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Critical Success Factors for Planning in the Bahrain Metro Project

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ABSTRACT

The success of infrastructure projects is significantly dependent on the planning stage. It is important to determine the successful factor by understanding the process involved with cooperation from all stakeholders. This study aims to determine the critical success factor for planning in the Bahrain Metro Project. A quantitative approach was adopted in the study by participation of 385 professionals including management and execution teams who were involved in the project. The critical success factors identified in the study are; 1) stakeholder engagement, 2) risk management, 3) financial investment, 4) procurement methods, 5) technical specifications, and 6) project ridership. The analysis shows significant relationships between stakeholder engagement, financial investment, procurement methods, and planning success, while risk management and technical specifications had a minimum impact. On the other hand, higher project ridership expectations are not significant to planning in the project. This study highlights the importance of comprehensive planning and informed decision-making in large-scale infrastructure projects, suggesting further research in these areas to enhance project management practices.

INTRODUCTION

In the realm of urban development and public transportation, the Bahrain Metro Project emerges as a landmark initiative (Zhang, 2005). This ambitious endeavor, spearheaded by the Ministry of Transportation and Telecommunications (MTT), represents Bahrain's commitment to modernizing its public transportation infrastructure (Walter & Scholz, 2007). The project aims to construct a 109 km-long metro system, with an initial phase covering a 28.6 km stretch featuring 20 stations (Babatunde & Perera, 2017). The significance of this project extends beyond its physical scope; it is a strategic response to the challenges of urbanization, traffic congestion, and the need for efficient transit solutions in a rapidly evolving nation (Wang et al.,

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2022). In summary, the company faces high warranty costs due to recurring design-related failures, and current data limitations hinder timely problem-solving. These multiple challenges, including both data quality issues and recurring design flaws, are closely linked, making it essential to address them simultaneously during the planning phase. This clear definition of the problem strengthens the study's focus and highlights the urgent need for a strategic approach to project planning and execution.

The success of such a monumental project hinges on rigorous and strategic planning (Nilashi et al., 2015). Unlike conventional project planning, the Bahrain Metro demands a high-level strategic approach, integrating critical aspects such as stakeholder engagement, financial structuring, regulatory compliance, and social impact assessment (Toor & Ogunlana, 2008; Yong & Mustaffa, 2017). The complexity of this project is further amplified by its adoption of a public-private partnership model and an international competitive bidding process (Liu et al., 2015). These factors underscore the need for a comprehensive understanding of the project's dynamics and the identification of critical success factors that will steer it towards successful completion. This update reflects the latest market outlook and ensures that the economic background referenced in the study remains current and relevant.

The Bahrain Metro Project, while a symbol of progress, is confronted with multifaceted challenges (Banihashemi et al., 2017). These include managing a substantial budget, navigating intricate planning requirements, and aligning the project with the broader objectives of sustainable urban development (Costantino et al., 2015). The planning stage, in particular, becomes the crucible for the project's success, where decisions made significantly influence its trajectory, adherence to quality standards, schedules, and budgetary constraints. This research focuses on dissecting the planning stage's impact on the overall success of the project, emphasizing the importance of identifying and managing critical success factors (Thomas & Bertolini, 2017). This study aims to explore and analyze the critical success factors in the planning stage of the Bahrain Metro Project (Ghosh & Jintanapakanont, 2004). By investigating the planning methodologies employed, challenges faced, and their collective contribution to the project's success, the research seeks to provide strategic insights for stakeholders and contribute to the academic discourse on large-scale infrastructure project management (Ataei Jafari & Ahmadvand, 2018). The research is particularly timely and relevant, considering the project's current phase and its potential as a case study for similar future endeavors in infrastructure development (Nallathiga et al., 2017).

