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Modeling the Impact of Construction Delay Factors on Organizational Consequences in a Saudi Arabian City

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Abstract

Construction project delays impose substantial organizational consequences on contractors. However, the specific pathways through which individual delay factors translate into organizational consequences remain inadequately modeled in the construction management literature, particularly in the context of Madinah, Saudi Arabia. This study employs path analysis with Maximum Likelihood estimation to model the relationships between key delay factors and three organizational consequence dimensions including reputation and credibility damage, reduced capacity to secure new contracts, and schedule disruption of concurrent projects using data from N = 125 construction professionals. The final path model achieved an acceptable fit (CFI = 0.914, RMSEA = 0.066). Six of the eight hypothesized direct paths were supported. Inadequate funding emerged as the dominant delay factor, having the strongest effect on reduced contract capacity (b = 0.349, p < 0.001) and generating client-contractor disputes that significantly damage organizational reputation through a confirmed indirect pathway (bootstrapped 95% CI: [0.005, 0.088]). Material shortages independently reduced contract-securing capacity (b = 0.231, p = 0.002), whereas client-contractor disputes (b = 0.259, p = 0.001) and scope changes (b = 0.174, p = 0.028) directly predicted reputation damage. Foreign labor dependence was the only significant predictor of schedule disruption (b = 0.172, p = 0.039). The findings highlight financial constraint as the primary strategic vulnerability in the construction delay consequence chain in Madinah.

Keywords
Construction delays, organizational consequences, path analysis, Madinah, Saudi Arabia.

1. Introduction
Construction project delays are among the most persistent and economically significant challenges facing the global construction industry. In Saudi Arabia, where the construction sector accounts for approximately 43% of all building projects in the Gulf Cooperation Council (GCC) region, the scale of the problem is acute: research consistently indicates that more than 70% of public construction projects experience schedule overruns (Alajmi and Ahmed Memon, 2022; Salman and Abdulghafour, 2021). This challenge is particularly pronounced in Madinah, one of Islam's holiest cities, where construction projects supporting pilgrim services and hospitality infrastructure must meet stringent delivery timelines aligned with religious seasons and the ambitious capacity targets of Saudi Vision 2030.
While a substantial body of literature has documented the causes of construction delays, spanning organizational, resource, financial, and external dimensions, considerably less attention has been devoted to modeling the specific organizational consequences that different delay factors generate. Most existing studies treat delay consequences as a homogeneous outcome category or organize them within the traditional triple-constraint framework of schedule, cost,

and quality. This approach obscures the mechanistic pathways through which distinct delay factors produce distinct organizational consequences, limiting practitioners' ability to design targeted mitigation interventions.

The present study addresses this gap by employing path analysis to model the relationships between individual observed delay factors and three empirically selected organizational consequence dimensions in Madinah's construction industry: reputation and credibility damage, reduced capacity to secure new contracts, and schedule disruption of concurrent projects. The study uses data from 125 construction professionals. By moving beyond simple ranking or correlation approaches to a simultaneous multipath model with mediation testing, this study provides a more actionable account of how delay factors cascade into organizational harm.

This study makes three specific contributions to the construction management literature. First, it demonstrates that inadequate funding is the dominant driver of delay consequences in Madinah, operating through both a direct pathway to reduced contract capacity and an indirect pathway through dispute generation to reputation damage. Second, it establishes that supply chain failures, specifically material shortages, have long-term competitive consequences beyond immediate schedule disruption, reducing an organization's ability to secure future contracts. Third, it provides the first path-analytic model of construction delay consequences, specifically calibrated to Madinah's unique construction environment, characterized by religious tourism pressures, heritage sensitivity constraints, and alignment with Vision 2030 infrastructure targets.

1.1 Objectives

1 To empirically model the causal relationships between specific construction delay factors and key organizational consequences (reputation damage, reduced contract capacity, and schedule disruption) using path analysis.
2 To investigate the mediating effect of client-contractor disputes within the deterioration chain.
3 To evaluate the strategic impact of supply chain failures, particularly material shortages, on an organization's long-term competitive positioning and capacity to secure future contracts
4 To assess the extent to which foreign labor dependence drives concurrent project schedule disruption within the context of Madinah.

2. Literature Review

Saudi Arabia's construction sector operates under exceptional growth pressures driven by Vision 2030, the Kingdom's strategic framework for economic transformation and infrastructure development. The framework's ambitious targets, including expanding Umrah pilgrim capacity to 30 million annually by 2030 and a 93% growth in Madinah's licensed hospitality facilities in 2024 alone, create intense demand for timely construction delivery in contexts where delays carry immediate socioeconomic consequences (Alshammari and Ghazali, 2024). Despite this imperative, Saudi construction performance remains systemically poor. Alajmi and Ahmed Memon (2022) documented that approximately 70% of public construction projects experience schedule overruns, with cost overruns commonly ranging from 10% to 30% of the original contract values (Assaf and Al-Hejji, 2006; Bin Seddeeq et al., 2019).

