Research Square

Preprints are preliminary reports that have not undergone peer review.
They should not be considered conclusive, used to inform clinical practice,
or referenced by the media as validated information.

Responsibility Allocation and Delay Mitigation Strategies in Owner-Initiated Changes in Ethiopia: A Case Study of the Nyala Insurance Headquarters Building Project

Zenagebriel Gebremedhn

zencheboy@gmail.com

Mekelle University

Research Article

Keywords: Owner-initiated changes, Responsibility allocation, Construction delays, Change management, Delay mitigation

Posted Date: November 26th, 2026

DOI: https://doi.org/10.21203/rs.3.rs-11869481/v1

License: This work is licensed under a Creative Commons Attribution 4.0 International License.
Read Full License

Additional Declarations: The authors declare no competing interests.

Responsibility Allocation and Delay Mitigation Strategies in Owner-Initiated Changes in Ethiopia: A Case Study of the Nyala Insurance Headquarters Building Project

Liu Fenghui [1], Zenagebriel Gebremedhn[2*], Lielti Gebreegziabher[2]

[1] China Wu Yi Co., Ltd., Floor 4, Zhidi Plaza, No. 89 Wusi Road, Fuzhou, Fujian Province 350001, People's Republic of China

[2] Faculty of Civil and Environmental Engineering, Ethiopian Institute of Technology-Mekelle, Mekelle University, P.O. Box 231, Mekelle, Ethiopia

** Corresponding author (email: zenagebriel.gebremedhn@mu.edu.et)*

Abstract

Owner-initiated changes are a major source of construction delays, particularly when design revisions occur after construction and procurement activities have commenced. This study examines responsibility allocation and delay-mitigation strategies for owner-initiated changes in the Nyala Insurance Headquarters Building Project, a 3B+G+18 commercial building in Addis Ababa, Ethiopia. A qualitative case-study design integrating project records, stakeholder interviews, informal discussions, and site observations was adopted. Data were analyzed using thematic content analysis and descriptive statistics.

The findings identified 50 recorded delay occurrences, with owner-initiated changes accounting for the largest contribution (38%), followed by design review and approval delays (24%), material procurement (18%), payment delays (12%), and external factors (8%). The average reported delay contribution was 26 days. Among the identified changes, MEP modifications recorded the highest frequency (7) and average delay (60 days), followed by curtain wall changes (5; 45 days), interior works (4; 30 days), and structural modifications (3; 20 days).

The project also recorded ETB 95 million in outstanding payments against ETB 430 million in listed payment categories. Although change orders were fully implemented, monitoring and reporting achieved only 50% implementation. The study demonstrates the importance of early design finalization, clear accountability, coordinated procurement, and proactive schedule monitoring.

Keywords: Owner-initiated changes; Responsibility allocation; Construction delays; Change management; Delay mitigation.

1. Introduction

Construction projects involve complex interactions among clients, consultants, contractors, suppliers, and other stakeholders. Their successful delivery depends on effective coordination of design, procurement, construction, financial resources, and contractual administration. However, changes introduced during implementation can disrupt established work sequences, increase rework, interrupt material procurement, and extend project completion periods. Previous studies have identified design modifications, delayed approvals, financial constraints, and inadequate project coordination as significant contributors to construction delays [1-3].

Owner-initiated changes involve additions, omissions, substitutions, or modifications to approved project requirements after contract award. Although such changes may improve functionality, accommodate emerging requirements, or correct design deficiencies, their consequences depend on timing, complexity, and implementation procedures. Late-stage modifications are particularly disruptive because they may require drawing revisions, technical approvals, material replacement, additional procurement, and rework. Recent empirical evidence confirms that client requirements and design modifications can substantially affect construction productivity and schedule performance [4-8]

Effective change management also requires clearly defined responsibilities among the employer, consultant, and contractor. The employer provides decisions, instructions, approvals, and financial commitments; the consultant coordinates design reviews, technical clarifications, and contract administration; while the contractor manages procurement, construction execution, staffing, subcontractors, and progress reporting. Nevertheless, unclear responsibilities, delayed decisions, insufficient communication, and weak monitoring can undermine contractual arrangements and increase implementation risks [9-12].

These challenges are particularly significant in developing economies, where construction projects frequently experience imported material shortages, foreign currency constraints, inflation, and payment delays. Ethiopian studies have identified design changes, procurement difficulties, delayed payments, inadequate planning, and economic instability among the major causes of construction time overruns [13-16].

The Nyala Insurance Headquarters Building Project in Addis Ababa provides an important case for investigating these relationships. The 3B+G+18 commercial building was initially contracted in May 2018. Following substantial schedule slippage, the employer issued a termination notice in September 2022. The project subsequently resumed under an amended contract signed in August 2023, with a revised completion date of 22 April 2025. During implementation, repeated modifications to curtain wall systems, mechanical, electrical and plumbing (MEP) installations, interior finishes, and selected structural and architectural components affected procurement, approvals, installation, and construction sequencing [17-19].

The project also experienced payment-related difficulties, inadequate personnel deployment, procurement planning weaknesses, and external economic constraints, including foreign currency restrictions and changes in import arrangements. These factors potentially reinforced the effects of design revisions and administrative delays. Similar relationships between financial limitations, material availability, and construction schedule performance have been documented in Ethiopian infrastructure and building projects [18, 20, 21].