LITERATURE REVIEW

Historical context of Bahrain's infrastructure development

Since gaining independence in 1971, the Kingdom of Bahrain has undergone a remarkable transformation in its infrastructure development. In the initial years following independence, the focus was predominantly on the oil and gas sector, which formed the backbone of the Bahraini economy. This period saw the development of key infrastructure to support this industry, including the establishment of refineries, ports, and transportation networks critical for the export of oil and natural gas (Alkhaldi & Altaei, 2020). The reliance on oil and gas not only fueled the country's economic growth but also shaped the early landscape of its infrastructural development. This phase was crucial in setting the groundwork for Bahrain's future economic and infrastructural expansion.

As the global economic landscape evolved, Bahrain recognized the need for economic diversification beyond its traditional oil and gas sector. This led to a significant shift in infrastructure investment towards the late 20th and early 21st centuries, focusing on a more sustainable and diversified economic model. The government embarked on a series of initiatives to develop roads, airports, and public transportation systems, alongside fostering growth in sectors such as tourism, finance, and real estate. Projects like the Bahrain Financial Harbor and Bahrain Bay became symbols of this new focus, demonstrating Bahrain's commitment to diversifying its economic base (Nakibullah, 2018; Ewers & Malecki, 2011). This transition was not only

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a strategic economic move but also a response to the evolving needs of a growing population and the demands of a modernizing nation, setting the stage for current and future infrastructure projects, including the ambitious Bahrain Metro Project.

Vision 2030 and the role of infrastructure in sustainable development

Bahrain's Vision 2030 represents a strategic shift towards a diversified, sustainable, and inclusive economy, recognizing infrastructure as a critical driver of this transformation. The kingdom has prioritized the development of sustainable and modern infrastructure to support economic diversification, moving beyond its traditional dependence on the oil and gas sector. This approach is evident in significant investments in various sectors including real estate, tourism, and public transportation systems. Notably, the real estate sector has been identified as playing a significant role in meeting economic and social criteria for sustainable development, acting as both an economic driver and a contributor to societal well-being (Mouzughi et al., 2014). The Bahrain Metro Project aligns with this vision, exemplifying the country's commitment to developing infrastructure that not only enhances economic growth but also improves the quality of life for its citizens. The Bahrain Metro Project aligns with smart infrastructure trends, including integration with digital twin technologies (Masubuchi et al., 2025).

Furthermore, Bahrain's commitment to sustainable development is reinforced by initiatives like the establishment of Bahrain Polytechnic and the emphasis on education and skill development in the national strategy. In addition, these initiatives are critical in bridging the gap between the job market and graduate capabilities, thereby supporting the nation's economic diversification goals (Al Daylami et al., 2015). The Bahrain Metro Project, in this context, is more than just an infrastructure development; it is a symbol of the nation's progress towards a more sustainable and diversified economy. The project is expected to create jobs, boost tourism, and enhance the efficiency of the urban transport system, thus playing a pivotal role in realizing the objectives of Vision 2030. Moreover, evaluation studies of metro planning in the GCC have established useful benchmarks for infrastructure performance and sustainability that are directly relevant to Bahrain’s context.

Impact of infrastructure on economy and society

Infrastructure development, particularly in the transportation sector, has a profound impact on the economy. Investments in public transport systems are key drivers of economic benefits, enhancing the connectivity and efficiency of urban spaces (Wu et al., 2016). The development of Intelligent Transport Systems (ITS), for example, although requiring significant investment, brings about substantial benefits to society and the economy, outweighing the initial costs (Zhang et al., 2021). Similarly, the introduction of new transportation infrastructure, like the Bahrain Metro, can fundamentally reshape urban development, potentially leading to increased property values and enhanced economic activity in areas served by the metro (Chen et al., 2019).

Moreover, well-planned public transportation systems contribute significantly to societal well-being by offering more sustainable and efficient travel options. The use of public transportation reduces the reliance on personal vehicles, thus diminishing traffic congestion and lowering greenhouse gas emissions (Guerrero-Ibanez et al., 2015). This not only improves air quality but also contributes to a reduction in the overall carbon footprint of urban areas. Furthermore, projects like the Bahrain Metro align with global sustainability goals, as they offer an eco-friendly mode of transport, thus playing a vital role in mitigating environmental challenges associated with urban transportation (Sun & Cui, 2018).