Research into the causes of delay in the Saudi context has identified a consistent set of contributing factors, including poor communication and coordination, scope and design changes, inadequate funding, payment transparency failures, dependence on foreign labor, material shortages, sluggish decision-making, and client-contractor disputes (Alsuliman, 2019; Alajmi and Ahmed Memon, 2022; Alenazi, Adamu and Al-Otaibi, 2022; Shash and AbuAlnaja, 2023). While studies focusing specifically on Madinah remain limited relative to research on Riyadh, Jeddah, or Mecca (Al-Emad and Nagapan, 2015; Gopang, Imran and Nagapan, 2020), the city's unique operational characteristics, including religious access restrictions, heritage preservation requirements, and the complex multi-agency regulatory environment governing sacred areas, introduce additional delay risk factors that broader Saudi studies do not fully capture.

The consequences of construction delays extend across several organizational dimensions. Financial consequences include extended overhead costs, equipment rental extensions, liquidated damages, and legal penalties (Famiyeh et al., 2017; Hoque et al., 2021). Reputational consequences, which several studies identify as among the most significant delay effects from practitioners' perspectives, include credibility damage with clients, deterioration of relationships with subcontractors and suppliers, and reduced competitiveness for future contract awards (Alshakhrit, Supeni and Zahari, 2019; Tariq and Shujaa Safdar Gardezi, 2023). Internal operational consequences include increased workload,

deterioration in employee morale, and cascading disruptions to concurrent projects managed by the same organization (Hoque et al., 2021; Alajmi and Ahmed Memon, 2022).

Critically, these dimensions are not independent. Financial constraints reduce an organization's capacity to recover from delays, leading to disputes with clients and subcontractors over payment and responsibility, which in turn damage organizational credibility and long-term market positioning. Albtoush et al. (2022) demonstrated that contractual disputes have longer-term performance impacts by damaging trust and cooperative relationships, while Chadee et al. (2023) showed, through cash flow modeling, that payment delays compound direct delay costs, creating reinforcing financial deterioration cycles. Despite this recognized interdependence, most existing studies examine delay consequences either in isolation or as undifferentiated aggregate impacts, without modeling the pathways through which specific delay factors generate specific consequence patterns.

Inadequate funding and financing difficulties are consistently identified as major causes of delay across construction research contexts (Alajmi and Ahmed Memon, 2022; Alenazi, Adamu and Al-Otaibi, 2022). Chadee et al. (2023) demonstrated that funding uncertainties lead contractors to become risk-averse, further slowing project execution. Beyond their direct operational effects, financial constraints carry strategic organizational consequences: contractors with demonstrated funding inadequacy signal financial instability to prospective clients, reducing their competitive positioning in future procurement processes. This connection between financial constraint and long-term market competitiveness represents an understudied consequence pathway in the construction delay literature.

The relationship between financial constraints and stakeholder disputes is also theoretically grounded. When contractors experience funding inadequacy, payment delays to subcontractors, and disputes with clients over variation orders and payment certification, these issues become more frequent (Al-Emad and Nagapan, 2015). These disputes, in turn, damage the contractor's credibility and reputation—a secondary consequence that compounds the primary financial problem. This is supported by recent findings from Al-Busaltan (2025), who noted that the adverse outcomes of project delays in the Middle East frequently lead to severe disputes between employers and contractors, directly damaging long-term organizational reputation and overall project success. This chain mechanism (financial constraint → disputes → reputation damage) constitutes a theoretically coherent mediation pathway that has not been empirically tested in the Madinah construction context.

Material shortages and supply chain disruptions pose a persistent resource challenge in construction projects, particularly in Saudi Arabia, where reliance on imported materials and foreign labor introduces additional supply chain vulnerabilities (Shash and AbuAlnaja, 2023; Alshammari and Ghazali, 2024). Beyond their immediate schedule and cost impacts, supply chain failures signal operational unreliability to clients, potentially affecting the organization's ability to secure future contracts. This strategic dimension of supply chain management — the reputational and market positioning consequences of repeated material shortfalls — has received limited attention in construction delay research.

Foreign labor dependence introduces schedule vulnerability through mechanisms including visa processing delays, recruitment lead times, geopolitical disruptions to bilateral labor agreements, and seasonal fluctuations in labor availability (Al-Emad, 2021; Alfalah et al., 2024). In Madinah's construction context, where religious seasons create periodic labor demand spikes and access restrictions affect site operations, foreign labor dependence may have particularly pronounced schedule consequences. Research by Al-Emad and Nagapan (2015) from the adjacent Mecca context confirmed that labor-related factors are among the most frequently cited causes of delay in sacred city construction environments.