Despite extensive research on construction delays, further project-specific investigation is necessary to understand how owner-initiated changes interact with stakeholder responsibilities and mitigation measures. Accordingly, this study assesses responsibility allocation and delay mitigation strategies associated with owner-initiated changes in the Nyala Insurance Headquarters Building Project. Specifically, it identifies major change categories and their underlying causes, examines the practical responsibilities of the employer, consultant, and contractor, evaluates the effectiveness of implemented mitigation measures, and proposes recommendations for improving change management, stakeholder accountability, procurement coordination, and construction schedule performance.

2. Materials And Methods

2.1 Description of the Study Area and Project

The study focused on the Nyala Insurance Headquarters Building Project, located in Addis Ababa, Ethiopia. The building consists of three basement levels, a ground floor, and eighteen upper floors (3B+G+18). Nyala Insurance S.C. is the employer, China Wu Yi Co. Ltd. is the main contractor, and BET Architects PLC is identified as the consultant and contract

administrator. The project was selected because of its history of schedule delays, contract termination, subsequent contract amendment, and repeated design modifications. The analysis concentrated on the amended contract period beginning in August 2023 and the documented project developments extending to June 2025. Particular attention was given to curtain wall, MEP, interior finishing, and structural or architectural changes, as shown in Figure 1.

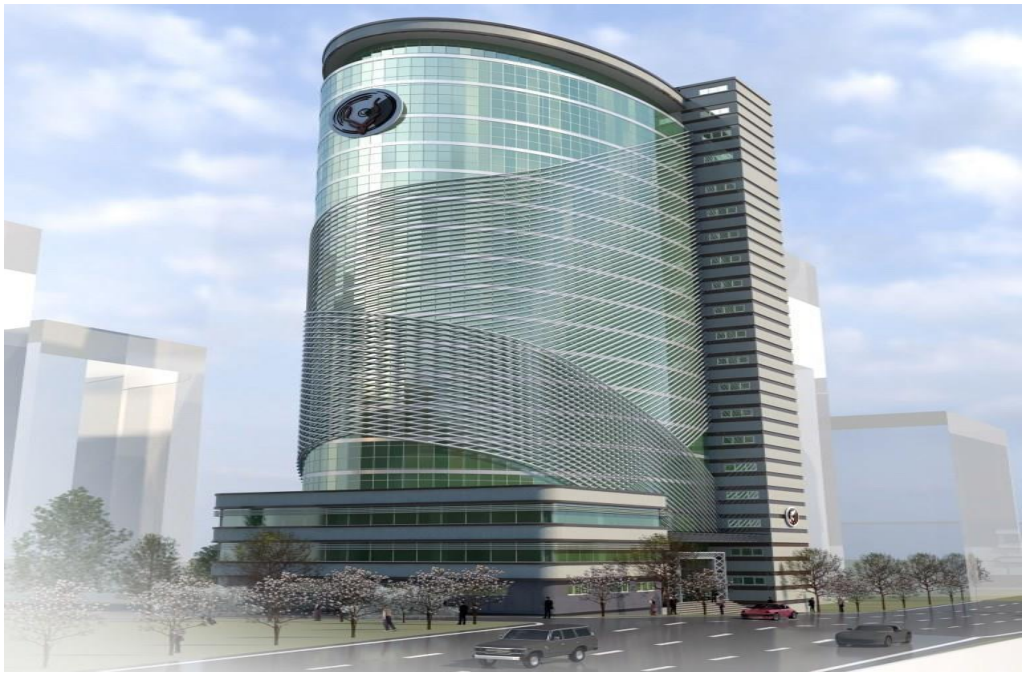


Figure 1. Architectural elevation of the building

2.2 Research Design

A qualitative case-study design supported by quantitative documentary analysis was employed. The case-study approach enabled an in-depth examination of project-specific changes, stakeholder interactions, responsibility allocation, and delay mitigation practices. Quantitative information extracted from project records was used to support and cross-check the qualitative findings. The research combined four principal sources of evidence: project documents, semi-structured stakeholder interviews, informal discussions, and site observations. The integration of these sources enabled the study to examine both the formal contractual arrangements and their practical implementation.

2.3 Target Population and Sampling Technique

The target population consisted of stakeholders directly involved in the planning, design, supervision, contract administration, procurement, and construction of the project. These included employer representatives, consultant personnel, contractor project managers, site engineers, contract administrators, quantity-related personnel, and construction supervisors. Purposive sampling was used to select participants with relevant project knowledge and experience. Selection considered professional responsibilities, direct involvement in managing changes or delays, relevant experience, availability, and willingness to participate. The research proposed approximately 15 participants, distributed among three to five employer representatives, seven consultant personnel, and eight contractor personnel. The final number and distribution should be confirmed against the completed interview records before journal submission using equation (1).

$$n = \frac{Z^2 \cdot p \cdot (1-p)}{e^2} \tag{1}$$

2.4 Sources and Methods of Data Collection

Both primary and secondary sources were used. Primary data were collected through semi-structured interviews and informal discussions with selected project stakeholders. The interviews addressed the causes and consequences of owner-initiated changes, approval procedures, responsibility allocation, communication, procurement difficulties, and the effectiveness of mitigation measures. Informal discussions during site visits and project interactions were used to clarify issues and obtain additional contextual information.

