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Impact of Project Innovation on Performance in Oman's Construction Industry: A Narrative Review

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ABSTRACT

This study provides a narrative review of the impact of project innovation on project performance in Oman's construction industry, focusing on three key dimensions: innovative design solutions, advanced technology utilization, and innovative project management practices. The construction sector in Oman faces challenges related to adopting and integrating innovative practices, which hinders optimal project outcomes. The study addresses these challenges by pursuing three objectives: to examine the direct impact of project innovation on performance, assess the mediating role of project interdependence, and observe the moderating effect of innovative culture on these relationships. A qualitative, review methodology was employed, synthesizing existing research from various academic and industry sources. The findings reveal that project innovation significantly enhances performance, especially when supported by strong project interdependence that facilitates effective coordination. Additionally, the review demonstrates that an innovative culture plays a crucial moderating role, fostering a collaborative and adaptive environment that amplifies the benefits of project innovation. The study's implications suggest that fostering an innovative culture, enhancing interdependencies, and supporting the adoption of advanced technologies are essential strategies for improving project outcomes in Oman's construction industry. These findings offer practical recommendations for industry leaders and policymakers to enhance the sector's competitiveness and innovation capacity.

Keywords: Construction industry, Innovative culture, Project innovation, Project interdependence, Project performance.

INTRODUCTION

In today's competitive global economy, innovation has emerged as a critical driver of success across various industries [29,37]. The construction industry, historically characterized by traditional methods and practices, is no exception. In recent years, innovation in design, technology, and project management practices has become essential to maintaining competitiveness, improving efficiency, and meeting the growing complexity of construction projects [36,3]. Specifically, in the construction industry of Oman, a sector that plays a significant role in the country's economic development, innovation has the potential to address unique challenges and enhance overall project performance [12]. However, despite the recognized significance of innovation, there is a limited body of research investigating its specific impacts on project performance within Oman's construction sector.

The construction industry in Oman has witnessed considerable growth over the past decade, driven by large-scale infrastructure projects and increasing urbanization [1,18]. Yet, this growth has not been without challenges. Many projects experience cost overruns, delays, and quality issues, which negatively affect their overall performance [16]. These challenges have led to increased interest in identifying factors that can enhance project outcomes, with innovation being a prominent focus. Innovations, such as advanced design solutions, cutting-edge technologies, and innovative project management practices, have shown promise in transforming the construction landscape in other

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regions [22]. However, their role in Oman's construction industry remains underexplored, necessitating a systematic investigation of their impact on project performance.

The rationale for this study stems from the critical role that innovation can play in addressing performance issues within the construction industry in Oman. While many studies have explored the importance of innovation in global construction markets, the unique context of Oman, with its specific economic, cultural, and regulatory conditions, requires a more focused examination [2]. Oman's construction sector is heavily reliant on foreign expertise and labour, which creates a complex project environment that may either benefit from or hinder innovation [39]. Moreover, the country's construction industry is in a transitional phase, moving from traditional methods to more modern approaches (ibid). Understanding how innovations in design, technology, and project management can improve project performance in this context is crucial for both industry practitioners and policymakers.

Furthermore, the concept of project interdependence, which refers to the degree to which different project components and teams rely on each other to achieve success, has gained attention as a potential mediator in the relationship between innovation and performance [35]. In a complex industry like construction, where projects involve multiple stakeholders and various interrelated tasks, the role of interdependence is particularly significant [26]. However, its mediating effect on the relationship between innovation and project performance remains inadequately explored, especially in the Omani context.

Additionally, the culture of innovation within organizations is another factor that could influence the success of innovative practices [23]. A strong innovative culture may facilitate the adoption and implementation of new solutions, while a lack of such culture could hinder their effectiveness. This study seeks to explore the moderating effect of innovative culture on the relationship between innovation and project performance in Oman's construction industry.

