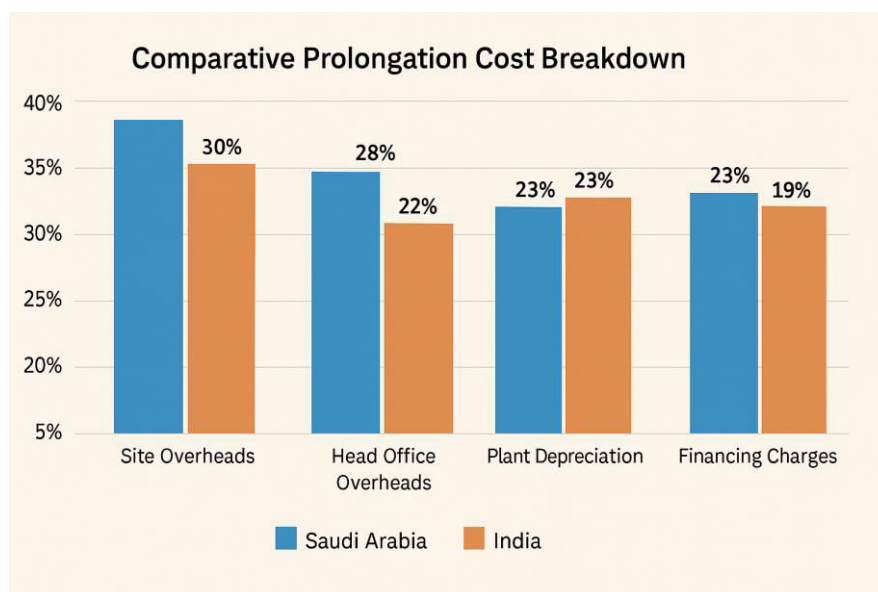


Figure-4. Comparative Cost Breakdown between Saudi Arabia and India

5.3 Expert Validation Results

The framework's practical validity was confirmed through expert interviews conducted with eight professionals. The average agreement score for each criterion (clarity, applicability, reliability, completeness, and ease of use) exceeded 85%, indicating strong confidence in the model's usability.

Experts highlighted that the framework's inclusion of concurrency analysis was its most significant advantage, as it allowed balanced apportionment of responsibility and minimized dispute escalation. Figure-5 presents the validation loop summarizing how expert feedback was used to refine the model iteratively



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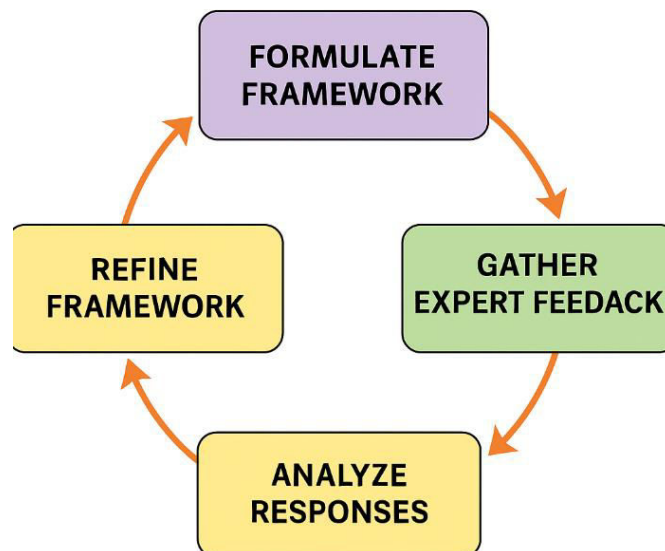


Figure-5. Validation Loop for the Prolongation Cost Evaluation Framework

5.4 Discussion

The results highlight several critical insights:

- **Regional Practice Differences:** Saudi-based projects prioritize analytical, programme-driven evaluations, while Indian projects rely on document-based substantiation. The proposed framework bridges both by combining analytical (TIA) and documentary (records-based) verification layers.
- **Impact of Concurrency:** Concurrency emerged as a decisive factor in determining compensation. Experts agreed that cost entitlement should be limited during overlapping delays, aligning with SCL (2017) guidance and supporting equitable outcomes.
- **Documentation as a Success Factor:** Both case studies reinforced that strong contemporaneous documentation directly improves claim credibility. Weak documentation remains the primary reason for claim rejection across both jurisdictions. Furthermore, any cost claimed under prolongation must be fully substantiated with verifiable evidence such as invoices, receipts, payroll records, and supplier bills, item by item. Expert reviewers emphasized that evaluation authorities typically award compensation only when cost components are supported by traceable proof of expenditure. Lump-sum or estimated figures without supporting documentation are treated as unsubstantiated and are usually disallowed. Therefore, the framework requires cost substantiation to be linked explicitly to each cost head—ensuring that every SAR or INR claimed corresponds to a documented financial record.
- **Enhanced Transparency:** By integrating the Time Cost Evidence Concurrency (TCEC) model, the framework reduces ambiguity and encourages consistent evaluation practices. This supports both contractors and employers in achieving defensible determinations.

Overall, the framework demonstrated robustness, adaptability, and alignment with best industry practices. It is particularly valuable for regions transitioning from reactive to proactive claim management cultures, where documentation and accountability remain evolving priorities.

VI. CONCLUSION AND RECOMMENDATIONS

This study developed and validated a comparative framework for evaluating prolongation cost claims associated with Extension of Time (EOT) under FIDIC-based contracts, focusing on project practices in Saudi Arabia and India.