Secondary data were obtained from project documentation maintained by the employer, consultant, and contractor. The documents reviewed included original and amended contract agreements, approved and revised drawings and technical specifications, change orders and design revision records, progress reports and updated work programs, official correspondence, formal notices and requests for information, procurement records and material delivery information, as well as payment records and outstanding payment summaries. These documents provided essential information for examining the nature and causes of owner-initiated changes,

contractual responsibility allocation, procurement and payment-related challenges, and their implications for project delays and schedule performance.

Periodic site observations were also used to assess the physical progress of curtain wall installation, MEP works, and interior finishing. Observations considered material availability, storage, workforce deployment, supervision, and the relationship between reported and observed progress.

2.5 Data Analysis Procedures

Qualitative information was analyzed using thematic content analysis. Interview notes and relevant records were organized, reviewed, and coded to identify recurring issues. The principal themes included owner-initiated changes, design review and approval, responsibility allocation, procurement delays, payment issues, personnel deficiencies, schedule non-compliance, external constraints, and mitigation practices.

Quantitative documentary information was analyzed using descriptive statistics, including frequencies, percentages, average delay durations, and estimated cost impacts. The analysis focused on the distribution of recorded delay causes and the relationship between identified changes and their reported effects on project progress. The following equations (1) describe the principal measures used in organizing and interpreting the documentary evidence. Frequency percentage was calculated using equation (2), Average delay duration using equation (3), and Outstanding payment ratio using equation (4).

$$P_i = \frac{f_i}{\sum_{i=1}^{k} f_i} \times 100 \tag{2}$$

$$\overline{D} = \frac{\sum_{i=1}^{n} D_i}{n} \tag{3}$$

$$OPR = \frac{\text{Outstanding Certified Payment}}{\text{Relevant Contract Payment Value}} \times 100 \tag{4}$$

This indicator can be used to express the proportion of listed payment amounts that remained outstanding. The denominator must be clearly defined when applying the indicator to individual payment categories or the overall payment summary using equation (5).

$$SS = \frac{T_a - T_p}{T_p} \times 100 \quad (5)$$

Where (SS) is schedule slippage, (Ta) is actual duration, and (Tp) is planned duration. This measure should only be calculated when the planned and actual dates refer to comparable project milestones and a clearly defined baseline.

2.6 Classification of Owner-Initiated Changes

The identified project changes were systematically grouped into four major categories: curtain wall modifications, mechanical, electrical, and plumbing (MEP) changes, interior finishing alterations, and structural or architectural modifications. The classification was determined by examining the nature, scope, and technical characteristics of each revised work item. Particular attention was given to the associated impacts on material procurement, resource availability, construction and installation activities, rework requirements, and overall project schedule sequencing. This categorization provided a structured basis for evaluating how different types of design changes influenced project execution, coordination, and time performance, as shown in Table 1.

Table 1. Classification of owner-initiated changes

Change category	**Examples identified in the project**	**Principal project effect**
Curtain wall	Changes to glass specifications, aluminum framing, finishes, and shading tubes	Procurement, fabrication, and installation delays
MEP systems	Revised HVAC layouts, ductwork, piping, electrical routes, and additional equipment	Rework, coordination difficulties, and cost increase
Interior finishing	Changes to partitions, ceilings, flooring,	Approval delays and

	and wall finishes	workflow disruption
Structural and architectural	Staircase redesigns, partition changes, and related modifications	Additional approvals and changes to work sequencing

2.7 Responsibility Allocation Framework

Responsibility allocation was examined using the roles of the employer, consultant, and contractor. The analysis distinguished between being responsible for carrying out an activity and being accountable for the final decision or outcome, as shown in Table 2.

Table 2. Responsibility allocation framework

Activity	Employer	Consultant	Contractor
Design approval	Accountable	Responsible	Consulted
Change-order issuance	Accountable	Responsible	Informed
Material procurement	Informed	Consulted	Responsible
Progress reporting	Informed	Responsible	Accountable
Delay mitigation planning	Accountable	Consulted	Responsible

2.8 Delay Mitigation Assessment

The study assessed four mitigation measures: contract amendments, change orders, formal notices, and monitoring and reporting. Implementation was expressed as a percentage, while effectiveness was rated on a five-point scale. The reported average implementation level and effectiveness rating were calculated from the four strategies. The Mean Implementation Score using equation (6), and the Mean Effectiveness Score using equation (7).

$$\overline{I} = \frac{\sum_{i=1}^{k} I_i}{k} \tag{6}$$

$$\overline{E} = \frac{\sum_{i=1}^{k} E_i}{k} \quad (7)$$

Where (Ii) represents the implementation percentage of strategy (i), (Ei) is its effectiveness rating, and (k) is the number of strategies assessed.

2.9 Triangulation, Reliability, and Ethical Considerations

Triangulation was applied by comparing stakeholder accounts with documentary evidence and site observations. Interview themes were checked against change orders, correspondence, progress reports, and schedule records. This process was intended to reduce dependence on a single source and strengthen the credibility of the findings.