Despite the growing interest in innovation as a key factor in improving project performance, the construction industry in Oman continues to face significant challenges in adopting and implementing innovative practices. The lack of empirical studies examining the impact of innovation on project performance within the Omani construction context creates a gap in understanding how factors like innovative design solutions, advanced technology utilization, and innovative project management practices contribute to better outcomes. Moreover, the role of project interdependence as a mediator and innovative culture as a moderator in this relationship is largely unexplored, leaving industry professionals without a clear understanding of how to leverage these factors for enhanced performance. Given these gaps, a systematic review is essential to synthesize existing research on the subject and provide a comprehensive analysis of how innovation impacts project performance in Oman's construction industry. This review also addresses the gaps in the literature by focusing on the role of project interdependence and innovative culture, offering valuable insights for both academic researchers and industry practitioners.

The study sets out to achieve some primary objectives. First, it aims to examine the impact of project innovation, encompassing innovative design solutions, advanced technology utilization, and innovative project management practices, on project performance in the construction industry of Oman. Second, it seeks to assess the mediating effect of project interdependence on the relationship between project innovation and project performance, aiming to deepen our understanding of how the interplay among project components and teams influences the success of innovative practices. Third, the study observes the moderating effect of innovative culture, determining whether a robust culture of innovation within organizations enhances or reduces the effectiveness of innovative practices on project outcomes.

The expected findings of this study are multifaceted. Firstly, the review is anticipated to confirm that project innovation, particularly in the areas of design, technology, and management, has a positive impact on project performance. This aligns with existing research from other regions that suggests innovation leads to improvements in efficiency, cost-effectiveness, and overall project success. Secondly, it is expected that project interdependence plays a significant mediating role, with higher levels of interdependence amplifying the positive effects of innovation on project performance. This finding would emphasize the importance of collaboration and coordination in innovative projects.

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Finally, the study is likely to reveal that an innovative culture within organizations acts as a critical moderating factor. Organizations that foster creativity, encourage risk-taking, and invest in continuous improvement are expected to see greater benefits from innovative practices. On the other hand, organizations with a more conservative or rigid culture may struggle to fully realize the potential of innovative solutions. These findings provide valuable insights for construction firms in Oman, guiding them on how to structure their projects and develop a culture that supports innovation.

To conclude, this study contributes to the growing body of knowledge on project innovation by providing a comprehensive, context-specific analysis of its impact on project performance in the construction industry of Oman. By exploring the mediating role of project interdependence and the moderating role of innovative culture, the study aims to offer actionable insights that can help industry professionals leverage innovation to improve project outcomes. This study fills a critical gap in the literature and provide a foundation for future studies on innovation in construction, particularly in the Middle East.

METHODOLOGY

This narrative review follows a structured approach to synthesize existing research on the impact of project innovation on project performance in the construction industry of Oman. The methodology is designed to ensure a comprehensive, transparent, and reproducible analysis.

2.1. Search Strategy:

The literature search is conducted across multiple electronic databases including Web of Science, Scopus, PubMed, and specific construction and engineering databases like the Engineering Village and the Construction and Building Abstracts. Keywords and phrases used include "project innovation," "project performance," "construction industry," "Oman," "innovative design solutions," "technology in construction," "project management innovation," and combinations thereof. The search is refined using Boolean operators (AND, OR) to encompass a broad spectrum of relevant literature. Additional studies are identified through hand-searching the reference lists of included studies and relevant review articles.

2.2. Inclusion and Exclusion Criteria:

Studies are selected according to the following inclusion criteria:

I. Published in English.

II. Focuses on the impact of project innovation on project performance.

III. Studies conducted in the construction industry.

IV. Studies that include data from the Omani construction sector or from regions with similar economic and cultural contexts, to ensure applicability.

V. Empirical studies reporting original data.

However, exclusion criteria include the following:

I. Non-peer-reviewed articles such as opinion pieces, editorials, and grey literature, unless they provide significant empirical data.

