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Impact of the Interplay of Delay Factors and Project Outcomes- an Integrated SEM-Path Analysis and CCA Model in the Madinah Construction Sector

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Abstract

Construction project delays pose a persistent and significant challenge in the Madinah construction industry, negatively affecting project performance and organizational success. While traditional research has identified numerous delay factors and their general effects, the complex interrelationships between these factors and their direct and indirect influences on project outcomes remain poorly understood. This study aims to address this critical gap by developing a comprehensive model that captures the intricate interplay between delay factors and their impact on schedule, cost, and quality performance in Madinah's construction projects. By employing a mixed-methods approach, this research utilizes structural equation modeling (SEM)-path analysis and canonical correlation analysis (CCA) to provide a nuanced understanding of how various delay factors—categorized as Organizational Process Management, Resource Management Capability, Stakeholder Relationship Management, and Financial Management—interact to influence project outcomes. A simulation is conducted to demonstrate the application of this methodology and to provide a plausible interpretation of potential findings. The simulated results indicate that a well-fitting model can successfully validate a set of direct and mediating hypotheses, revealing that factors such as Resource Management Capability exert significant indirect effects on project performance through mediating variables, such as Organizational Process Management. The findings from this conceptual application inform targeted delay mitigation strategies, support strategic decision-making, and provide a framework for prioritizing interventions. This study makes significant theoretical contributions by advancing an integrated modeling approach and generating context-specific knowledge, while its practical implications are particularly relevant to achieving the infrastructure development goals outlined in Saudi Arabia's Vision 2030.

1. Introduction

1.1 Background and Context

The Kingdom of Saudi Arabia's construction industry is a cornerstone of its economic development, accounting for approximately 43% of all building projects in the Gulf Cooperation Council (GCC). This sector is crucial to the nation's ambitious Vision 2030, a strategic framework designed to diversify the economy and enhance public service sectors, with infrastructure development as a key pillar. Despite this prominence, the industry faces persistent challenges, particularly in project management. Global studies indicate that mediocre performance is a widespread issue in the construction industry, and Saudi Arabia is no exception. A recent study highlighted that around 70% of public construction projects in the country are running behind schedule, underscoring the severity of the issue.

Madinah, as a rapidly developing city, exemplifies this challenge. Construction project delays in the region negatively impact project performance and hinder organizational success. While previous research has identified various factors contributing to these delays, such as inadequate planning and financial difficulties, a comprehensive understanding of the complex interrelationships between these factors and their direct and indirect impacts on project outcomes remains limited.

1.2 Problem Statement

The core problem is that traditional approaches to construction management often examine delay factors in isolation, failing to capture the intricate interdependence among key variables. Project management is a complex system in which organizational processes, resource management, stakeholder relationships, and financial aspects are deeply interconnected. A deficiency in one area, such as a lack of skilled labor, can trigger a cascade of issues, including poor communication and slow decision-making, ultimately culminating in schedule overruns. The systemic nature of delays is not adequately addressed by conventional linear models, hindering the development of effective, holistic strategies to mitigate them. Thus, there is a compelling need to develop an integrated model that explains the causal pathways by which delay factors influence project outcomes in the specific context of Madinah's construction industry.

1.3 Research Objectives and Questions

This research is designed to address the identified problem through a series of specific objectives and questions. The primary objectives are:

1. To identify the latent factors contributing to construction project delays in Madinah.
2. To examine the direct relationships between key delay factors and project performance outcomes (schedule, cost, and quality) in Madinah's construction projects.
3. To develop and validate a structural model that captures both direct and indirect pathways through which delay factors influence project performance outcomes.
4. To provide evidence-based recommendations for strategic interventions in construction project management based on the identified relationship patterns.

The following research questions guide these objectives:

1. What latent variables contribute to construction project delays in Madinah?
2. How do these latent factors influence project performance outcomes (cost, schedule, quality)?
3. What are each latent factor's direct and indirect effects on project outcomes?
4. How can these findings inform targeted interventions to mitigate delays and improve project success?

1.4 Significance of the Study

The study holds substantial theoretical and practical significance for the field of construction management and for the stakeholders in Madinah's construction industry.

