

# The Current Advance Tools & Techniques Organisational and Environmental Factors in PMO Effectiveness in KSA

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This study examines how stakeholder engagement serves as an intermediary for the Project Management Offices (PMOs) in the construction industry, the implementation of advanced project management tools, and the impact of both internal and external factors. Over 70% of industry-wide initiatives to accomplish ambitious mega-projects fail dramatically, despite significant pressure to succeed. Drawing on the Technology-Organization-Environment (TOE) framework, Dynamic Capabilities Theory, and Stakeholder Theory, we develop a conceptual model that considers technological dimensions—such as tool complexity, relative advantage, and compatibility—alongside organizational factors like top management commitment and PMO structure, and environmental forces including competitive intensity. These elements appear to drive PMO effectiveness largely by strengthening stakeholder involvement. The study employs a quantitative methodology utilizing Partial Least Squares Structural Equation Modelling (PLS-SEM) to produce substantial empirical evidence, set against the backdrop of Saudi Vision 2030's significant infrastructure initiatives, where proficient Project Management Offices (PMOs) are crucial for realizing national objectives. The findings are expected to enhance project management scholarship and provide construction leaders with practical guidance for managing digital transformation amid swift economic changes.

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## I. INTRODUCTION

The 21st-century global landscape is increasingly characterized by nations pursuing ambitious, large-scale strategic initiatives to ensure future prosperity, economic resilience, and geopolitical influence. These initiatives, frequently appearing as portfolios of intricate mega-projects, signify a paradigm shift in national planning and implementation (Bourne et al., 2023; Söderlund et al., 2017).

This research investigates the dynamics of PMO effectiveness within this unique and challenging context. It posits that the effectiveness of PMOs in achieving their strategic goals relies on the synergistic interplay of advanced project management tools and favourable organizational factors. This research asserts that the benefits of these enablers are enhanced by the

The Kingdom of Saudi Arabia's Vision 2030 represents a highly ambitious and transformative agenda, reliant on the successful execution of giga-projects of unparalleled scale and complexity (Berge et al., 2025). The proficient administration of these significant projects has positioned the field of project management, particularly the function of the Project Management Office (PMO), at the intersection of strategy and implementation (Ichsan et al., 2023).

Project Management Offices (PMOs) have assumed increased significance. They serve as an essential organizational framework, enhancing project success through standardized procedures, established methodologies, and carefully selected tools ultimately establishing a more robust foundation for excelling in a high-pressure environment.

PMO's capacity to engage stakeholders effectively. (Alghaseb & Alali, (2024); Asfahani et al., (2025) assert that initiatives such as NEOM, The Red Sea Project, AMAALA, and Qiddiya represent complex, interconnected systems designed to create entirely new industries and ecosystems.

Conventional project management methodologies, characterized by linear planning, compartmentalized departmental roles, and manual documentation, are inadequate for managing this degree of complexity. These methods frequently neglect the dynamic interdependencies among project components, resulting in inefficiencies, including cost overruns averaging 40-60% and suboptimal resource utilization (Ershadi et al., 2021). Research demonstrates that mega-projects in Saudi Arabia intensify these risks due to their magnitude, with studies indicating that fragmented management structures exacerbate problems such as environmental non-compliance and stakeholder conflicts (Alotaibi et al., 2024).

Vision 2030's digital mandate has expedited the incorporation of sophisticated tools such as Building Information modelling (BIM), Project Management Information Systems (PMIS), Artificial Intelligence (AI), Machine Learning (ML), and Internet of Things (IoT) technologies (Berge et al., 2025). Saudi Arabia's Vision 2030 exemplifies this trend, delivering giga-projects of unprecedented scale, including NEOM at USD 500 billion (Berge et al., 2025). This study seeks to empirically examine the influence of technological and organizational factors, mediated by stakeholder engagement, on the operational effectiveness of PMOs.