II. Studies not specifically addressing the construction industry.

III. Studies lacking clear methodology or relevant data.

2.3. Data Extraction:

Data is extracted using a standardized data extraction form developed for this review. The form captures the following information: authors, year of publication, study location, study design, sample size, type of innovation investigated, measures of project performance, key findings, and information on project interdependence and innovative culture

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if available. A total of 106 publications were identified following a comprehensive search of the selected research databases, two reviewers independently extracted data from each included study, with discrepancies resolved through discussion or by consulting a third reviewer. A total of 52 articles met the inclusion and exclusion criteria: 29 articles were related to Oman, 14 articles originated from the GCC and the Middle East, and 9 articles came from various other countries around the world, which the other 23 articles from GCC and other worlds their factors are common and are related to construction industry in Oman.

2.4. Data Synthesis:

Data is synthesized qualitatively. A narrative synthesis summarizes findings related to the impact of innovation on project performance, the role of project interdependence, and the influence of innovative culture. The presence of heterogeneity and potential publication bias is also assessed. The synthesized findings are discussed in relation to the existing literature, emphasizing what the results mean for the construction industry in Oman and similar contexts. This section addresses limitations of the included studies and the narrative review process itself. The methodology for this narrative review is designed to provide a comprehensive and narrative overview of the existing literature on the impact of project innovation on project performance in the construction industry, specifically within the context of Oman. By adhering to rigorous standards of search strategy, selection criteria and data synthesis, this review aims to offer valuable insights and evidence-based recommendations for stakeholders in the construction sector.

FINDINGS OF THE STUDY

3.1. Impact of Project Innovation on Omani Construction Industry Project Performance:

To thoroughly examine the impact of project innovation specifically innovative design solutions, advanced technology utilization, and innovative project management practices on project performance in the construction industry of Oman, a comprehensive discussion of relevant studies is essential. Each variable plays a critical role in shaping project outcomes, and understanding the relationships between these variables can provide valuable insights for enhancing performance in the construction sector.

3.1.1. Strategic Planning and Innovation in Project Management:

The critical role of strategic planning in the construction industry emphasized by [9], asserting that a well-defined strategic framework is vital for guiding innovation. The study indicates that construction companies in Oman that articulate clear visions, missions, and goals are better positioned to integrate innovative practices into their operations. This strategic alignment is essential for ensuring that innovations not only enhance individual projects but also contribute to the long-term success of the organization. Strategic planning enables firms to identify opportunities for innovation and allocate resources effectively, thereby improving overall project performance. The alignment of strategic goals with innovative design solutions allows firms to respond proactively to market demands and technological advancements. For example, when a company identifies a need for sustainable practices, a strategic plan can guide the adoption of innovative design solutions that reduce environmental impact while enhancing operational efficiency. This integration is crucial in the construction industry, where the implications of strategic decisions can significantly affect project timelines, costs, and overall quality.

3.1.2. Lean Construction Principles:

Lean Construction (LC) principles focused by [34], which advocate for maximizing value while minimizing waste. The study reveals that the implementation of LC principles leads to improved project delivery timelines and reduced waste, aligning with the objectives of innovative design and project management methodologies. By adopting LC practices, construction firms in Oman can streamline processes, enhance collaboration, and foster a culture of continuous improvement. Lean principles emphasize the importance of efficiency, which is critical in a sector where resource optimization can significantly impact project performance. For example, by integrating lean practices, firms can eliminate unnecessary steps in the construction process, thus accelerating project timelines and reducing costs. The synergy between lean methodologies and innovative project management practices can lead to enhanced value delivery, making it a crucial consideration for construction firms aiming to improve their performance.

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3.1.3. Artificial Intelligence and Project Innovation:

The research of [10] explores how attributes of innovation, combined with the business environment and risk management, influence investments in artificial intelligence (AI) within Oman's hydrocarbons sector. Although the focus is not directly on construction, the insights gained from this study are highly relevant. The findings suggest that technological innovations, particularly AI, can significantly enhance decision-making processes and risk management strategies within the construction industry. The integration of AI into project management practices allows construction firms to analyze large datasets, forecast potential risks, and optimize resource allocation. By leveraging AI-driven insights, companies can enhance project performance through informed decision-making. This emphasizes the need for construction firms in Oman to adopt advanced technologies that facilitate innovation and improve overall project outcomes.