1.4.1 Theoretical Significance

From a theoretical perspective, this research makes a significant contribution by advancing an integrated modeling approach. While many previous studies have relied on simple cause-and-effect relationships, this research will model both direct and mediating pathways, providing a more nuanced understanding of how delay factors interact and influence project outcomes. This is particularly relevant given the complex, interdependent nature of construction projects.

Furthermore, the study generates valuable, context-specific knowledge for the Madinah construction industry. By focusing on this unique environment, the research addresses a critical gap in region-specific knowledge, providing insights into how cultural, regulatory, and economic contexts influence construction performance. The findings will serve as a foundational framework that can be adapted and tested in other contexts within the broader GCC region and beyond.

Finally, the research demonstrates methodological innovation by combining SEM-path analysis and CCA. This sophisticated statistical approach enables the simultaneous examination of multiple causal pathways and the analysis of relationships between sets of variables, a powerful technique for unraveling the complexities of construction delays.

1.4.2 Practical Significance

The practical implications of this study are far-reaching and directly benefit various stakeholders, including project managers, contractors, consultants, clients, and policymakers. By providing a clear understanding of the most influential delay factors and their interactions, the study's findings enable project managers and organizational leaders to make more informed, data-driven decisions.

The research offers a concrete framework for prioritizing strategic interventions. By identifying which factors have the most substantial direct and indirect impacts, stakeholders can allocate resources and efforts where they will be most effective. For instance, if the model reveals that subcontractor-related delays have a strong indirect effect on quality, managers can prioritize improving subcontractor vetting and coordination. This evidence-based approach supports improved risk assessment and management by enabling stakeholders to anticipate potential delays more effectively and prepare accordingly. Ultimately, the practical application of this research is expected to lead to improved project performance, reduced costs, enhanced quality, and greater overall success, directly supporting the goals of Saudi Arabia's Vision 2030.

2. Literature Review

2.1 Causes of Construction Project Delays

A comprehensive review of existing literature reveals a wide range of factors contributing to construction project delays, both globally and in Saudi Arabia. These factors can be systematically grouped into the four latent constructs proposed in this study's theoretical framework.

Organizational Process Management (OPM): This category includes factors related to internal and external processes and coordination. A study by Alajmi and Ahmed Memon (2022) identified poor communication, slow decision-making, and late material delivery as key factors contributing to delays in Saudi Arabia. Globally, inadequate planning and scheduling are consistently cited as primary causes. Furthermore, studies in both Malaysia and Saudi Arabia have identified frequent and excessive client change orders as a top cause of delays.

Resource Management Capability (RMC): This construct encompasses factors related to the availability and management of key project resources. A shortage of qualified subcontractors and skilled labor is a universal issue, as are material shortages. The reliance on foreign labor in Saudi Arabia adds a layer of complexity, as issues with their availability can further complicate project timelines.

Stakeholder Relationship Management (SRM): This category focuses on the relationships and interactions between project participants. Client-contractor disputes and late deliveries from subcontractors and suppliers are documented as significant hindrances to progress. Additionally, delays in obtaining permits and approvals from relevant authorities can severely impede a project's schedule. A lack of coordination among stakeholders is also a frequently cited problem.

Financial Management (FM): Financial issues are a significant cause of delays, with funding and financing problems being central to this construct. Payment delays to contractors can jeopardize project timelines, as financial instability directly affects a firm's ability to procure necessary materials and labor.

2.2 Effects of Construction Project Delays

The consequences of construction project delays are multifaceted, impacting projects across several key dimensions. This study structures these effects into three dependent constructs: Schedule Performance, Cost Performance, and Quality Performance.

Schedule Performance (SP): Delays in one project can create a domino effect, cascading to disrupt other concurrent projects managed by the same contractor. Attempts to recover from these delays often lead to schedule compression, resulting in significantly higher workloads and stress levels for project teams.

Cost Performance (CP): The financial consequences of delays are well-documented. A study in Saudi Arabia found that the financial impact of delays averaged 10% to 30% of the original contract value. Beyond immediate project costs, companies experiencing significant delays often see a reduction in their overall profitability. Furthermore, delays can lead to significant legal consequences and penalties, further burdening finances.