## **II. STATEMENT OF THE PROBLEM**

The construction industry presently faces ongoing pressures to attain optimal project results, improve efficiency, and cultivate genuine innovation amid its intrinsic complexity and rapid transformation. This is unsurprising, given that projects often involve intricate interdependencies and unforeseen challenges that can swiftly escalate costs or delays. Efficient project management is crucial for finishing projects on time, within budget, and to the necessary quality standards (Elghaish et al., 2021). In light of ongoing challenges, Environment (TOE) framework, established by (Tornatzky et al., 1990), serves as a foundational structure for analysing technology adoption by delineating three contexts: technological context (attributes of available technologies), organizational context (internal resources and capabilities), and environmental context (external pressures and opportunities). This framework has been thoroughly validated in research within the construction industry

The persistent inefficiency of PMO operations in international construction projects indicates significant shortcomings in our understanding. The study by (Raharjo et al., 2018), illustrate that PMOs face challenges in substantiating their value. Research indicates that 75% of PMOs that terminate operations within three years fail to meet their organizational responsibilities. Merely 33% of PMO users indicate that their frameworks enable timely project completion within budgetary constraints (Ko & Kim, 2019).

Globally, PMO inefficacy has produced significant adverse effects for organizations, leading to wasted resources, diminished stakeholder trust, and strategic discord. The effectiveness of contemporary PMO operations is impeded by fragmented integration with advanced technological tools and methodologies, further aggravated by user resistance to change and organizational cultures that resist innovation (Affonso et al., 2020; Barbalho et al., 2019). Kreiling & Bounfour, (2020); Lindblad & Guerrero, (2020) identified a substantial deficiency in understanding how factors such as complexity, relative advantage, compatibility, PMO structure, upper management support, and competitive pressure influence the adoption of advanced technological tools and their effect on the operational efficacy of PMOs.

The construction sector in Saudi Arabia possesses distinctive characteristics that require focused academic examination. The construction sector in Saudi Arabia operates within a unique socio-economic context significantly shaped by the Vision 2030 initiative, which demands accelerated project delivery, enhanced efficiency standards, and rapid technological progress. Research by Altaefi, (2022) showed that PMOs can improve operational efficiency and significantly reduce project failure rates in Saudi Arabian organizations. However, there is a lack of studies that examine the impact of advanced tools on PMO effectiveness in construction projects.

## **VI. LITERATURE REVIEW**

### **A. Theoretical Framework**

This research combines three complementary theoretical frameworks to create a comprehensive conceptual model. The Technology-Organization-influence strategic execution. In the study conducted by El Khatib et al., (2024), a strong correlation was found between higher process maturity and delivery performance. The research indicates that the relationship between standardization and project success has a coefficient ( $\beta$ ) ranging from approximately 0.30 to 0.45. Typically, PMO maturity models consist of five developmental stages, each representing

that investigates digital transformation initiatives (Felemban et al., 2024; Zhong et al., 2024).

The Dynamic Capabilities Theory asserts that organizations attain success by integrating, developing, and altering their competencies to adapt to evolving conditions (Teece et al., 1997). In the realm of PMOs, effectiveness is optimized when these entities consistently adjust their methodologies, technologies, and stakeholder engagement strategies to accommodate changing conditions. Barbosa & Carvalho, (2024) found that PMOs with strong dynamic capabilities, especially in identifying emerging risks, adopting innovative technologies, and modifying governance structures, achieve improved outcomes in schedule adherence, cost management, and strategic alignment.

Stakeholder Theory, introduced by Freeman, (1984), emphasizes the necessity of managing relationships with all groups impacted by an organization for its success. In the construction industry, stakeholders encompass clients, contractors, regulatory agencies, and communities, each with distinct interests. This theory provides the rationale for perceiving stakeholder engagement as a crucial "mediating" element specifically, the conduit through which technology and organization are transformed into an effective PMO (Mari et al., 2023; Motalebi et al., 2025; Wu et al., 2023).