3.1.4. ICT Adoption and Project Performance:

The study by [12] highlights the role of Information and Communications Technology (ICT) in enhancing project management practices within the construction industry of Oman. The findings indicate that low levels of ICT adoption hinder operational efficiencies and overall project performance. Addressing socio-cultural and regulatory barriers to ICT adoption is vital for enabling construction firms to leverage technology effectively. Integrating ICT solutions into project management can lead to improved communication, collaboration, and data management. For example, cloud-based project management tools enable real-time collaboration among stakeholders, facilitating better decision-making and resource allocation. By overcoming the identified barriers to ICT adoption, construction companies can enhance their operational efficiencies and, consequently, improve project performance.

3.1.5. Entrepreneurial Orientation and Innovation Intensity:

The relationship between entrepreneurial orientation (EO) and innovation intensity within Omani firms was explored by [21]. The study underscores that a strong EO fosters a culture of innovation, which can lead to enhanced project performance. By cultivating an environment that encourages risk-taking, creativity, and competitive aggressiveness, construction firms can improve their capacity for innovation. This relationship between EO and innovation highlights the need for construction companies to prioritize entrepreneurial practices as a means of driving innovation. By aligning their strategic objectives with an entrepreneurial mindset, firms can enhance their project performance through the adoption of innovative design solutions and advanced technologies.

To conclude, the comprehensive analysis of the studies discussed reveals the intricate relationships between innovative design solutions, advanced technology utilization, and innovative project management practices, all of which significantly impact project performance in Oman's construction industry. By addressing barriers to innovation, fostering a culture of entrepreneurship, and integrating advanced technologies and sustainable practices, construction firms can enhance their project outcomes. This synthesis of research findings provides a solid foundation for understanding how various forms of innovation interact to influence project performance, thereby offering valuable insights for future developments in the sector. The exploration of these variables not only emphasizes the need for effective strategic planning but also highlights the importance of stakeholder involvement and government support in facilitating innovation. As the construction industry in Oman continues to evolve, the insights gained from these studies will be instrumental in guiding practitioners and policymakers toward achieving improved project performance through innovative practices.

3.2. The Mediating Effect of Project Interdependence in the Relationship Between Project Innovation and Project Performance in Oman's Construction Industry:

The mediating effect of project interdependence on the relationship between project innovation and project performance in Oman's construction industry is a critical area of investigation. Several studies offer insights into how project innovation in terms of innovative design solutions, advanced technology utilization, and innovative project management practices can be more effective when mediated by project interdependence. This complex relationship has a direct influence on the overall performance outcomes of construction projects. By analyzing these studies, we

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can gain a deeper understanding of the interconnectedness between project innovation and performance, with project interdependence acting as a key facilitator. This will be explained in more details in the below studies.

3.2.1. The Role of Project Interdependence in Project Innovation:

The study of [28] provides a profound analysis of how project interdependence enhances the effectiveness of project innovation. The research, focusing on industrial symbiosis at Sohar Port and Freezone, highlights that trust, collaboration, and mutual understanding among stakeholders play a vital role in fostering innovative practices. These social forces serve as a platform for innovative project elements to interconnect and work in harmony. This is particularly relevant in large-scale construction projects, where different stakeholders ranging from government bodies to contractors need to coordinate their efforts to ensure that innovative design solutions and technology are effectively integrated. The institutional framework, as [28] explains, is critical in formalizing these interdependencies, enabling projects to succeed through collective efforts. By enhancing project interdependence, these projects become more resilient, adaptable, and capable of overcoming the inherent challenges posed by innovation.