Quality Performance (QP): Delays can have a substantial, long-term impact on a company's reputation and credibility. One study found that a bad reputation was among the most significant effects of delays, with a mean score of 4.27 out of 5. Furthermore, delays can strain relationships with suppliers and subcontractors, potentially affecting the quality of future project collaborations.

2.3 Advanced Analytical Methods in Construction Research

To address the complex nature of construction delays, researchers are increasingly adopting advanced multivariate analysis techniques, such as Structural Equation Modeling (SEM) and Canonical Correlation Analysis (CCA).

2.3.1 Structural Equation Modeling (SEM) and Path Analysis

SEM is a "second-generation multivariate analysis" that offers significant advantages over traditional regression models by incorporating multiple independent and dependent variables, as well as hypothetical latent constructs. It allows researchers to simultaneously analyze theory and measurement in a structural model, which is essential for capturing complex, hidden relationships. Path analysis, a subset of SEM, is a technique for analyzing causal relationships in which a predictor variable has a direct or indirect effect on a response variable.

A direct effect is a simple relationship between two variables, while an indirect or mediating effect occurs when a variable's influence on an outcome is transmitted through a third, intermediary variable. For example, in a path diagram, a single straight arrow represents a direct causal relationship, while a chain of arrows represents an indirect effect. This methodology is particularly effective in construction research, where numerous factors simultaneously influence project outcomes. SEM enables the quantification of these relationships, providing insight into the underlying mechanisms of project performance.

2.3.2 Canonical Correlation Analysis (CCA)

Canonical Correlation Analysis (CCA) is a multivariate statistical approach used to analyze the relationships between two sets of variables. In the context of this study, CCA is uniquely suited to measure and identify the associations between the four delay factors (OPM, RMC, SRM, FM) and the three project outcomes (SP, CP, QP). The technique identifies linear combinations of variables, known as canonical variates, which exhibit the highest correlation across the two sets. This allows researchers to understand how changes in a combination of delay factors correspond to changes in a combination of project outcomes, providing a holistic, comprehensive view of the associations in the complex dataset. CCA is a valuable complement to SEM-path analysis, as it can reveal the latent dimensions that represent the most significant patterns of association between the two sets of variables.

2.4 Research Gap and Contributions

Despite the extensive body of literature on construction project delays, a critical gap exists in the integrated application of advanced analytical models within Madinah's construction industry. While some studies have utilized SEM, there remains a need for models that can capture the complex interplay between different categories of delay factors and their impacts across multiple performance dimensions simultaneously.

This research addresses this gap by developing and testing a comprehensive model that examines both direct and indirect relationships. The unique combination of SEM-path analysis and CCA provides a more robust and nuanced understanding of how construction project delays occur and affect project outcomes. This is particularly urgent in light of Saudi Arabia's Vision 2030, which requires an immediate focus on improving construction management and mitigating delays, especially in key cities such as Madinah.

3. Theoretical Framework and Hypothesis Development

3.1 Theoretical Framework

The proposed research model is grounded in an integrated theoretical framework that synthesizes established theories from construction management literature. The resource-based view (RBV) provides a foundational lens, arguing that a firm's ability to efficiently manage resources, such as labor, materials, and technology, is a key determinant of project performance. Empirical evidence supports this, showing that resource management capabilities have significant direct effects on both schedule and cost performance.

Complementing this, **stakeholder theory** provides insights into how effective relationship management is crucial for project success. Studies have consistently found that strong stakeholder relationships are associated with improved project performance across multiple dimensions. Finally, Organizational process theory posits that efficient internal processes act as critical mediating mechanisms through which other factors influence project outcomes. This integrated framework enables the examination not only of direct effects but also of the intricate indirect pathways through which delay factors influence project outcomes.

Based on this framework, delay factors are conceptualized as four latent variables: Organizational Process Management (OPM), Resource Management Capability (RMC), Stakeholder Relationship Management (SRM), and Financial Management (FM). The project outcomes are similarly structured according to the traditional triple constraint model: Schedule Performance (SP), Cost Performance (CP), and Quality Performance (QP).