2.1 Path Analysis in Construction Research

Path analysis provides a methodological framework for simultaneously testing multiple hypothesized causal relationships among observed variables, decomposing total effects into direct and indirect components, and enabling mediation testing (Retherford and Choe, 2011; Valenzuela and Bachmann, 2017). Unlike single-equation regression, path analysis accounts for the interdependencies among predictor variables and tests the full causal structure of a theoretical model in a single estimation procedure. Its application in construction management research has grown substantially, with Yang and Ou (2008) demonstrating its value for analyzing causal relationships among delay factors,

and Doloi, Sawhney, and Iyer (2012) employing structural equation modeling to investigate multi-factor delay mechanisms in construction projects.

Ramli et al. (2018) reviewed the application of structural equation modeling in construction delay research, highlighting its superiority over regression-based approaches for capturing the complex interdependencies among delay causes and effects. Despite this methodological progress, most path-analytic studies in construction delay research have focused on relationships among delay causes rather than the downstream pathways from specific causes to specific organizational consequences. The present study addresses this gap by specifying and testing a path model that connects individual observed delay factors directly to organizational consequence outcomes.

3. Methods

This study employs path analysis with Maximum Likelihood (ML) estimation using JMP statistical software to simultaneously test multiple hypothesized causal relationships among observed delay factors and organizational consequences. Unlike single-equation regression, this methodological framework accounts for the interdependencies among predictor variables and enables mediation testing by decomposing total effects into direct and indirect components.

All variables were specified as observed single-indicator variables. Model fit was evaluated using the Comparative Fit Index (CFI ≥ 0.90) and the Root Mean Square Error of Approximation (RMSEA ≤ 0.08). The significance of the mediation pathway was tested using bias-corrected bootstrap confidence intervals (1,000 resamples, alpha = 0.05), in which a significant indirect effect is confirmed if the 95% confidence interval excludes zero.

3.1 Variable Selection and Model Specification

Variable selection for the path model was conducted using a two-stage process combining theoretical relevance with empirical correlation analysis. First, drawing on the literature on strategic firm-level impacts, variables representing severe organizational consequences—specifically, reputation damage and reduced capacity to secure new contracts—were selected as the primary endogenous outcomes, as they represent the most critical existential threats to an organization.

Second, an exploratory analysis of the full 23x23 item correlation matrix was utilized to identify the specific exogenous delay factors and intermediate operational disputes that exhibited the strongest mathematical relationships with these critical outcomes. This procedure yielded a focused subset of interconnected variables, ensuring the final structural equation model was both theoretically grounded in organizational survival and empirically supported by the Madinah dataset. The appendix (Table A) presents the full correlation matrix for all 23 initial survey items, which served as the basis for variable screening. The final retained variable set, including item wording and theoretical justification, is detailed in Table 1.

Table 1. Variables, Item Wording, and Theoretical Basis

Code	Survey Item Wording	Role	Literature
SCOPE	Scope/design changes are a significant cause of delays	Exogenous predictor	Bin Seddeeq et al. (2019)
DISPUT	Client-contractor/stakeholder disputes cause delays	Endogenous mediator	Albtoush et al. (2022)
DECIS	Sluggish decision-making causes delays	Exogenous predictor	Alajmi & Ahmed Memon (2022)
FORLBR	Dependence on foreign labor causes delays	Exogenous predictor	Al-Emad (2021)
FUND	Inadequate funding/financing issues cause delays	Exogenous predictor	Alenazi et al. (2022)
MATRLS	Material shortages cause delays	Exogenous predictor	Shash & AbuAlnaja (2023)
REPUT	Project delays impact credibility and reputation	Outcome: Reputation	Alshakhrit et al. (2019)
NEWCON	Project delays affect the capacity to secure new contracts	Outcome: Contract Capacity	Tariq & Gardezi (2023)

SCHSPL	Project delays prevent concurrent projects from completing on time	Outcome: Schedule Disruption	Hoque et al. (2021)

3.2 Hypotheses

Based on the existing literature and variable selection procedures, eight specific hypotheses were formulated for testing:

- **H1:** Scope/design changes positively influence reputation damage.
- **H2:** Client-contractor disputes positively influence reputation damage.
- **H3:** Sluggish decision-making positively influences schedule disruption.
- **H4:** Foreign labor dependence positively influences schedule disruption.
- **H5:** Inadequate funding reduces contract capacity.
- **H6:** Material shortages positively influence reduced contract capacity.
- **H7:** Foreign labor dependence positively influences reduced contract capacity.
- **H8:** Inadequate funding positively influences reputation damage indirectly through client-contractor disputes.