The research discusses the use of internal consistency assessment, including Cronbach's alpha, for questionnaire-based constructs. However, because the principal design is a qualitative case study supported by project records, a Cronbach's alpha value should only be reported if a completed and valid multi-item questionnaire dataset exists. No reliability coefficient is assumed in this manuscript.

Ethical considerations were carefully maintained throughout the research process to ensure transparency, integrity, and responsible data management. Informed consent was obtained from participants before collecting their responses, while confidentiality and privacy of project-related information were strictly protected. All stakeholder opinions, documentary evidence, and project records were handled responsibly and presented objectively without manipulation or misrepresentation.

3. Results And Discussions

3.1 Nature and Frequency of Owner-Initiated Changes

The results indicate that owner-initiated changes affected four major work categories: curtain wall, MEP systems, interior finishing, and structural or architectural modifications. These changes required repeated design reviews, revisions to technical specifications, additional approvals, and adjustments to procurement and construction sequences.

The project records identified seven MEP-related changes, five curtain wall changes, four interior-work changes, and three structural modifications. MEP changes therefore represented the most frequently recorded category among the four groups. The modifications included revised HVAC layouts, changes to power distribution, additional mechanical equipment, partition alterations, and adjustments to architectural and structural interfaces, as shown in Figure 2.

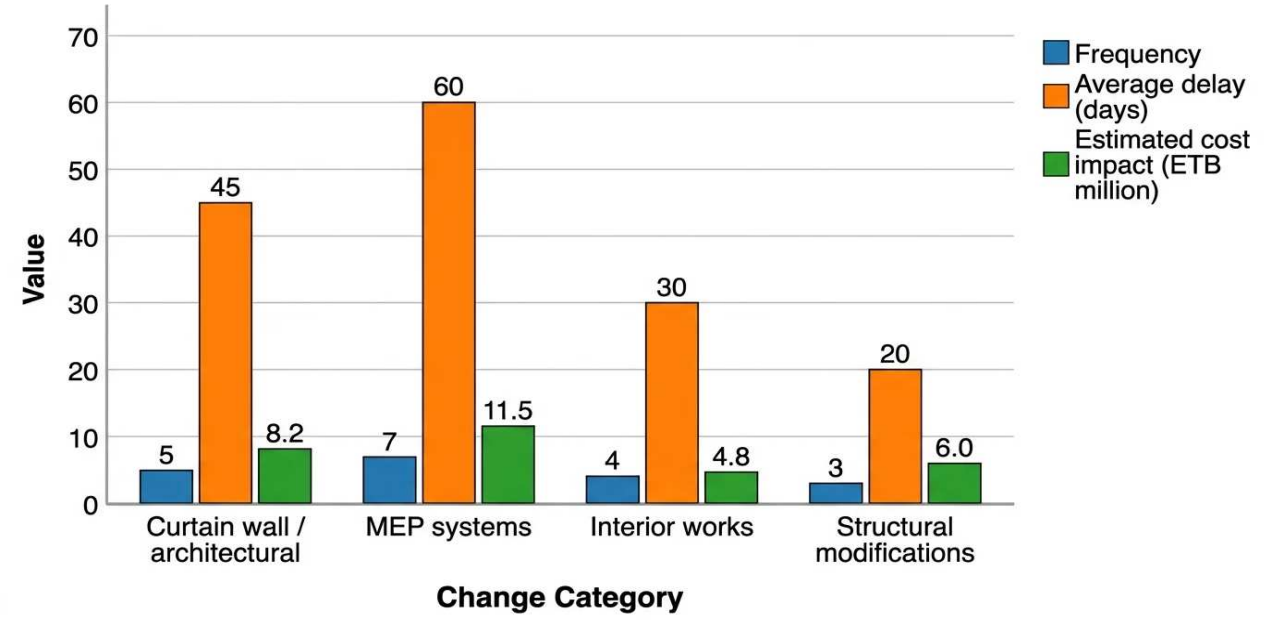


Figure 2. Frequency, average delay, and estimated cost impact of owner-initiated changes

MEP modifications recorded the highest average delay of 60 days and the largest estimated cost impact of ETB 11.5 million. This outcome reflects the technical interdependence of mechanical, electrical, plumbing, and architectural systems. Changes to duct routes, ceiling heights, electrical fixtures, and equipment locations can require coordination across several disciplines. Where revised drawings are incomplete or issued after installation has started, the contractor may need to dismantle and reinstall previously completed work.

Curtain wall modifications recorded an average delay of 45 days and an estimated cost impact of ETB 8.2 million. The research further reports that curtain wall procurement was delayed by more than six months. This longer procurement disruption should be distinguished from the 45-day average delay recorded in Table 3: the two indicators describe different aspects of the project evidence and should not be treated as interchangeable. Repeated changes to glass parameters, aluminum framing, surface finishes, and shading components affected material approvals,

fabrication, and installation. Because façade completion is linked to subsequent interior and finishing activities, the delay had implications beyond the curtain wall package itself.