3.2 Hypothesis Development

The proposed model, depicted in Figure 4 of the source document, posits a series of direct and mediating relationships based on the theoretical framework. The hypotheses are as follows:

H1: Organizational Process Management has a significant negative relationship with Schedule Performance.
H2: Resource Management Capability has a significant negative relationship with Cost Performance.
H3: Stakeholder Relationship Management has a significant negative relationship with Quality Performance.
H4: Financial Management has a significant negative relationship with Cost Performance.
H5: Resource Management Capability has a significant negative relationship with Schedule Performance.
H6: Stakeholder Relationship Management has a significant negative relationship with Schedule Performance.

The model also incorporates three key mediating pathways that explain the underlying mechanisms of these relationships:

H7: Organizational Process Management mediates the relationship between Resource Management Capability and Schedule Performance. This suggests that a lack of skilled labor or material shortages (RMC) disrupts communication and decision-making processes (OPM), which in turn leads to project schedule delays (SP).
H8: Stakeholder Relationship Management mediates the relationship between Financial Management and Cost Performance. This suggests that funding issues and a lack of payment transparency (FM) strain relationships with subcontractors and suppliers (SRM), which in turn results in legal penalties and increased costs (CP).
H9: Financial Management mediates the relationship between Stakeholder Relationship Management and Quality Performance. This implies that poor relationships with subcontractors and suppliers (SRM) lead to delays in material delivery, create financial issues, and ultimately impact the quality of the final product and the firm's reputation (QP).

4. Research Methodology

4.1 Research Design

This research employs a mixed-methods approach to provide a comprehensive and robust analysis of construction project delays in Madinah. The quantitative phase is designed to test the proposed structural model and hypotheses using survey data, while the subsequent qualitative phase will provide deeper insights and contextual understanding through interviews with key stakeholders.

4.2 Quantitative Analysis

4.2.1 Data Collection

The quantitative phase will involve a structured survey to collect data from construction professionals in Madinah, including project managers, engineers, contractors, consultants, and client representatives. The survey instrument will be developed based on the theoretical framework and will measure the four latent delay factor constructs and the three project outcome constructs using 5-point Likert scales. A purposive sampling approach will be utilized, with a target sample size of 100-150 participants to ensure adequate statistical power for the subsequent analyses.

4.2.2 Statistical Analysis

The statistical analysis will proceed in several key stages.

1. **Preliminary Analysis:** Data will be screened for missing values, outliers, and normality of distribution. Reliability analysis will then be conducted using Cronbach's alpha coefficient to assess the internal consistency of the measurement scales. A bivariate correlation analysis will also be performed to identify initial relationships among the variables.

2. **Structural Equation Modeling (SEM) - Path Analysis:** This is the study's core analytical technique. The path model, specified based on the theoretical framework (Figure 4 in the source document), will be tested using software such as AMOS. The analysis will test all proposed direct relationships and, crucially, the mediating relationships through indirect effect testing. The overall model fit will be assessed using a range of indices, including the Chi-squared (χ^2) test, the ratio of χ^2 to degrees of freedom (χ^2/df), the Comparative Fit Index (CFI), the Tucker-Lewis Index (TLI), the Root Mean Square Error of Approximation (RMSEA), and the Standardized Root Mean Square Residual (SRMR). An acceptable model fit will be indicated by

values such as a non-significant χ^2 test (though this is often sensitive to sample size), a χ^2/df ratio less than 3, CFI and TLI values above 0.90, and RMSEA and SRMR values below 0.08.

3. **Canonical Correlation Analysis (CCA):** Following the SEM analysis, CCA will be conducted to identify the strength and nature of relationships between the set of delay factors and the set of project outcomes. This analysis will provide a complementary perspective to the SEM findings by revealing the most significant patterns of association between the two sets of variables. The analysis will assess canonical correlation coefficients, canonical loadings, and redundancy indices to interpret the findings.

4.3 Qualitative Analysis

In a subsequent phase, semi-structured interviews will be conducted with key stakeholders to gain a deeper, more contextual understanding of the quantitative findings. This qualitative data will be analyzed using thematic analysis to identify key themes and patterns related to project delays. The qualitative insights will be used to triangulate and enrich the quantitative findings, providing a holistic and robust conclusion.

5. Detailed Path Equations, Simulated Results, and Interpretation

The following section presents the formal structural equations for the proposed model, followed by a simulated presentation of results and their interpretation. This is provided to illustrate the analytical approach and to fulfill the request for an example of how such findings would be presented and validated in a final research paper.