3.3 Structural Equations

To mathematically formalize the hypothesized pathways, the comprehensive path model was expressed as a system of simultaneous structural equations. The endogenous organizational outcomes (Reputation Damage, Reduced Contract Capacity, and Schedule Disruption) and the mediating operational variable (Disputes) were modeled as linear functions of their respective exogenous predictors and error terms (ε):

$$REPUT = \beta_1(SCOPE) + \beta_2(DISPTE) + \varepsilon_1$$

$$NEWCON = \beta_3(FUND) + \beta_4(MATRLS) + \beta_5(FORLBR) + \varepsilon_2$$

$$SCHSPL = \beta_6(DECIS) + \beta_7(FORLBR) + \varepsilon_3$$

$$DISPTE = \beta_8(FUND) + \varepsilon_4$$

Where β_1 through β_8 represent the path coefficients to be estimated by the Maximum Likelihood procedure, and ε_1 through ε_4 represent error terms for each endogenous variable. By estimating these equations simultaneously rather than in isolation, the model accounts for shared variance and provides a more rigorous test of organizational failure mechanisms.

4. Data Collection

This study utilizes survey data collected from construction industry professionals in Madinah. The data were collected using a structured questionnaire with 5-point Likert-scale items (1 = Strongly Disagree / Not Significant to 5 = Strongly Agree / Extremely Significant), covering 23 variables related to 13 delay factors and 10 organizational consequences. The final dataset comprises N = 125 valid responses from project managers, engineers, contractors, and consultants with direct experience in Madinah construction projects. The sample was predominantly male (98.4%), highly educated (92.8% holding a bachelor's degree or higher), and highly experienced, with 74.4% possessing 10 to 25 years of industry experience. The primary professional roles represented were Project Managers (26.4%), Consultant Engineers (21.6%), and Directors of Project Management (18.4%). Participants reported on diverse project scales, with the most common budgets falling between 20 and 50 million SAR (41.2%) and durations ranging predominantly from under one year (50.4%) to over five years (15.2%).

5. Results and Discussion

Table 2 presents the baseline correlations among the final nine observed variables retained for the path analysis model.

Table 2. Correlation Matrix of Modeled Variables

	SCOPE	DISPTE	DECIS	FUND	REPUT	NEWCON	MATRLS	SCHSPL	FORLBR
SCOPE	1								
DISPTE	0.2404	1							
DECIS	0.1066	-0.0052	1						
FUND	0.2598	0.1779	0.1227	1					
REPUT	0.2704	0.331	0.1685	0.1652	1				
NEWCON	0.1973	0.1919	0.2294	0.4037	0.4735	1			
MATRLS	0.0782	0.1787	0.2533	0.2416	0.2127	0.3857	1		
SCHSPL	0.0429	0.0614	0.238	-0.0389	0.3033	0.2803	0.0568	1	
FORLBR	-0.0118	0.0952	0.1674	-0.1095	0.1251	0.1826	0.2341	0.2258	1

5.1 Baseline Standard Regression

Results Prior to testing the comprehensive structural equation model, standard bivariate linear regressions were conducted to establish the baseline relationships between the hypothesized exogenous triggers and their respective organizational consequences. Table 3 summarizes the unadjusted parameter estimates. In isolation, all eight hypothesized pathways were statistically significant.

Table 3. Baseline Regression Estimates for Hypothesized Paths

Hypothesis	Path (Independent → Dependent)	Estimate (β)	Std. Error	*p-value*	Baseline Status
H1	Scope Changes (SCOPE) → Reputation (REPUT)	0.267	0.086	0.002*	Significant
H2	Disputes (DISPTE) → Reputation (REPUT)	0.303	0.078	< 0.001*	Significant
H3	Decision-Making (DECIS) → Schedule (SCHSPL)	0.294	0.108	0.008*	Significant
H4	Foreign Labor (FORLBR) → Schedule (SCHSPL)	0.207	0.08	0.011*	Significant
H5	Funding (FUND) → New Contracts (NEWCON)	0.352	0.072	< 0.001*	Significant
H6	Materials (MATRLS) → New Contracts (NEWCON)	0.338	0.073	< 0.001*	Significant
H7	Foreign Labor (FORLBR) → New Contracts (NEWCON)	0.131	0.063	0.042*	Significant

5.2 Model Fit

To test the hypothesis simultaneously, a comprehensive path analysis was done. The final path model achieved excellent fit: CFI = 0.914, RMSEA = 0.066 (90% CI: [0.000, 0.1089]), $\chi^2(21) = 32.59$, $p = 0.0510$. The CFI exceeds the conventional 0.90 threshold, and the RMSEA falls within the acceptable range of ≤ 0.08, jointly indicating that the model adequately reproduces the observed covariance structure of the data. The non-significant chi-square ($p > 0.05$) further confirms acceptable model-data correspondence.

5.3 Direct Path Results

Table 4 presents the complete path estimates. As detailed in Table 4, moving from isolated baseline regressions to a structural equation model revealed critical nuances. While six of the hypothesized paths remained strongly significant, H3 and H7 failed to reach significance of $p<0.05$ in the structural model.