### *B. PMO Effectiveness in Construction Projects*

The PMO has transformed into an essential organizational unit for aligning project management practices with strategic goals in construction firms. The Dynamic Capabilities View states that a PMO's effectiveness relies on its ability to identify environmental changes, utilize opportunities through standardized methods, and reallocate resources within the organization to sustain a competitive advantage in changing construction environments. In their systematic literature review on PMO typologies, Monteiro et al., (2024) identified governance, support, and control as fundamental functions of PMOs that facilitate organizations' comprehension of market dynamics and emerging project demands.

Sandhu et al., (2024) examined the functions of PMOs in executing strategic plans within project-oriented organizations. Their findings demonstrate that the functions of monitoring and controlling substantially technology implementation.

This encompasses the sufficiency of infrastructure, the competencies of the workforce, and the capability for change management (Wang et al., 2025).

Environmental factors, particularly competitive pressures and regulatory frameworks, affect the contexts of technology adoption in construction projects. In

increasingly sophisticated capabilities for sensing, seizing, and reconfiguring (Firmansyah et al., 2024).

### *F. Advanced Application Tools and Techniques*

Advanced application tools in construction Project Management Offices (PMOs) include technologies such as Building Information Modelling (BIM), Project Management Information Systems (PMIS), Artificial Intelligence (AI), Machine Learning (ML), the Internet of Things (IoT), blockchain, and Virtual/Augmented Reality. The adoption of BIM significantly enhances construction project results, with research demonstrating a decrease in design errors by up to 20% and improved coordination among project stakeholders (Al-Yami & Sanni-Anibire, 2021). The research by Yuan et al., (2023) revealed that simpler and more intuitive technologies generally exhibit higher adoption rates and greater integration success, whereas more complex tools and techniques demonstrate lower adoption rates.

Adoption decisions are heavily influenced by the relative advantage, or the perceived superiority of new tools over existing practices. The adoption of artificial intelligence (AI) by small and medium-sized enterprises (SMEs) in Saudi Arabia is significantly influenced by the perceived performance benefits, according to a study by Badghish & Soomro, (2024). This suggests that businesses that recognize these advantages are more motivated to implement AI. Furthermore, research by Shirowzhan et al., (2020) demonstrates that technologies congruent with current workflows, systems, and organizational culture are more likely to be embraced and integrated successfully.

### *D. Organizational and Environmental Factors*

Top management support is a crucial organizational factor that influences the adoption of advanced tools and the effectiveness of Project Management Offices (PMOs). Their research consistently demonstrates that executive sponsorship is a significant predictor of successful technology implementation. Leaders are essential in resource allocation, ensuring strategic alignment, and conferring organizational legitimacy to digital transformation initiatives (Zada et al., 2023). The framework of a PMO includes the financial, technical, and human resource competencies essential for effective PMO activities; (3) To ascertain the relationship between stakeholder engagement and the improvement of PMO operational effectiveness in construction projects; and (4) To examine the mediating role of stakeholder engagement in the interplay between advanced tools, organizational factors, and PMO effectiveness.

Saudi Arabia, governmental initiatives like MASHROAT and EXPRO demonstrate the evolution of PMOs influenced by competitive dynamics, whereas BIM mandates for public projects since 2019 signify regulatory impact on technology integration (Alghaseb & Alali, 2024). Felemban et al., (2024) identified governmental support as a crucial factor facilitating AI readiness in Saudi construction companies.

#### *E. Stakeholder Engagement as Mediator*

Stakeholder engagement encompasses all the ways an organization identifies, analyses, and communicates with the people involved in a project. Zhang et al., (2023) demonstrated that this engagement plays a critical mediating role essentially serving as the connector between BIM implementation and project performance. Their work provides evidence that technological tools translate into success specifically through the mechanism of engagement. Therefore, effective practice requires systematically identifying stakeholder interests and influence, then using that insight to build tailored communication strategies.

A construction mega-project is notoriously difficult to manage due to the large number of people and organizations involved, including local communities, contractors, international collaborators, and governing bodies. Conflicts of interest often arise from differing objectives and unequal levels of influence among various groups. Xue et al., (2020) contends that active stakeholder engagement in a project result in enhanced outcomes. Nonetheless, they highlight a critical concern: relationships demand time to cultivate, requiring flexible engagement strategies. Digital platforms significantly enhance communication, facilitate data visibility, and promote collaborative decision-making (Martins et al., 2022).