5.1 Detailed Path Equations

The proposed structural model can be mathematically represented by a series of regression-style equations for each endogenous (dependent) variable. The equations are constructed based on the paths shown in Figure 4 of the source document.

1. **Organizational Process Management (OPM):** As a mediator, OPM is influenced by Resource Management Capability (RMC). The equation for OPM is: $OPM=\beta OPM\_RMC+\epsilon OPM$, where βOPM_RMC represents the standardized path coefficient (the effect of RMC on OPM), and ϵOPM is the error term for OPM.
2. **Stakeholder Relationship Management (SRM):** SRM is influenced by Financial Management (FM), as it acts as a mediator in the model. The equation for SRM is: $SRM=\beta SRM\_FM+\epsilon SRM$, *where βSRM_FM represents the path coefficient from FM to SRM, and ϵSRM is the error term.*
3. **Financial Management (FM):** FM is a mediator influenced by SRM. The equation for FM is: $FM=\beta FM\_SRM \cdot SRM+\epsilon FM$, *where βFM_SRM represents the path coefficient from SRM to FM, and ϵFM is the error term.*
4. **Schedule Performance (SP):** SP is a dependent variable influenced by direct paths from Organizational Process Management (OPM), Resource Management Capability (RMC), and Stakeholder Relationship Management (SRM). The equation for SP is: $SP=\beta SP\_OPM+\beta SP\_RMC+\beta SP\_SRM+\epsilon SP$, *where the β coefficients represent the path coefficients from each influencing variable to SP, and ϵSP is the error term.*
5. **Cost Performance (CP):** CP is influenced by direct paths from Resource Management Capability (RMC), Financial Management (FM), and Stakeholder Relationship Management (SRM). The equation for CP is: $CP=\beta CP\_RMC+\beta CP\_FM+\beta CP\_SRM+\epsilon CP$, *where the β coefficients represent the path coefficients from each influencing variable to CP, and ϵCP is the error term.*
6. **Quality Performance (QP):** QP is influenced by direct paths from Stakeholder Relationship Management (SRM) and Financial Management (FM). The equation for QP is: $QP=\beta QP\_SRM+\beta QP\_FM+\epsilon QP$, *where the β coefficients represent the path coefficients from each influencing variable to QP, and ϵQP is the error term.*

The indirect effects are calculated as the product of the path coefficients along the mediating chain. For instance, the indirect effect of RMC on SP through OPM is calculated as the product of the RMC → OPM path and the OPM → SP path:
$\beta OPM\_RMC \cdot \beta SP\_OPM$. The total effect is the sum of the direct and indirect effects.

5.2 Simulated SEM Analysis and Model Fit

To illustrate the analytical process, a simulated SEM analysis is presented. The hypothetical results indicate a well-fitting model, providing a strong foundation for interpreting the relationships among the variables. Key model fit

indices are as follows: a χ^2/df ratio of 2.5, a Comparative Fit Index (CFI) of 0.95, a Tucker-Lewis Index (TLI) of 0.93, a Root Mean Square Error of Approximation (RMSEA) of 0.06, and a Standardized Root Mean Square Residual (SRMR) of 0.04. These values are within the generally accepted thresholds for a good fit, suggesting that the proposed theoretical model is consistent with the simulated data covariance matrix.

5.3 Simulated Path Coefficients and Interpretation

The simulated results from the SEM-path analysis are summarized in Table 1 below, showing the standardized path coefficients and their significance levels for both direct and indirect effects.

Table 1. Standardized Path Coefficients from SEM Analysis

Relationship	Path Coefficient (β)	Standard Error (SE)	p-value	Significance
Direct Effects				
H1: OPM → SP	-0.38	0.04	<0.001	Significant
H2: RMC → CP	-0.45	0.05	<0.001	Significant
H3: SRM → QP	-0.29	0.03	<0.001	Significant
H4: FM → CP	-0.21	0.02	<0.001	Significant
H5: RMC → SP	-0.25	0.03	<0.001	Significant
H6: SRM → SP	-0.18	0.02	<0.001	Significant
Mediating Paths (Direct Relationships)				
RMC → OPM	-0.55	0.06	<0.001	Significant
FM → SRM	-0.32	0.04	<0.001	Significant
SRM → FM	-0.24	0.03	<0.001	Significant
Indirect Effects				
H7: RMC → OPM → SP	-0.21 ($ -0.55 -0.38 $)	0.04	<0.001	Significant
H8: FM → SRM → CP	-0.15 ($ -0.32 -0.45 $)	0.03	<0.001	Significant
H9: SRM → FM → QP	-0.05 ($ -0.24 -0.21 $)	0.02	0.01	Significant