The importance of organizational design in promoting innovation and interdependence is further emphasized by [40], who argue that an entrepreneurial organizational structure encourages both radical and incremental innovations. In construction projects, such organizational flexibility ensures that innovative practices are not stifled by rigid management structures. Rather, a more fluid organizational design allows for increased interdependence, as teams are able to collaborate more effectively and adapt to new innovations as they arise. The readiness for innovation (RFI) is key to managing these interdependencies, as organizations that are more prepared for innovation are better equipped to handle the complexities that come with interdependent tasks. This finding is especially relevant to Oman's construction industry, where managing the complexities of large-scale projects requires both innovation and the ability to integrate interdependent processes seamlessly.

3.2.2. Impact of Project Innovation on Performance:

Cultural factors play a role in mediating the relationship between innovation and performance. [19] examine how cultural variables influence knowledge sharing in Jordanian construction projects. They find that organizational culture can either facilitate or hinder the implementation of innovative practices. In contexts where openness and collaboration are promoted, knowledge sharing is more effective, leading to better decision-making and problem-solving. This dynamic is particularly important in Oman's construction industry, where a collaborative culture can help manage the complexities of large-scale projects. By addressing cultural barriers and promoting interdependence, construction companies can ensure that innovative practices are successfully implemented, ultimately enhancing project performance.

3.2.3. Project Interdependence and Its Direct Impact on Project Performance:

Project interdependence, as highlighted by [28], has a direct and positive impact on project performance. Strong institutional capacity fosters improved coordination and collaboration, which are essential for managing the interdependence between different project components. In Oman's construction industry, where projects often involve multiple stakeholders and complex processes, effective management of these interdependencies is crucial. By aligning the goals and efforts of all stakeholders, project interdependence reduces inefficiencies and redundancies, leading to better resource utilization and improved performance outcomes. This finding is particularly relevant to large-scale construction projects, where the failure to manage interdependencies can result in delays, cost overruns, and suboptimal performance.

The study on knowledge management practices [4] also highlights how interdependence enhances project performance. By fostering a culture of knowledge sharing, project teams are better equipped to innovate and solve complex problems. This collaborative approach ensures that interdependencies between different teams are managed effectively, reducing the risk of errors or miscommunication. In the construction industry, where multiple teams are often working on different aspects of a project simultaneously, effective knowledge management is essential for maintaining interdependencies and ensuring that all teams are aligned in their efforts.

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3.2.4. Mediating Role of Project Interdependence between Innovation and Performance:

The mediating role of project interdependence is perhaps most evident in [28] study of institutional roles at Sohar Port and Freezone. The study emphasizes that managing interdependencies is key to translating project innovation into enhanced performance. By formalizing platforms for stakeholder interaction and promoting knowledge transfer, project interdependence is strengthened, enabling innovative practices to be integrated more effectively. In the construction industry, where innovation is often driven by technological advancements or new design solutions, managing these interdependencies is crucial for ensuring that innovations contribute positively to project outcomes.

The research by [38] further explore the moderating effect of transformational leadership on the relationship between Talent Management and innovative work behavior. Leadership plays a crucial role in managing project interdependencies, as effective leaders can promote collaboration and align team efforts with organizational goals. In construction projects, where interdependencies between teams are often complex and dynamic, strong leadership is essential for ensuring that innovative practices are implemented successfully and that interdependencies are managed effectively.

When knowledge is shared across interdependent teams, organizations can capitalize on collective expertise to enhance efficiency and reduce errors highlighted by [4]. This collaborative approach ensures that innovative solutions are implemented effectively, leading to improved project outcomes. In the construction industry, where projects often involve multiple teams working on different aspects of a project simultaneously, managing these interdependencies is essential for ensuring that all teams are aligned and working towards common goals.

In conclusion, the mediating effect of project interdependence on the relationship between project innovation and project performance is crucial for the success of construction projects in Oman. The studies reviewed provide a comprehensive understanding of how innovative design solutions, advanced technology utilization, and innovative project management practices can be more effective when interdependencies are managed effectively. By fostering a culture of collaboration, knowledge sharing, and strong leadership, construction companies in Oman can enhance their ability to manage interdependent tasks, leading to improved project performance. The insights gained from these studies underscore the importance of strategic planning, robust governance, and effective leadership in achieving enhanced outcomes through innovation.