Planning stage and its impact on project success

The planning phase is pivotal in setting the trajectory of a project. Research has shown that the presence of a dedicated project manager and a formal project management structure, such as a Project Management Office (PMO), significantly contributes to adherence to planned budgets and project timelines (Berssaneti

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et al., 2014). Furthermore, effective project planning processes, such as the development of Work Breakdown Structures (WBS) and the use of tools like the Program Evaluation Review Technique (PERT) or Gantt Charts, have a positive impact on construction project success (Yayok et al., 2022).

The complexity of procurement strategies, particularly in large-scale projects like the Bahrain Metro, significantly impacts project success. One study emphasizes the importance of selecting competent procurement processes during the early stages of complex mega-projects (Crosby, 2017), highlighting resilience-building measures to counter optimism bias and promote a 'mission-assurance' mindset. Additionally, the quality of project preparation, including procurement strategy, has been shown to strongly influence project outcomes (Hofstadler & Kummer, 2019).

The technical specifications of a project also play a vital role. It has been found that the status of early planning, particularly the development of technical specifications, can effectively predict project success (Wang et al., 2012). Recent advancements in smart metro systems now use digital twin platforms to monitor long-term structural integrity, supporting high-quality planning and predictive maintenance (Zhou et al., 2024). This view is further supported by research indicating that project success is positively correlated with investment in technical specification development (Dvir et al., 2003). In conclusion, the planning stage, with its focus on detailed project management, procurement strategies, and technical specifications, is critical to the success of the Bahrain Metro Project.

METHODOLOGY

The population of the study comprises professionals intimately involved in the project's planning stage. This encompasses project managers, engineers, financial analysts, Ministry of Work staff, and other crucial personnel from both public and private sectors. Stakeholders such as investors and government officials are also integral to this group. The study aims to gather and analyze numerical data on Direct Cost, Indirect Cost, Time, and Resources to assess their impact on the project's planning stage. For sampling, the study targets a statistically significant sample size, derived using a formula that factors in the desired confidence level and margin of error. Given the large population involved in the Bahrain Metro Project, the formula for calculating the required sample size is: $n = \frac{Z^2 \times p \times (1-p)}{E^2}$, where n is the required sample size, Z is the Z-value for a 95% confidence level, p is the estimated proportion of the attribute of interest, and E is the margin of error (precision). Based on the formula, it suggests a sample size of approximately 385 participants. This size ensures the reliability and validity of the study's quantitative findings, adhering to a 95% confidence level and a 5% margin of error (Brown, 2012).

The structured questionnaire in Table 1 used in this study was designed to collect primary data from professionals involved in the Bahrain Metro Project. The quantitative data collected through the structured questionnaire were analyzed using inferential statistical techniques. Inferential statistical methods were applied to explore relationships among the research variables. Specifically, regression analysis was employed to examine the predictive power of the independent variables on the planning stage and overall project success. These tests helped in verifying the hypotheses and identifying significant factors influencing the Bahrain Metro Project's success. The questionnaire is divided into four main sections: Section A covers demographic information, Section B focuses on independent variables (critical success factors), Section C addresses the mediating variable (planning stage), and Section D captures the dependent variable (project success).

Section A collects basic demographic information such as gender, age group, education level, occupation, and frequency of public transit use. This information provides important background characteristics of the respondents and allows for a better understanding of the sample profile. Sections B, C, and D employ a five-point Likert scale, ranging from 1 (Strongly Disagree) to 5 (Strongly Agree). The

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independent variables measured in Section B include Stakeholder Engagement (Gemino et al., 2020), Risk Management (El Khatib et al., 2022), Financial Investment (Polzin et al., 2019), Procurement Methods (Lappi et al., 2019), Technical Specifications (Haghani et al., 2023), and Project Ridership (Erhardt et al., 2022). Section C assesses the mediating variable, the Planning Stage (Pinto et al., 2022). Section D evaluates the dependent variable, Project Success (King & Masson, 2023). The survey instrument was developed based on validated measures from prior studies to ensure the reliability and relevance of the questions.