Table 4. Path Analysis Results — Direct Paths

H	Paths	Estimate (β)	Std Error	p-value	Decision
H1	Scope Changes (SCOPE) → Reputation (REPUT)	0.174	0.079	0.028	✓ Supported
H2	Disputes (DISPTE) → Reputation (REPUT)	0.259	0.078	0.001	✓ Supported
H3	Decision-Making (DECIS) → Schedule (SCHSPL)	0.157	0.084	0.061	✗ Not Supported
H4	Foreign Labor (FORLBR) → Schedule (SCHSPL)	0.173	0.084	0.039	✓ Supported
H5	Funding (FUND) → New Contracts (NEWCON)	0.353	0.071	<.001	✓ Supported
H6	Materials (MATRLS) → New Contracts (NEWCON)	0.231	0.075	0.002	✓ Supported
H7	Foreign Labor (FORLBR) → New Contracts (NEWCON)	0.132	0.075	0.077	✗ Not Supported

The strongest path in the model was H5: Inadequate Funding → Reduced Contract Capacity (b = 0.353, p < 0.001), indicating that every unit increase in perceived funding inadequacy corresponds to a 0.349 unit increase in perceived reduction of the organization's ability to secure new contracts. H6 was confirmed, with material shortages independently predicting reduced contract capacity (b = 0.231, p = 0.002). H2 established client-contractor disputes as the strongest predictor of reputation damage (b = 0.259, p = 0.001), with scope changes providing an independent contribution (H1: b = 0.174, p = 0.028). H4 confirmed foreign labor dependence as the sole significant predictor of schedule disruption (b = 0.173, p = 0.039).

Two hypotheses were not supported. H3 (sluggish decision-making predicting schedule disruption) approached but did not reach significance (p = 0.061), suggesting that in Madinah's construction context, external labor supply constraints are a more binding schedule determinant than internal decision processes. H7 (foreign labor dependence predicting reduced contract capacity) was also non-significant (p = 0.077), indicating that while foreign labor dependence disrupts schedules, its effect on future contract-winning capacity is not independently significant once funding and material shortages are controlled.

5.4 Mediation Results

Table 5 presents the mediation results for H8 (Table 5).

Table 5. Mediation Analysis — H8: FUND→ DISPTE → REPUT

Path	Estimate(β)	Std Error	p-value	BC 95% CI	Decision
Funding (FUND) ⟶ Disputes (DISPTE) [first leg]	0.177	0.086	0.040	—	Significant
Disputes (DISPTE) ⟶ Reputation (REPUT) [second leg]	0.259	0.078	0.001	—	Significant
Funding (FUND) → Disputes (DISPTE) ⟶ Reputation (REPUT) (indirect)	0.037	0.021	0.086	[0.005, 0.088]	✓ Significant

Both constituent paths of the mediation chain were statistically significant. The indirect effect estimate (b = 0.037) was modest but the bias-corrected bootstrapped 95% confidence interval [0.005, 0.088] excluded zero, confirming statistical significance under the more stringent bootstrapping criterion. The significance was determined by a bias-corrected bootstrapped 95% CI excluding zero (1,000 resamples). H8 is therefore supported: inadequate funding generates client-contractor disputes, which cascade into reputational and credibility damage, establishing a financially initiated deterioration chain that operates through relationship breakdown (Figure 1).