Interior finishing changes recorded an average delay of 30 days and an estimated cost impact of ETB 4.8 million. Revisions to partitions, ceiling layouts, flooring, and wall finishes affected material selection, subcontractor coordination, and work sequencing. Structural and architectural modifications recorded an average delay of 20 days and an estimated cost impact of ETB 6.0 million. Although their reported frequency was lower, staircase redesigns and related modifications required additional design coordination and affected the sequence of construction activities.

3.2 Relative Contribution of Delay Causes

The analysis identified five principal categories of delay affecting project implementation: owner-initiated changes, design review and approval delays, material procurement delays, payment-related delays, and external factors. A total of 50 delay occurrences were recorded and systematically classified according to their underlying causes and effects on construction activities. Each occurrence was examined to establish its relationship with project execution, resource availability, decision-making processes, and construction schedule performance. The classification provided a structured approach to understanding the major sources of delays and their potential interrelationships. Furthermore, it enabled the assessment of how changes in project scope, administrative procedures, procurement activities, financial constraints, and external conditions contributed to disruptions in planned construction activities and overall project time performance, as shown in Figure 3.

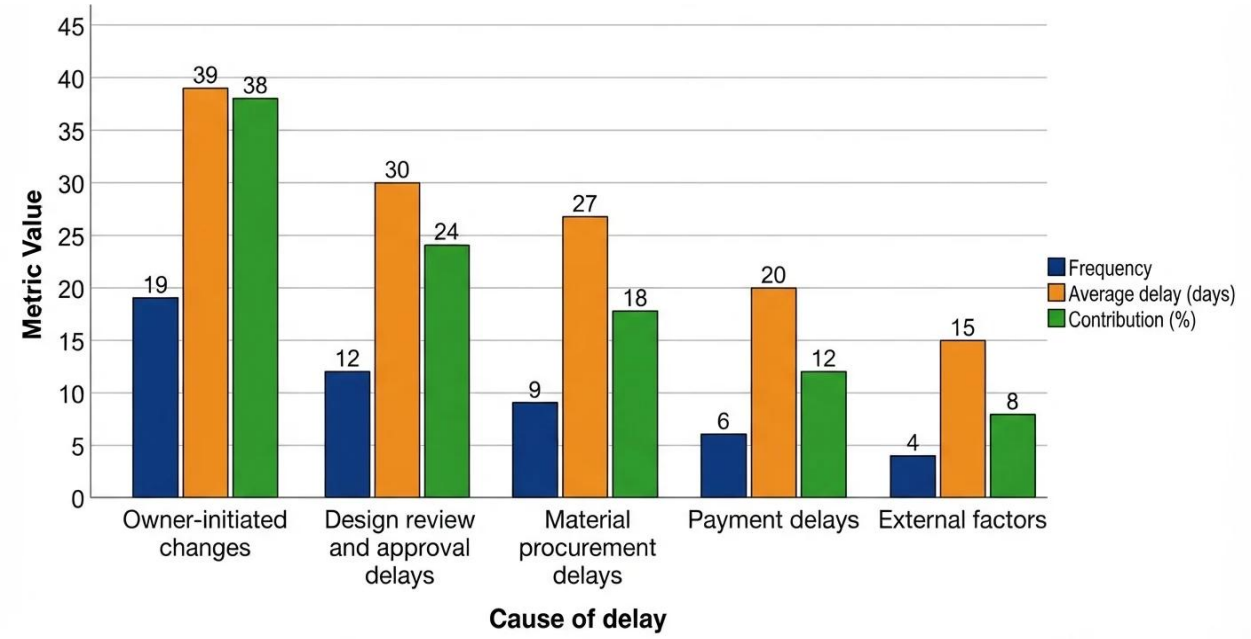


Figure 3. Causes of delay and their relative contribution

Owner-initiated changes accounted for the largest reported contribution at 38%, representing 19 of the 50 recorded occurrences. This finding confirms the central role of late-stage design modifications in the project's schedule difficulties. Design review and approval delays represented another 24%, indicating that the effects of changes were intensified by the time required to review, clarify, and approve revised information.

Material procurement delays contributed 18%. Although the research assigns this category to the contractor, the narrative indicates that procurement difficulties were also influenced by incomplete design information and external foreign currency constraints. Therefore, the responsibility classification should be interpreted as the principal responsibility assigned in the study rather than proof that procurement delays were exclusively caused by the contractor.

Payment delays contributed 12%, while external factors accounted for 8%. The latter included inflation, policy changes, foreign currency restrictions, and importation challenges. These findings suggest that the project's delay performance was shaped by both internal management weaknesses and external economic conditions.

3.3 Payment Performance and Outstanding Amounts

Payment performance was another factor affecting project progress. The research reports a total of ETB 430 million across the listed payment categories, of which ETB 335 million had been paid, and ETB 95 million remained outstanding, as shown in Figure 4.