Table 1. Questionnaire design

Section	Construct	Item description
Demographic enquiry	Gender	Male, Female
	Age group	Below 20; 21-30; 31-40; 41-50; 51-60; Above 60
	Education level	College; Bachelor's Degree; Master's Degree; Doctorate Degree
	Occupation	Government Employee; Private Sector Employee; Self-Employed; Student; Retired
	Frequency of public transit use	Daily; Weekly; Monthly; Rarely; Never
Independent variables (IV)	Stakeholder engagement (IV1)	1. The project management team communicates effectively with all stakeholders. 2. Stakeholder input is actively sought during the planning and execution phases. 3. The project team understands and addresses stakeholder needs and expectations. 4. Stakeholder involvement contributes to improved project outcomes. 5. A structured process is followed for stakeholder engagement
	Risk management (IV2)	1. A well-defined risk management plan is consistently followed. 2. Risks are regularly identified, assessed, and prioritized. 3. Effective mitigation strategies are implemented for identified risks. 4. The project team is prepared to manage unforeseen challenges. 5. Risk management practices positively influence project success
	Financial investment (IV3)	1. The project is adequately funded. 2. Financial resources are allocated efficiently. 3. A transparent and effective budget management system is in place. 4. Contingency funds are available to address unexpected costs. 5. Financial investment positively impacts project success.
	Procurement methods (IV4)	1. Procurement methods are efficient and cost-effective. 2. Public-private partnership models enhance project success. 3. Procurement processes are transparent and free from corruption. 4. Procurement methods align with project objectives and scope. 5. Procurement strategies contribute to successful project outcomes.
	Technical specifications (IV5)	1. Technical specifications meet international safety standards. 2. Automation levels enhance operational efficiency. 3. Construction materials are durable and of high quality. 4. Technical measures are well-planned and effectively executed.
	Project ridership (IV6)	1. Projected ridership numbers are realistic and achievable. 2. Metro will reduce road traffic congestion. 3. Metro project will meet community transportation needs. 4. Ridership estimates based on thorough market research. 5. High ridership is key to project success.

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Mediating variable (MV)	Planning stage	1.	Accurate budgeting for labor costs during planning.
		2.	Precise calculation of material costs in planning.
		3.	Adequate budgeting for administrative expenses.
		4.	Proper allocation of contingency funds.
		5.	Realistic timeline setting for project milestones.
		6.	Effective planning to ensure deadlines met.
		7.	Adequate manpower planned during project planning.
		8.	Ensuring material availability through planning.
Dependent variable (DV)	Project success	1.	Project on track to complete within budget.
		2.	Project likely to meet scheduled completion date.
		3.	Project meeting objectives and deliverables.
		4.	Effective risk and challenge management during execution.
		5.	Expected high operational efficiency upon completion.

These questionnaires, distributed to professionals involved in or impacted by the project, like project managers, engineers, financial analysts, and Ministry of Work staff, aim to statistically evaluate critical success factors such as Stakeholder Engagement, Risk Management, Financial Investment, Procurement Methods, Technical Specifications, and Project Ridership as in Fig 1.