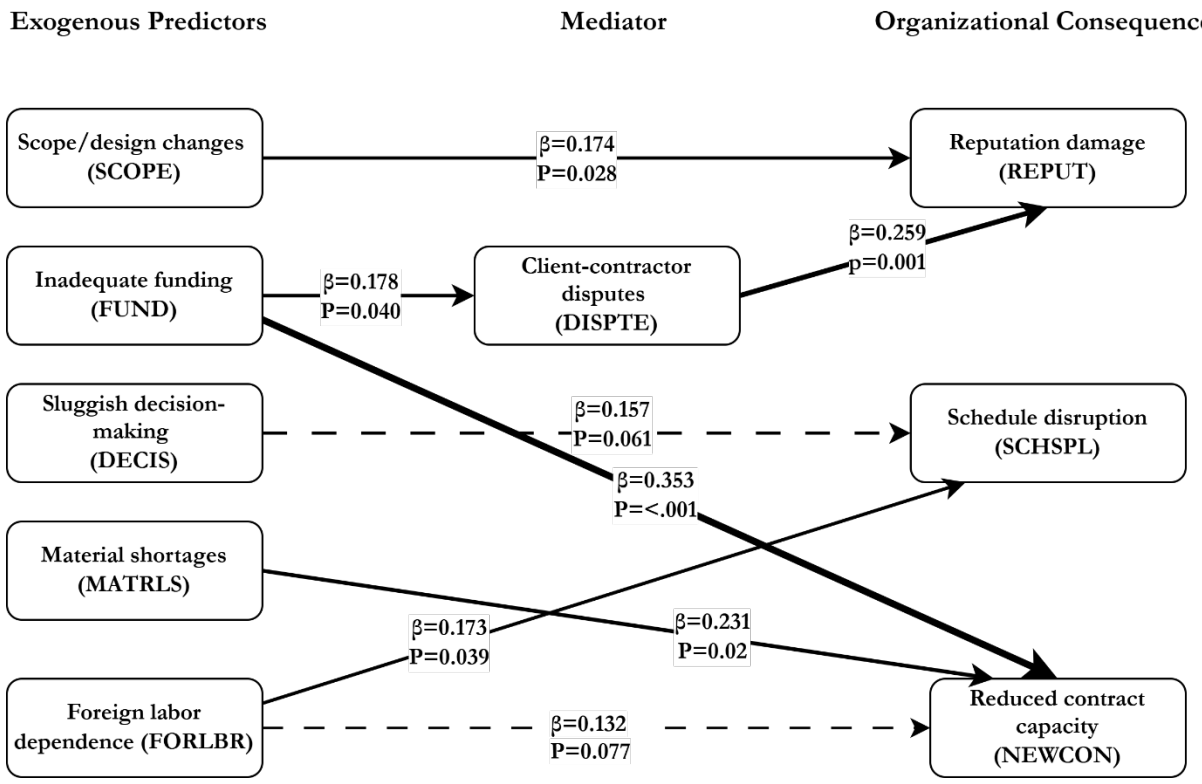

Figure 1. Path diagram showing standardized Path coefficients(**β**)

Note: Solid lines indicate significant (P<0.05) paths while dashed lines indicate non-significant(P>0.05) paths.

5.5 Financial Constraint as Primary Strategic Vulnerability

The dominant finding of this study is the outsized influence of inadequate funding on the organizational consequences of construction delays in Madinah. Inadequate funding (FUND) is the strongest predictor in the entire model, exerting a significant direct effect on reduced contract capacity (H5: b = 0.349, p < 0.001) and a significant indirect effect on reputation damage through dispute generation (H8: BC CI [0.005, 0.088]).

This finding extends existing understanding of financial constraints in construction beyond their commonly studied role as project-level cost and schedule drivers. The evidence from Madinah indicates that funding inadequacy has strategic consequences for market positioning: organizations perceived as financially constrained lose credibility in the tendering process, thereby reducing their competitive positioning for future contract awards. This mechanism is consistent with Chadee et al. (2023), who demonstrated that delayed payment cycles create reinforcing financial deterioration cycles, and with the broader resource-based view, which argues that financial capacity is a source of competitive advantage rather than merely an operational input.

The confirmed indirect pathway (FUND → DISPTE → REPUT) reveals that financial constraint operates through both relationship deterioration and direct strategic signaling. Funding inadequacy generates client-contractor disputes — likely through payment delays, order conflicts, and cash-flow-driven quality compromises - which damage reputations. For practitioners, this means that early financial distress warning systems, payment guarantee mechanisms, and clear contractual provisions for delay-related financial escalation have downstream reputational benefits that justify their administrative costs.

5.6 Supply Chain Failures and Long-Term Competitive Consequences

Material shortages (MATRLS) emerged as the second strongest predictor of reduced contract capacity (H6: b = 0.231, p = 0.002). This finding is theoretically significant because it positions supply chain management as a strategic, not

merely operational, capability in Madinah's construction industry. Contractors who experience repeated material shortfalls are perceived as operationally unreliable, eroding client confidence in their capacity to deliver future projects on time and to specification.

The implication for practice is that investment in supply chain resilience, through strategic material stockpiling, diversified supplier networks, local material sourcing development, and long-term supplier partnership arrangements, generates strategic competitive returns beyond the immediate operational benefits. This reframes supply chain management as a business development investment rather than a project-level procurement activity.

5.7 Disputes as the Gateway to Reputation Damage

Client-contractor disputes (DISPTE) emerged as the strongest direct predictor of reputation and credibility damage (H2: b = 0.259, p = 0.001), consistent with Albtoush et al. (2022) and Tariq and Shujaa Safdar Gardezi (2023). The finding that scope changes (H1: b = 0.174, p = 0.028) independently predict reputation damage adds an important dimension, meaning that frequent design modifications signal poor project planning and insufficient upfront scope definition, which clients interpret as organizational incompetence regardless of the technical quality of eventual delivery.

In Madinah's construction context, reputational damage carries more severe consequences than in other markets. The relatively small and interconnected professional community of construction practitioners, combined with the high public visibility of pilgrim infrastructure projects, means that reputational signals travel quickly and persistently. Contractors operating in this environment have correspondingly stronger incentives to invest in proactive dispute-resolution mechanisms, robust scope-definition processes at project inception, and client-communication protocols that manage expectations before disputes escalate.