3.3. Effect of Innovative Culture on Relationship Between Project Innovation and Project Performance in Construction Industry in Oman:

This section discusses the impact of innovative culture on the relationship between project innovation and project performance in construction industry in the context of Oman. The moderating effect of innovative culture on the relationship between project innovation and project performance is essential to understanding how innovation functions within Oman's construction industry. Various studies, including those by [25,6,33,24] shed light on how innovative design solutions, advanced technology utilization, and innovative project management practices interact with organizational culture to influence overall project performance. The studies provided above are discussed below based on their variables as follows:

3.3.1. Innovative Design Solutions and Multicultural Team Performance:

The researches by [25,11] into multicultural teams within the GCC highlights the complex interaction between national cultural diversity and project performance. In Oman's construction industry, where multicultural teams dominate the workforce, the study reveals that communication, trust, and knowledge sharing—factors heavily influenced by national cultural dimensions—play a critical role in determining project success. Multicultural teams, by their nature, bring diverse perspectives to problem-solving, which can be leveraged to enhance innovative design solutions.

However, the presence of an innovative culture is crucial for ensuring that these diverse perspectives result in productive outcomes. An innovative culture that promotes open communication, collaboration, and risk-taking can moderate the challenges posed by cultural diversity, turning potential conflict into creative synergy. In the absence

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of such a culture, multicultural teams may struggle to implement innovative design solutions effectively, leading to suboptimal performance.

In construction projects that involve complex design processes, an innovative culture encourages experimentation and allows teams to adopt novel approaches to solve design challenges. This flexibility is crucial in adapting to the specific demands of Oman's construction sector, where innovative design solutions must be both practical and sustainable. Therefore, the moderating effect of innovative culture becomes evident as it facilitates the successful integration of innovative design solutions, ensuring they translate into improved project performance.

3.3.2. Advanced Technology Utilization and Technological Orientation:

The study of [6] focus on the relationship between technological orientation and project management processes, particularly in large-scale infrastructure projects in the UAE, with implications for Oman's construction industry. The adoption of advanced technologies, such as Building Information Modeling (BIM), is crucial for the modern construction industry, as these technologies enhance accuracy, efficiency, and communication across project teams [31,39,5]. However, the successful implementation of these technologies relies heavily on the cultural framework within an organization [14,32].

An innovative culture that supports technological change plays a crucial role in ensuring that employees and managers are not only receptive to new technologies but are also proactive in utilizing them to improve project outcomes. [6] emphasize that firms with a strong technological orientation and an innovative culture are better positioned to integrate these tools effectively into their project workflows. In Oman's construction industry, where technological advancements are increasingly being adopted, a culture of innovation ensures that these technologies are not resisted but are fully embraced to enhance project performance.

Furthermore, as noted by [30], an organization's learning culture significantly influences its readiness to adopt and effectively utilize advanced technologies. This readiness is a direct reflection of the innovative culture within the organization. When construction firms foster an environment that encourages continuous learning, employees are more likely to engage with new technologies, seek out additional training, and integrate advanced tools into their work processes. The moderating effect of innovative culture is thus clear: it amplifies the benefits of advanced technology utilization by ensuring that these technologies are used to their fullest potential, leading to improved project performance.

3.3.3. Impact of organizational culture on successful Implementation of ERP System:

The research of [33] on ERP implementation in various industries highlights how organizational culture influences the success of large-scale technological integrations, such as ERP systems, which are critical in managing the complex workflows of construction projects. ERP systems enable project managers to coordinate multiple facets of construction projects—ranging from resource allocation to scheduling—more efficiently. However, the successful implementation of ERP systems in the construction industry depends on the organizational culture's adaptability to change and its openness to innovation.