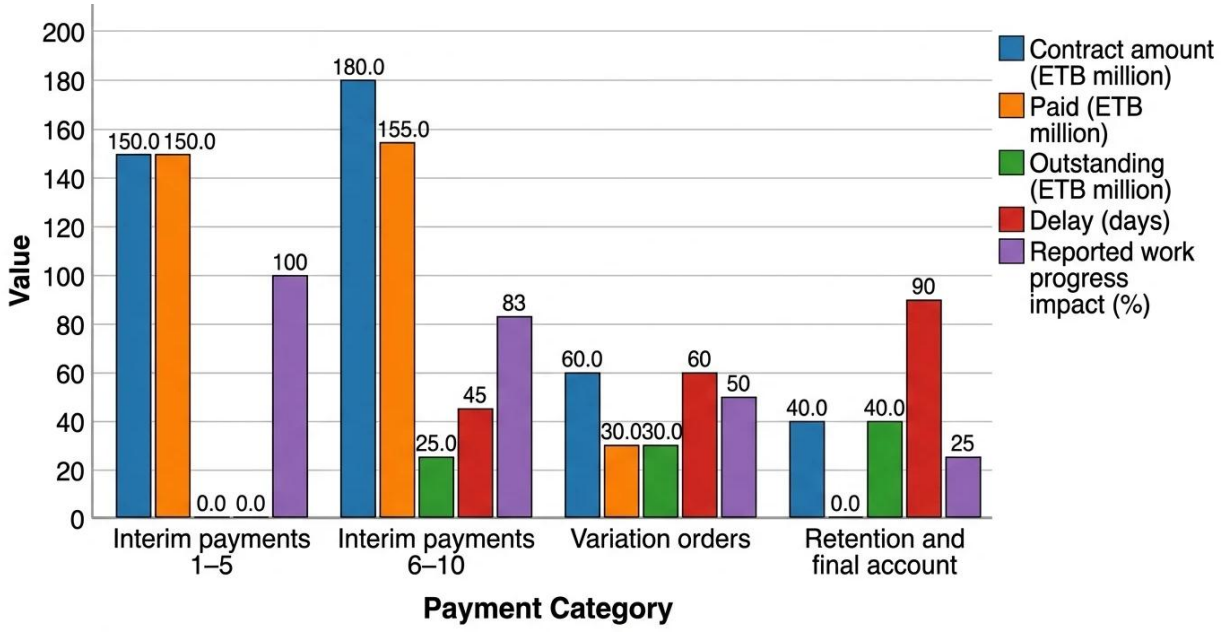


Figure 4. Summary of project payment delays and outstanding amounts

The Outstanding Payment Ratio (OPR) is 22.1%, indicating that outstanding certified payments account for approximately 22.1% of the relevant contract payment value using equation (8).

$$OPR = \frac{95}{430} \times 100 = 22.09\% \approx 22.1\% \tag{8}$$

The largest outstanding amount was associated with retention and the final account, amounting to ETB 40 million. Variation orders accounted for a further ETB 30 million outstanding, with a reported delay of 60 days. Interim payments 6–10 had ETB 25 million outstanding and a reported delay of 45 days. The reported work-progress impacts were lower for payment categories with outstanding amounts, particularly variation orders and retention/final account. These associations indicate a possible relationship between payment performance and work progress; however, the case-study evidence does not establish that payment delays alone caused the reported progress differences.

3.4 Responsibility Allocation and Coordination Performance

Although the project clearly defined the contractual responsibilities of the employer (Nyala Insurance S.C.), consultant (BET Architects PLC), and contractor (China Wu Yi Co. Ltd.), the findings revealed significant gaps between assigned responsibilities and actual implementation. The employer's repeated design revisions and delayed approvals affected the timely release of construction information. Similarly, the consultant's delayed approval of final curtain wall drawings until August 2024, alongside unresolved MEP and interior design issues, disrupted procurement and construction sequencing. The contractor also experienced management weaknesses, including delayed project manager replacement, inadequate skilled personnel, weak procurement planning, and inconsistent progress reporting. These findings demonstrate that effective responsibility management requires timely decisions, clear instructions, documented approvals, proactive contractual enforcement, and continuous coordination among all project stakeholders to minimize delays and improve schedule performance.

3.5 Impact on Project Schedule and Critical Activities

The combined effects of design changes, approval delays, procurement constraints, payment delays, and personnel deficiencies significantly disrupted project schedule performance. Curtain wall procurement was delayed by more than six months, while MEP-related rework extended installation timelines by approximately 15%. These disruptions affected critical-path activities and subsequent façade, interior, and finishing works. Overall schedule slippage was estimated at 10–12%, although verification requires comparison with the approved baseline and updated schedules. Furthermore, the cancellation of the Franco Valuta scheme and foreign currency restrictions constrained the procurement of imported curtain wall materials and building management system (BMS) components, resulting in delays of up to four months. These external constraints further compounded internal coordination, approval, and procurement challenges.

3.6 Evaluation of Delay Mitigation Strategies

The project applied several mitigation measures, including contract amendments, change orders, formal notices, and monitoring and reporting. Their implementation and effectiveness were not uniform, as shown in Figure 5.