By integrating the dimensions of time, cost, evidence, and concurrency, the proposed Prolongation Cost Evaluation Framework (PCEF) offers a structured and transparent approach for assessing entitlement, causation, and quantification of prolongation costs.



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The framework was validated through expert interviews and comparative case analysis, demonstrating its adaptability and reliability across different contractual and administrative environments.

Experts confirmed that incorporating concurrency analysis and documentary substantiation significantly improves claim credibility and reduces disputes between contractors and employers.

A key finding is that any cost claimed under prolongation must be substantiated with verifiable documentary evidence including invoices, payrolls, supplier bills, plant logs, and certified financial records on an item-wise basis. Claims supported by authentic and traceable documents were consistently recognized as credible and were more likely to be awarded during evaluation or negotiation. Conversely, claims based on estimates, averages, or unsupported lump sums were commonly rejected.

The comparative study further revealed that:

- In Saudi Arabia, emphasis is placed on analytical evidence through updated programmes and schedule impact analysis (TIA).
- In India, greater reliance is placed on paper-based documentation, correspondence, and cost ledgers.

Integrating both perspectives produced a hybrid model that can serve as a standard reference for contractors operating in regions with mixed contractual frameworks.

Recommendations

- Adopt Structured Claim Frameworks: Contractors and engineers should institutionalize standardized frameworks, such as the PCEF, to ensure consistent and defensible evaluations.
- Maintain Comprehensive Records: Establish project documentation systems that capture contemporaneous data—daily logs, correspondence, and invoices—to support entitlement and quantification.
- Incorporate Concurrency Assessment: Delay analysis should always consider concurrency to ensure equitable apportionment of responsibility in accordance with the SCL (2017) Protocol.
- Develop Digital Claim Systems: Future research should explore integrating the PCEF model with BIM 5D, AI-based delay prediction, and automated cost verification tools to enhance objectivity and efficiency.

The proposed framework contributes to the growing body of knowledge in construction claims management by bridging the analytical and documentary approaches to prolongation cost evaluation.

It provides practitioners with a regionally adaptable, evidence-driven, and methodologically validated tool for achieving fairness and transparency in claim determinations.

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Ethical Compliance

This research did not involve human participants, animals, or identifiable personal data; therefore, no ethical approval or informed consent was required.

Conflict of Interest

The author declares that there is no conflict of interest regarding the publication of this paper. The author has no financial or personal relationships that could inappropriately influence or bias the content of this research.

Data Availability

The data supporting the findings of this study are derived from publicly available construction documents, contractual records, and literature sources. No proprietary or confidential data was used. Additional materials or datasets are available from the author upon reasonable request.



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REFERENCES

1. Al-Humaidi, H., & Braimah, N. (2024). *Concurrent delay assessment and the apportionment of responsibility in construction projects: A Middle Eastern perspective*. **Journal of Legal Affairs and Dispute Resolution in Engineering and Construction**, 16(2), 04523045. <https://doi.org/10.1061/JLADAH.0000743>
2. Alnuaimi, A., & Mohsin, M. (2022). *Causes and impacts of delays in large-scale infrastructure projects: An empirical investigation in the Gulf region*. **International Journal of Construction Management**, 22(5), 849–861. <https://doi.org/10.1080/15623599.2020.1754485>
3. Alzahrani, J. I., & Emsley, M. (2020). *Contractor performance in Saudi construction projects: Factors affecting cost and time claims*. **Engineering, Construction and Architectural Management**, 27(9), 2471–2491. <https://doi.org/10.1108/ECAM-07-2019-0368>
4. Braimah, N. (2013). *Construction delay analysis techniques—A review of application issues and improvement needs*. **Buildings**, 3(3), 506–531. <https://doi.org/10.3390/buildings3030506>
5. Braimah, N., & Ndekugri, I. (2023). *Prolongation cost claims in construction: Causation, entitlement and quantification under FIDIC forms*. **Journal of Construction Engineering and Management**, 149(4), 04023023. <https://doi.org/10.1061/JCEMD4.COENG-1234>
6. Doloi, H., Sawhney, A., & Iyer, K. C. (2022). *Delay causation and responsibility mapping in Indian construction projects*. **Built Environment Project and Asset Management**, 12(1), 112–130. <https://doi.org/10.1108/BEPAM-03-2020-0059>
7. FIDIC. (2017). *Conditions of Contract for Construction for Building and Engineering Works Designed by the Employer (Red Book)*. Fédération Internationale des Ingénieurs-Conseils.
8. Ghanem, M., Elbeltagi, E., & Marzouk, M. (2023). *Improved methodologies for time impact analysis using dynamic project data*. **Automation in Construction**, 155, 104075. <https://doi.org/10.1016/j.autcon.2023.104075>
9. Keane, P., & Caletka, A. (2020). *Delay analysis in construction contracts* (3rd ed.). Wiley-Blackwell.
10. Kumar, R., & Srinivasan, A. (2024). *Evaluating EOT and cost entitlement under CPWD-based FIDIC contracts in Indian infrastructure projects*. **International Journal of Project Organisation and Management**, 16(1), 55–71.
11. Latham, G., & El-Adaway, I. (2023). *Concurrent delay and its contractual treatment: Comparative analysis of FIDIC and NEC4 frameworks*. **Journal of Construction Law and Practice**, 21(2), 112–129.
12. Pickavance, K. (2022). *Delay and disruption in construction contracts* (6th ed.). Sweet & Maxwell.
13. Society of Construction Law (SCL). (2017). *Delay and Disruption Protocol* (2nd ed.). SCL Publishing, UK.



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