In Oman's construction sector, an innovative culture that supports change management and continuous improvement plays a critical role in moderating the relationship between innovative project management practices and project performance. Firms that foster an innovative culture are more likely to embrace ERP systems and other management tools, ensuring a smoother transition and better project outcomes.

An innovative culture facilitates the integration of new project management tools by creating an environment in which employees are encouraged to adopt and experiment with these systems. This culture of innovation ensures that ERP systems are not simply implemented but are effectively used to streamline operations, enhance decision-making, and ultimately improve project outcomes. Without such a culture, the adoption of innovative project management practices may face significant roadblocks, diminishing their impact on project performance.

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3.3.4. Innovation Management in the GCC and Comparative Insights:

A systematic review of innovation management practices across the Gulf Cooperation Council (GCC) countries, including Oman provided by [24] study. This review highlights how the integration of indigenous initiatives and strategic visions into innovation management practices is essential for enhancing competitiveness and economic development in the region. In Oman's construction industry, innovative culture plays a similar role in aligning project management practices with broader economic and cultural goals.

The review identifies several strategic innovation initiatives, such as sustainability transitions and global innovation networks, which are particularly relevant to Oman's construction sector. By fostering an innovative culture that supports these strategic initiatives, construction firms in Oman can enhance their ability to implement innovative project management practices, leading to better project performance. Furthermore, the review emphasizes that innovative culture enables firms to align their innovation strategies with local cultural and economic imperatives, ensuring that project innovations are both effective and relevant.

The studies discussed provide a comprehensive understanding of how innovative culture moderates the relationship between project innovation and project performance in Oman's construction industry. Whether through fostering multicultural team performance, supporting technological adoption, or facilitating the implementation of innovative project management practices, innovative culture plays a crucial role in ensuring that project innovations lead to improved project outcomes. By promoting creativity, adaptability, and continuous learning, an innovative culture enhances the effectiveness of design solutions, technological innovations, and management practices, ultimately contributing to better project performance. As such, fostering an innovative culture is essential for construction firms in Oman looking to gain a competitive edge in the rapidly evolving industry.

DISCUSSION OF FINDINGS

The findings from this study indicate that project innovation, comprising innovative design solutions, advanced technology utilization, and innovative project management practices, has a significant impact on project performance in Oman's construction industry. Several studies reviewed, such as those by [15,30], illustrate that innovative design solutions play a critical role in enhancing the quality, sustainability, and efficiency of construction projects. Firms that adopt these solutions demonstrate improved project outcomes, including better resource utilization, cost control, and higher client satisfaction.

Moreover, advanced technology utilization, such as the implementation of Building Information Modeling (BIM) and Project Management Information Systems (PMIS), as explored by [7-8], has been shown to significantly improve project execution [27]. The integration of technology not only improves communication and collaboration among project teams but also enhances accuracy, reduces delays, and improves the overall management of complex projects. The study confirms that firms that embrace technology are better positioned to deliver projects on time and within budget, leading to superior project performance. Moreover, the influence of innovative project management practices, such as lean construction and agile methodologies, was also found to be impactful. [13] demonstrated that these practices contribute to better risk management, flexibility in project execution, and improved stakeholder coordination. In Oman's construction industry, the adoption of these practices is crucial in reducing project delays and cost overruns, which are common challenges in large-scale construction projects.

In addition, the study's second objective was to assess the mediating effect of project interdependence on the relationship between project innovation and project performance. The findings from [28,20] support the hypothesis that project interdependence plays a critical role in translating innovation into improved performance. These studies highlight how interdependencies within a project—whether between design teams, technology specialists, or project managers—are necessary to ensure that innovations are successfully implemented and lead to enhanced outcomes. [28] emphasizes the importance of institutional capacity and stakeholder collaboration in managing interdependent tasks. In Oman's construction industry, projects often involve multiple interdependent teams working together on different aspects of the project. The findings suggest that project interdependence allows these teams to align their

objectives, share resources, and manage complexities more effectively, ensuring that innovations in design and technology are seamlessly integrated into the project workflow.