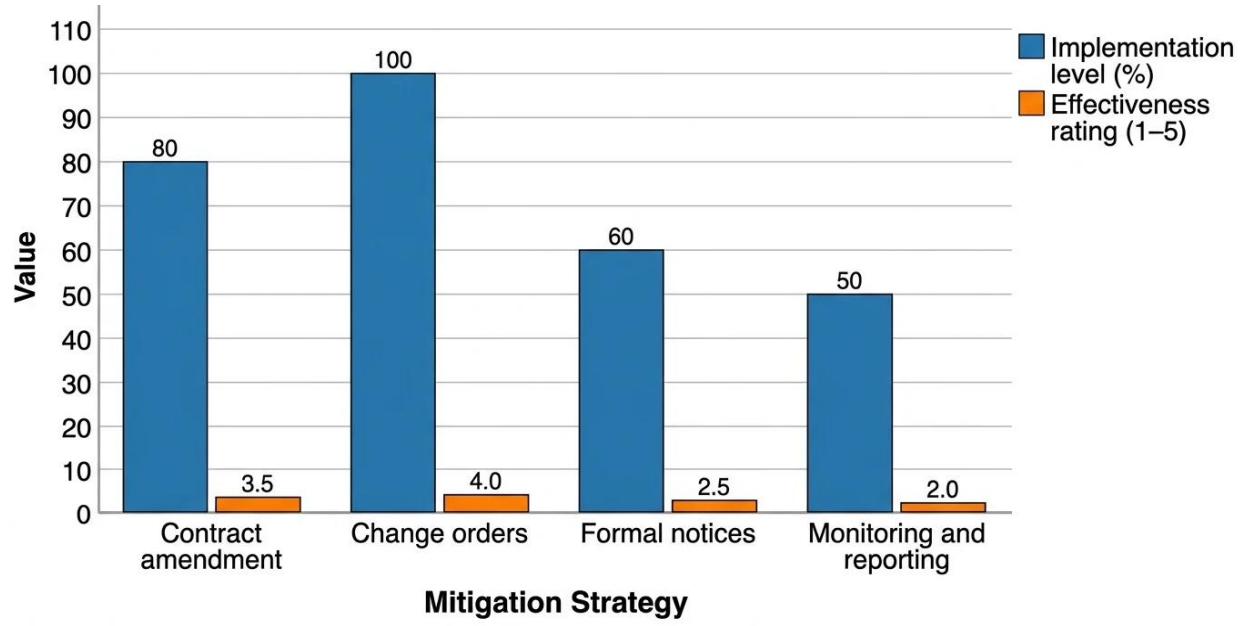


Figure 5. Implementation and effectiveness of delay mitigation strategies

Change orders recorded the highest implementation level (100%) and effectiveness rating (4.0). This indicates that formal change-order procedures were consistently applied and were considered the most effective of the four assessed measures. Contract amendments achieved 80% implementation and an effectiveness rating of 3.5. These measures provided a formal basis for revising contractual arrangements and authorizing changes.

Formal notices recorded 60% implementation and an effectiveness rating of 2.5. Monitoring and reporting recorded the lowest implementation level (50%) and effectiveness rating (2.0). The research explains that weekly material delivery updates and revised work programs were requested, but contractor reporting was inconsistent. Incomplete or late information reduced the ability of the employer and consultant to identify bottlenecks and initiate corrective actions promptly.

The average implementation level was 72.5%, while the average effectiveness rating was 3.0 out of 5. These values suggest moderate implementation and effectiveness overall. However, the results also demonstrate that formal mechanisms alone are insufficient when they are applied reactively or without timely design information, realistic recovery programs, and adequate resource allocation.

4. Conclusions

This study examined responsibility allocation and delay-mitigation strategies for owner-initiated changes in the Nyala Insurance Headquarters Building Project in Addis Ababa, Ethiopia. The findings show that project delays resulted from the interaction of design changes, approval processes, procurement constraints, payment issues, staffing weaknesses, and external economic conditions. The main conclusions are:

1. Owner-initiated changes were the leading reported delay cause, accounting for 38% of 50 recorded delay occurrences. Design review and approval delays contributed a further 24%.

2. MEP changes had the greatest recorded impact among the change categories, with seven occurrences, an average delay of 60 days, and an estimated cost impact of ETB 11.5 million. Curtain wall changes were associated with procurement delays exceeding six months.

3. Responsibility allocation was clearer in contractual arrangements than in actual implementation. Delayed approvals, inadequate contractor staffing, weak procurement planning, and inconsistent communication contributed to schedule disruption.

4. Payment performance presented an additional project constraint, with ETB 95 million outstanding from ETB 430 million in listed payment categories, equivalent to approximately 22.1%.

5. Mitigation measures were moderately implemented overall, with an average implementation level of 72.5% and effectiveness rating of 3.0/5. Change orders performed best, while monitoring and reporting recorded the lowest implementation and effectiveness.

6. Improved project performance requires proactive change management, including early design finalization, prompt approvals, clear responsibility and accountability, coordinated procurement, adequate staffing, timely payment, and reliable schedule monitoring.

Acknowledgment

This research was conducted in collaboration with Mekelle University, with financial sponsorship provided by the Ethiopian Branch of China Wu Yi Co.

Declaration of Competing Interest

The authors declare that they have no competing interests.

Availability of Data

This article outlines research that has not used any data.

Statement of Consent

All authors have provided their publication consent

References

[1] Q. Amarkhil, Elwakil, E., & Hubbard, B. , "A meta-analysis of critical causes of project delay using Spearman's rank and relative importance index integrated approach. ," *Canadian Journal of Civil Engineering.,* vol. 1, no. 1, 2020.