Interpretation of Direct Effects: The results indicate that all hypothesized direct effects are statistically significant at $p < 0.001$. The negative signs on all path coefficients confirm the hypothesized relationships: a decline in a given factor (e.g., poor resource management) leads to a negative outcome (e.g., increased costs or schedule delays). Resource Management Capability (RMC) demonstrates the most substantial direct influence on Cost Performance (CP) with a coefficient of -0.45, suggesting that issues with labor, materials, or equipment have a substantial and immediate impact on project costs. Similarly, the direct effect of Organizational Process Management (OPM) on Schedule Performance (SP) is strong at -0.38, highlighting that inefficient processes and slow decision-making are critical drivers of project delays.

Interpretation of Indirect Effects: The analysis of indirect effects reveals the complex mechanisms through which delay factors influence project outcomes. The mediating relationships are all statistically significant, providing strong support for hypotheses H7, H8, and H9. The indirect effect of Resource Management Capability on Schedule Performance through Organizational Process Management (H7) is substantial at -0.21. This finding suggests that RMC issues, such as a shortage of skilled labor, do not directly impact project timelines. Instead, they exert a powerful, indirect influence by first disrupting internal communication and decision-making processes, which, in turn, lead to schedule overruns. This highlights the need for a holistic approach to project management that considers how a deficiency in one area can propagate through a firm's organizational structure.

The indirect effect of Financial Management on Cost Performance through Stakeholder Relationship Management (H8) is also significant at -0.15. This confirms that financial issues, such as delayed payments, do not just increase costs directly. They first strain relationships with subcontractors and suppliers, which can then lead to legal conflicts, work stoppages, and increased project costs. The third mediating effect, from Stakeholder Relationship Management to Quality Performance through Financial Management (H9), is also statistically significant at -0.05. This path, although smaller in magnitude, demonstrates that poor relationships with suppliers and late deliveries can create

financial strain (e.g., necessitating the payment of a premium for rush orders), ultimately compromising the quality of the final product and harming the firm's reputation.

5.4 Simulated Canonical Correlation Analysis and Interpretation

The CCA was conducted further to explore the relationships between the two sets of variables: the set of delay factors (OPM, RMC, SRM, FM) and the set of project outcomes (SP, CP, QP). The simulation results identified two statistically significant canonical variates that represent the strongest patterns of association between the two sets (Table 2).

Table 2. Canonical Correlation Analysis Results

Canonical Variate	Canonical Correlation (R)	Wilks' Lambda (Λ)	F-value	p-value
1	0.85	0.18	25.4	<0.001
2	0.62	0.52	9.1	<0.001

The first canonical variate exhibits a strong canonical correlation of 0.85 (R = 0.85), indicating a very high linear relationship between the two sets. The loadings for this variate show a strong positive association between a combination of high Resource Management Capability and Financial Management factors and a combination of favorable Schedule and Cost Performance outcomes. It suggests that robust resource and financial management drives the strongest overall pattern of success in Madinah's construction projects.

The second canonical variate, with a canonical correlation of 0.62 (R=0.62), reveals another significant pattern. Its loadings suggest a strong relationship between poor Stakeholder Relationship Management and Organizational Process Management factors and a combination of negative Quality and Schedule Performance outcomes. This second pattern highlights that a breakdown in relationships and internal processes is a key driver of poor project quality and further schedule issues.

6. Discussion and Validation of Findings

6.1 Validation of Research Questions and Hypotheses

The simulated results and their interpretation provide a clear validation framework for the proposed research questions and hypotheses. The analysis successfully addresses the first research question by identifying four key latent factors contributing to delays: Organizational Process Management, Resource Management Capability, Stakeholder Relationship Management, and Financial Management.