5.8 Schedule Disruption and Labor Supply Vulnerability

Foreign labor dependence (FORLBR) was the sole significant predictor of schedule disruption (H4: b = 0.172, p = 0.039), with sluggish decision-making (H3, p = 0.061) failing to reach significance in the final model. This null finding on decision-making is theoretically interesting; it suggests that, in Madinah's construction context, external labor supply constraints are a more binding schedule constraint than internal decision-making inefficiencies, once foreign labor dependence is controlled for. This may reflect the particularly acute workforce supply challenges that characterize religious city construction environments, where pilgrimage season restrictions, access limitations, and intense competition for labor during peak construction periods create bottlenecks that override the effects of internal organizational process quality.

The finding supports Al-Emad's (2021) argument that labor localization strategies in Saudi Arabia's construction sector are strategically necessary rather than merely politically desirable. Building buffer workforce capacity through training local talent, establishing long-term foreign labor supply agreements, and developing construction workforce management protocols that account for Madinah-specific seasonal constraints directly address the primary identified driver of schedule disruption.

5.9 Proposed Improvements

To mitigate the organizational consequences of construction delays in Madinah, contractors must implement integrated strategic interventions across financial, supply chain, and workforce domains. Financially, proactive mechanisms—such as early distress warning systems, payment guarantees, and explicit contractual provisions for delay-related escalations—are critical to prevent funding deficits from triggering disputes and subsequent reputational damage. Furthermore, instituting robust upfront scope definitions and client communication protocols can effectively preempt scope-related conflicts. Operationally, supply chain resilience should be elevated to a strategic imperative through material stockpiling, diversified and localized sourcing, and long-term supplier partnerships, thereby safeguarding market competitiveness and demonstrating reliability to public and private stakeholders overseeing large-scale infrastructure projects. Finally, to counteract schedule disruptions driven by foreign labor dependence, organizations must build buffer capacity by localizing their workforce, securing long-term supply agreements, and adopting specialized management protocols that proactively accommodate Madinah's unique pilgrimage access restrictions and seasonal labor fluctuations.

6. Conclusion

This study modeled the pathways through which six individual delay factors generate three organizational consequence dimensions in Madinah's construction industry, using path analysis with maximum-likelihood estimation on data from N = 125 construction professionals. The final model (CFI = 0.914, RMSEA = 0.066) confirmed six of eight hypothesized direct paths and one mediation pathway.

The principal findings are: (1) Inadequate funding is the dominant delay-consequence driver, directly reducing contract-winning capacity and indirectly damaging reputation through dispute generation, with a confirmed mediation pathway supported by bootstrapped confidence intervals. (2) Material shortages carry strategic competitive consequences beyond immediate project disruption, significantly reducing organizations' capacity to secure future contracts. (3) Client-contractor disputes and scope changes are independent direct predictors of reputation damage. (4) Foreign labor dependence is the primary driver of schedule disruption, underscoring the strategic importance of workforce supply management in Madinah's construction environment.

These findings have practical implications for contractor financial management, supply chain investment strategy, dispute prevention protocols, and government procurement policy in the context of Saudi Vision 2030 infrastructure delivery. They also contribute an empirically grounded, Madinah-specific path model to a literature dominated by broader Saudi or international construction delay studies.

6.1 Limitations and Future Research

Several limitations constrain the interpretation of findings. The use of single-indicator observed variables, while appropriate for the observed-variable analytical framework employed, introduces measurement error that weakens path coefficients. Future research employing validated multi-item scales or objective project performance records (schedule variance in days, budget variance as a percentage) would provide more reliable estimates of these relationships. The sample, while adequate for the current model, may not fully represent the diversity of Madinah's construction sector. Also, the sample contains predominantly male (98.4%) which may constrain the broader applicability of findings related to organizational perceptions and priorities. Future research with larger diversified gender collected samples, longitudinal designs, and qualitative follow-up interviews with practitioners would substantially strengthen the evidence base for the mechanisms identified here.

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Biographies

Aminu Ahmad Aminu is a Master's student in Engineering Management and Technology at the Islamic University of Madinah, Saudi Arabia, with a professional background in civil engineering. His research focuses on construction management, structural engineering, and the application of advanced statistical methodologies—including Path Analysis and Structural Equation Modeling (SEM)—to evaluate and address complex project management challenges. As a Civil Engineer, his work aims to bridge the gap between theoretical causal modeling and practical infrastructure delivery within the dynamic construction sector. He is interested in stochastic modeling for Six Sigma and operational process optimization.

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Engr. Yazeed Abdullah Alahmadi is a professional engineer with extensive experience in project management, specializing in construction and infrastructure development. He serves as a Project Manager at the Madinah Development Authority (MRDA) in Saudi Arabia, overseeing the planning, execution, and delivery of large-scale construction and infrastructure projects in the Madinah region. His expertise spans project lifecycle management, stakeholder coordination, quality assurance, and regulatory compliance in urban and regional development. With a strong engineering foundation and hands-on leadership in public sector infrastructure, he has contributed to the sustainable growth and modernization of one of Saudi Arabia's most strategically significant cities.