[2] G. Qiao and J. J. A. J. C. E. Li, "Finite Element Modeling and Analysis of Precast Reinforced Concrete U-Shaped Box Culvert Using ABAQUS," vol. 6, no. 5, p. 162, 2018.

[3] A. V. Thomas and J. Sudhakumar, "Critical Analysis of the Key Factors Affecting Construction Labour Productivity –An Indian Perspective," *International Journal of Construction Management,* vol. 13, no. 4, pp. 103-125, 2013/01/01 2013.

[4] G. Zenagebriel, J. Li, and G. Qiao, "Experimental and Finite Element Analysis of Precast Reinforced Concrete U-Shaped Box Culvert," *Iranian Journal of Science and Technology, Transactions of Civil Engineering,* vol. 45, no. 4, pp. 2133-2143, 2021/12/01 2021.

[5] H. Doloi, A. Sawhney, and K. C. Iyer, "Structural equation model for investigating factors affecting delay in Indian construction projects," *Construction Management and Economics,* vol. 30, no. 10, pp. 869-884, 2012/10/01 2012.

[6] I. Mahamid, "Factors affecting cost estimate accuracy: Evidence from Palestinian construction projects," *International Journal of Management Science and Engineering Management,* vol. 10, no. 2, pp. 117-125, 2015/04/03 2015.

[7] M. S. Bajjou and A. Chafi, "Empirical study of schedule delay in Moroccan construction projects," *International Journal of Construction Management,* vol. 20, no. 7, pp. 783-800, 2020/09/21 2020.

[8] E. Umuhoza and S.-H. An, "ANN model predicting quality performance for building construction projects in Rwanda," *International Journal of Construction Management,* vol. 24, no. 15, pp. 1679-1688, 2024/11/17 2024.

[9] A. Tiwari, S. Singh, S. Routroy, A. Gopinath, and P. K. Sahu, "Analysing critical risk factors of Indian road construction projects: a fuzzy DEMATEL approach," *International Journal of Construction Management,* vol. 25, no. 4, pp. 469-480, 2025/03/12 2025.

[10] I. Mahamid, "Contractors' perception of risk factors affecting cost overrun in building projects in Palestine," *The IES Journal Part A: Civil & Structural Engineering,* vol. 7, no. 1, pp. 38-50, 2014/01/02 2014.

[11] V. Bhavsar, S. Thomas Alex, V. P. K, A. Jose, N. G. Koshy, and S. Atiwadkar, "Investigation of critical factors influencing construction of airports: the case of India," *International Journal of Construction Management,* vol. 22, no. 15, pp. 2905-2913, 2022/11/28 2022.

[12] S. Z. S. Tabish and K. N. Jha, "Identification and evaluation of success factors for public construction projects," *Construction Management and Economics,* vol. 29, no. 8, pp. 809-823, 2011/08/01 2011.

[13] K. V. Prasad, V. Vasugi, R. Venkatesan, and N. S. Bhat, "Critical causes of time overrun in Indian construction projects and mitigation measures," *International Journal of Construction Education and Research,* vol. 15, no. 3, pp. 216-238, 2019/07/03 2019.

[14] S. Gupta, K. N. Jha, and G. Vyas, "Construction and demolition waste causative factors in building projects: survey of the Indian construction industry experiences," *International Journal of Construction Management,* vol. 24, no. 4, pp. 432-442, 2024/03/11 2024.

[15] A. Goel, L. S. Ganesh, and A. Kaur, "Sustainability assessment of construction practices in India using inductive content analysis of research literature," *International Journal of Construction Management,* vol. 21, no. 8, pp. 802-817, 2021/06/30 2021.

[16] A. Shrivas and H. K. Singla, "Analysis of interaction among the factors affecting delay in construction projects using interpretive structural modelling approach," *International Journal of Construction Management,* vol. 22, no. 8, pp. 1455-1463, 2022/05/17 2022.

[17] K. K. Tripathi and K. N. Jha, "An empirical study on factors leading to the success of construction organizations in India," *International Journal of Construction Management,* vol. 19, no. 3, pp. 222-239, 2019/05/04 2019.

[18] E. G. Sinesilassie, S. Z. S. Tabish, and K. N. Jha, "Critical factors affecting cost performance: a case of Ethiopian public construction projects," *International Journal of Construction Management,* vol. 18, no. 2, pp. 108-119, 2018/03/04 2018.

[19] D. Karthik and C. B. Kameswara Rao, "Identifying the significant factors affecting the masonry labour productivity in building construction projects in India," *International Journal of Construction Management,* vol. 22, no. 3, pp. 464-472, 2022/03/17 2022.

[20] G. Muneeswaran, P. Manoharan, P. O. Awoyera, and A. Adesina, "A statistical approach to assess the schedule delays and risks in Indian construction industry," *International Journal of Construction Management,* vol. 20, no. 5, pp. 450-461, 2020/09/02 2020.

[21] A. Enshassi, S. Mohamed, and S. Abushaban, "Factors affecting the performance of construction projects in the Gaza strip," *Journal of Civil Engineering and Management,* vol. 15, no. 3, pp. 269-280, 2009/01/01 2009.