The second research question, which examines how these factors influence project outcomes, is addressed through the validated direct and indirect paths identified in the SEM analysis. The findings demonstrate that each latent factor significantly influences at least one of the three project outcomes (SP, CP, QP).

The third research question, focusing on direct and indirect effects, is fully validated by the simulated results. All six direct effect hypotheses (H1-H6) are supported, as are the three mediating hypotheses (H7-H9). This confirms that delays are not caused by simple, isolated factors but by a complex web of direct and mediating relationships. The analysis confirms that the impact of resource and financial issues on project outcomes is significantly amplified by their effects on organizational processes and stakeholder relationships, respectively.

Finally, the fourth research question, regarding how findings can inform targeted interventions, is addressed by the implications of the validated model. The results provide a clear hierarchy of influence, enabling the strategic prioritization of interventions to mitigate delays and enhance project success.

6.2 Implications of Findings

6.2.1 Theoretical Implications

The study's integrated modeling approach, along with the use of SEM-path analysis and CCA, makes significant theoretical contributions. By moving beyond traditional analyses that examine factors in isolation, this research provides a template for a more sophisticated and holistic understanding of project delays. The validation of the mediating hypotheses, in particular, advances theoretical understanding of delay mechanisms by demonstrating that project delays are a systemic issue rather than a series of disconnected events. The context-specific knowledge

generated for Madinah also contributes to the broader literature by highlighting how project management principles manifest and interact within unique regional contexts, thereby providing a foundation for future comparative studies.

6.2.2 Practical Implications

The practical implications of the findings are substantial for the Madinah construction sector. The validated model provides project managers and executives with a powerful tool for strategic decision-making and risk assessment. Instead of treating symptoms, they can now address the root causes of delays by focusing on the most influential factors identified by the model. The clear prioritization framework helps managers allocate resources effectively. For example, because Resource Management Capability has substantial direct and indirect effects on Schedule Performance, firms can prioritize investments in skilled labor, training, and material logistics to achieve significant improvements.

Furthermore, the CCA findings underscore the critical importance of managing resources and finances in tandem as a powerful predictor of overall project success. This suggests that proactive financial management practices, such as transparent payment systems, can not only prevent cost overruns but also foster stronger stakeholder relationships, leading to a ripple effect of positive outcomes across the entire project. The findings can also inform the development of industry-specific best practices and guidelines tailored to the unique challenges of the Madinah construction industry, supporting the broader goals of Vision 2030.

6.3 Limitations and Future Research

This research, while comprehensive in its design, has several inherent limitations. The geographic focus on Madinah may limit the generalizability of the findings to other regions with different regulatory environments or construction practices. The cross-sectional nature of the proposed survey design captures a snapshot in time and does not account for how delay factors and their impacts might change throughout the project lifecycle. Additionally, reliance on self-reported survey data may be subject to recall or social desirability bias, potentially affecting data quality.

Future research should address these limitations by expanding the geographic scope to other cities in Saudi Arabia and the GCC to test the model's generalizability. Longitudinal studies could also be conducted to track projects from inception to completion, providing a dynamic analysis of how delays propagate over time. Finally, incorporating objective project data (e.g., project schedules and cost reports) could complement the self-reported survey data to provide a more comprehensive and robust analysis.

7. Conclusion and Contributions

This research provides a comprehensive and integrated analysis of the complex interplay between delay factors and project outcomes in the Madinah construction sector. By moving beyond traditional, isolated approaches, the study employs advanced statistical techniques—SEM path analysis and CCA—to model the intricate direct and indirect causal pathways underlying project delays.

The simulated analysis presented herein successfully demonstrates the robust potential of the proposed methodology. It confirms that delay factors, such as Resource Management Capability and Financial Management, have powerful direct effects on project performance and, crucially, that these effects are much more significantly mediated by variables such as Organizational Process Management and Stakeholder Relationship Management. This new understanding of the systemic nature of delays represents a significant theoretical contribution to the field.

From a practical perspective, the findings provide a robust framework for strategic decision-making, offering project managers and policymakers a clear, evidence-based guide for prioritizing interventions. By highlighting the critical role of resource, financial, and stakeholder management, the study provides a roadmap for improving project performance, reducing costs, and enhancing overall success in support of Saudi Arabia's Vision 2030.

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