### **III. RESEARCH OBJECTIVES**

The primary objective of this study is to analyse the diverse components related to the implementation of advanced tools and organizational factors affecting PMO efficacy in the Saudi Arabian construction industry. The specific objectives are: (1) To investigate the impact of advanced tools and critical organizational factors on PMO effectiveness in Saudi Arabian construction projects; (2) To assess the influence of diverse characteristics of advanced tools and vital organizational factors on stakeholder engagement in validated instruments and suitable statistical controls alleviates this limitation.

#### **A. SCOPE OF THE STUDY**

This research examines advanced application tools and techniques designed to improve PMO operations in the construction industry, specifically emphasizing technologies such as AI, ML, BIM, IoT, blockchain, VR/AR, and other emerging innovations. The geographical scope is limited to the Kingdom of Saudi Arabia, concentrating on large-scale construction projects associated with Vision 2030 initiatives. This research specifically concentrates on PMOs within the construction sector, omitting those in related domains such as IT and manufacturing. The unit of analysis comprises professionals in project management, including directors, managers, project managers, and senior project coordinators, within Saudi Arabian construction firms.

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#### **C. LIMITATIONS OF THE STUDY**

This study focuses solely on construction projects within the Kingdom of Saudi Arabia. However, due to the homogeneity of the construction sector across countries and project scales, the study's recommendations may be relevant to other nations, especially those in the Gulf Arab region. The cross-sectional research design captures relationships at a specific point in time, which may restrict causal inference. Furthermore, dependence on self-reported data may lead to response bias; however, employing enhance our understanding of the effectiveness of Project Management Offices (PMOs) and provide construction firms with valuable strategies for addressing the challenges of digital transformation. These challenges arise in dynamic economic environments influenced by ambitious national



#### IV. SIGNIFICANCE OF THE STUDY

This study provides critical insights for enhancing PMO efficacy in the demanding context of Saudi Arabia's construction industry. The primary theoretical contribution addresses a substantial gap in project management literature by analysing the interplay between advanced tools, organizational components, and stakeholder engagement within PMO operations. This study identifies stakeholder engagement as a crucial intermediary, thereby broadening stakeholder theory within PMO operations and providing a more sophisticated framework for understanding how PMOs achieve their objectives (Nguyen & Mohamed, 2021; Wembe, 2019).

The practical implications are directly aligned with the strategic objectives of Saudi Arabia's Vision 2030, which depend significantly on the successful implementation of mega-projects in the construction sector. The findings will provide substantial value to industry practitioners, competitive pressure creators, and PMO managers by delivering evidence-based recommendations for the selection and implementation of advanced tools tailored to construction project requirements. The research will offer explicit strategies for enhancing project outcomes, potentially resulting in substantial cost savings and a decrease in project delays prevalent in the Saudi construction sector (Alghaseb & Alali, 2024). Moreover, insights will assist governmental bodies like EXPRO in developing national best-practice guidelines and training programs to enhance project management maturity in the construction sector of the Kingdom.

#### V. CONCLUSIONS

This research examines the essential mechanisms of PMO effectiveness within the transformative framework of Saudi Arabia's Vision 2030 construction projects. This study constructs a comprehensive model by integrating the TOE framework, Contingency Theory, and Stakeholder

Theory to analyse the impact of technological factors (complexity, relative advantage, compatibility), organizational factors (top management support, PMO structure), and environmental factors (competitive pressure) on PMO operational effectiveness, mediated by stakeholder engagement.

The intersection of global PMO inefficacy issues with Saudi Arabia's distinctive contextual elements presents a significant research opportunity that cannot be sufficiently explored through the sole application of Western-derived perspectives. This research aims to

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development initiatives. This study advances the objectives established in Vision 2030. It enhances our understanding of both the theoretical and practical aspects of construction project management.

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