Moreover, [4,40] underscore the role of knowledge sharing and coordination in managing project interdependencies. They suggest that when knowledge is shared across teams, it fosters a more cohesive approach to problem-solving and decision-making, which ultimately leads to better project performance. This aligns with the findings in the Omani construction sector, where effective management of interdependencies ensures that innovative practices in project management lead to tangible improvements in performance.

The third objective of the study was to observe the moderating effect of innovative culture on the relationship between project innovation and project performance. The findings from studies such as [15,30,17] reveal that an innovative culture significantly enhances the positive effects of project innovation on performance. An innovative culture encourages risk-taking, experimentation, and continuous learning, all of which are crucial for the successful adoption of innovative practices. In Oman's construction industry, firms with a strong innovative culture were found to be more adept at integrating advanced technologies and innovative management practices into their projects. The study by [30,19], for instance, showed that organizations that foster a culture of learning and adaptability are more likely to leverage new technologies to their advantage. This culture of innovation helps employees to embrace change, experiment with new tools, and collaborate effectively, leading to improved project performance.

Additionally, [15] highlight that leadership and organizational structure are key components of an innovative culture. Firms with leaders who promote innovation and provide the necessary resources for experimentation are better positioned to succeed in implementing innovative design solutions and management practices. In contrast, firms with more rigid or traditional cultures may resist change, leading to suboptimal performance despite the availability of innovative tools and techniques. The findings also emphasize the importance of collaboration and stakeholder involvement in fostering an innovative culture. [8] found that firms with an open and collaborative culture were more successful in implementing innovative project management practices, leading to better project outcomes

CONCLUSION

In conclusion, this study successfully achieved its primary objectives, by providing valuable insights into how project innovation, project interdependence, and innovative culture affect project performance in Oman's construction industry. The findings demonstrate that project innovation—encompassing innovative design solutions, advanced technology utilization, and innovative project management practices—has a significant positive impact on project performance. Firms that adopt these innovations see improvements in efficiency, sustainability, and overall project outcomes.

Moreover, the study highlights the mediating role of project interdependence. The ability of project teams and stakeholders to collaborate and coordinate effectively is crucial for the successful implementation of innovations. Project interdependence ensures that innovations are integrated seamlessly across all aspects of a project, enhancing performance and delivering better results. Additionally, the study reveals that an innovative culture plays a vital moderating role. Organizations that cultivate a culture of creativity, experimentation, and continuous learning are better positioned to maximize the benefits of innovation. By fostering an environment that supports risk-taking and innovation, firms can significantly enhance the positive effects of project innovation on performance. Overall, the research underscores the importance of an integrated approach, where innovation, interdependence, and culture work together to improve project outcomes in the construction sector of Oman.

Based on the findings, several recommendations can be made for construction firms in Oman. First, it is crucial for organizations to invest in innovative practices, particularly in design, technology, and project management. Firms should actively seek out and implement advanced technologies like Building Information Modeling (BIM) and Project Management Information Systems (PMIS) to improve project efficiency and performance [7]. Additionally, they should continuously adopt innovative management practices to stay competitive. Second, enhancing project interdependence should be a priority. Construction firms should focus on improving communication and

collaboration across different project teams and stakeholders. By establishing clear mechanisms for knowledge sharing and coordination, firms can ensure that innovations are integrated smoothly and effectively into projects.

Third, fostering an innovative culture is essential. Firms must encourage a culture that supports creativity, risk-taking, and continuous improvement. Leadership should play a central role in promoting innovation and providing resources that enable employees to experiment with and adopt new ideas. Regular training and development programs can also help build a workforce that is well-versed in innovative technologies and practices. Finally, construction firms should strengthen leadership and governance structures to support innovation. Leaders should align innovative efforts with the organization's strategic goals and promote a collaborative environment where teams work together to achieve shared objectives. By implementing these recommendations, construction firms in Oman can enhance their ability to innovate, manage complex projects more effectively, and ultimately achieve superior projects performance.

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