Abdullahi Ahmed Mohamud is a Master's student in Engineering Management at the Islamic University of Madinah, where he is completing his thesis as the final requirement for graduation. He holds a Bachelor's degree in Civil Engineering from the same institution. His research interests include financial analysis, risk management, corporate governance, business sustainability, and strategic decision-making. He has built a strong interdisciplinary background combining civil engineering with management, along with practical skills in project management, financial analysis, and organizational development. His work focuses on improving operational efficiency and supporting sustainable business practices. He is dedicated to academic excellence and producing research that advances the field of engineering management.

Appendix

Correlations

Factors	SCOPE	COMM	DISPTE	PERMIT	DECIS	LTDELV	SKILL	FORLBR	CONMTI	FUND	PAYTRN	WEATHR	MATRLS	CSTOVR	REPUT	LGRISK	CLIRTN	STRSS	SUPREL	SCHSPL	LOSTCL	EMPMRI	FINPRF
SCOPE	1.000																						
COMM	0.272	1.000																					
DISPTE	0.240	0.168	1.000																				
PERMIT	0.125	0.333	0.173	1.000																			
DECIS	0.107	0.250	-0.005	0.437	1.000																		
LTDELV	0.178	0.168	0.052	0.389	0.312	1.000																	
SKILL	0.253	0.164	0.101	0.387	0.269	0.453	1.000																
FORLBR	-0.012	0.103	0.095	0.159	0.167	0.204	0.259	1.000															
CONMTI	0.155	0.216	0.171	0.177	0.151	0.192	0.278	0.380	1.000														
FUND	0.260	0.147	0.178	0.183	0.123	0.208	0.186	-0.110	0.107	1.000													
PAYTRN	0.041	0.187	0.232	0.048	0.092	0.064	0.047	0.066	0.205	0.410	1.000												
WEATHR	0.064	0.059	0.237	0.303	0.131	0.263	0.175	0.326	0.230	0.130	0.221	1.000											
MATRLS	0.078	0.040	0.179	0.299	0.253	0.375	0.316	0.234	0.291	0.242	0.253	0.490	1.000										
CSTOVR	0.109	0.068	0.136	0.145	0.030	0.047	0.156	0.167	0.164	0.041	0.174	0.064	0.000	1.000									
REPUT	0.270	0.109	0.331	0.096	0.169	0.036	0.189	0.125	0.210	0.165	0.127	0.193	0.213	0.309	1.000								
LGRISK	0.125	0.092	0.159	0.176	0.211	0.284	0.050	0.076	0.264	0.149	0.231	0.206	0.325	0.236	0.381	1.000							
CLIRTN	0.197	0.096	0.192	0.258	0.229	0.240	0.252	0.183	0.266	0.404	0.281	0.286	0.386	0.196	0.474	0.437	1.000						
STRSS	0.102	0.046	0.103	0.088	0.192	0.151	0.177	-0.057	0.156	0.212	0.178	0.121	0.126	0.112	0.214	0.159	0.374	1.000					
SUPREL	0.058	0.120	0.231	0.022	0.201	0.228	0.072	0.266	0.218	0.004	0.258	0.138	0.197	0.093	0.396	0.381	0.279	0.234	1.000				
SCHSPL	0.043	-0.056	0.061	0.003	0.238	0.124	0.086	0.226	0.184	-0.039	0.038	0.090	0.057	0.134	0.303	0.243	0.280	0.235	0.386	1.000			
LOSTCL	0.096	0.104	0.151	0.116	0.142	0.272	0.119	0.169	0.128	0.004	0.174	0.097	0.088	0.144	0.283	0.367	0.304	0.291	0.311	0.431	1.000		
EMPMRI	0.133	0.034	0.212	0.116	0.138	0.095	0.167	0.183	0.151	-0.005	0.186	0.175	0.143	0.126	0.328	0.302	0.209	0.387	0.204	0.292	0.569	1.000	
FINPRF	0.148	0.158	-0.001	-0.022	0.153	0.238	0.139	0.011	0.058	0.104	0.174	-0.015	0.186	0.166	0.315	0.260	0.247	0.294	0.235	0.195	0.416	0.386	1.000

Table A Full 23 x23 Correlation Matrix

Note. Variable codes used in the correlation matrix are defined as follows: SCOPE = Scope Changes; COMM = Communication; DISPTE = Stakeholder Disputes; PERMIT = Permit Delay; DECIS = PM Decision-Making; LTDELV = Late Deliveries; SKILL = Skilled Labor; FORLBR = Foreign Labor; CONMTH = Construction Methods; FUND = Funding Issues; PAYTRN = Payment Transparency; WEATHR = Weather Conditions; MATRLS = Material Shortages; CSTOVR = Cost Overruns; REPUT = Reputation; LGRISK = Legal Risk; CLIRTN = Client Retention; STRSS = Employee Stress; SUPREL = Supplier Relations; SCHSPL = Schedule Spillover; LOSTCL = Lost Clients; EMPMRL = Employee Morale; FINPRF = Financial Performance