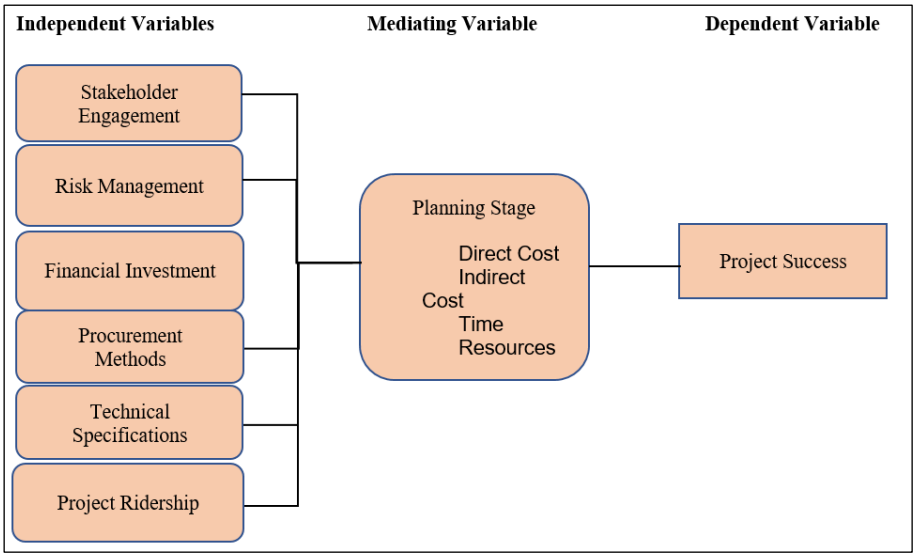

Fig. 1. Research conceptual framework.

RESULTS AND DISCUSSION

In order to identify the significant critical success factors for infrastructure projects in the planning stage Table 2 details the coefficients of multiple regression, offers an in-depth analysis of the influence of various factors on the research subject. The model begins with a significant constant (2.404), which establishes a baseline for the analysis. The constant's high *t*-value (14.339) and low significance (<0.001) underscore its statistical importance in the model. Stakeholder Engagement shows a positive unstandardized coefficient (0.149) and a significant *t*-value (3.264), indicating its positive influence on the dependent variable. The significance level of 0.001 reinforces its importance in the model.

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Contrarily, Risk Management presents a negative coefficient (-0.071), suggesting a potential inverse relationship with the dependent variable. However, its high *p*-value (0.203) implies that this relationship is not statistically significant within the model's context. Recent studies suggest that digital twin technologies can simulate and mitigate risks in transport megaprojects by identifying failure patterns and environmental stress factors (Wang et al., 2023). With a coefficient of 0.186 and a highly significant *p*-value (<0.001), Financial Investment is a critical factor. This strong significance indicates a robust and positive impact on the project, emphasizing the importance of financial considerations in the project's success.

Similarly, Procurement Methods also demonstrate a positive relationship (0.150), with statistical significance ($p < 0.001$). This suggests that the methods employed in procurement significantly contribute to the outcomes of the project. This variable has a coefficient of 0.123 and a *p*-value of 0.034, suggesting a significant but less pronounced impact compared to other factors. This level of significance implies that while technical specifications play a role in the project's success, their influence might be more subtle or indirect. Project Ridership displays a negative coefficient of -0.145 with a *p*-value of 0.013. This significant value suggests a counterintuitive relationship; higher expectations or forecasts of ridership may negatively impact certain aspects of the project. This finding calls for a deeper investigation into how ridership projections are managed and their potential effects on project outcomes.

Table 2. Coefficients of multiple regression

	Model	Unstandardized B	Coefficients std. error	Standardized coefficients beta	*t*	Sig.
1	(Constant)	2.404	0.157		14.339	<0.001
	Stakeholder engagement	0.149	0.046	0.209	3.264	0.001
	Risk management	-0.071	0.056	-0.094	-1.275	0.203
	Financial investment	0.186	0.045	0.269	4.093	<0.001
	Procurement methods	0.150	0.043	0.214	3.524	<0.001
	Technical specifications	0.123	0.058	0.157	2.132	0.034
	Project ridership	-0.145	0.058	-0.171	-2.501	0.013

Table 3 of the research presents the results of a multiple regression analysis to analyze the relationship between the planning stage and overall Bahrain metro project success. The model includes a constant and the Planning Stage as an independent variable. The constant has a value of 2.022 with a very significant *t*-value of 9.275, indicating its relevance in the model. The Planning Stage shows a strong positive influence on Project Success, as evidenced by an unstandardized coefficient of 0.534 and a high standardized coefficient (Beta) of 0.437. Its significance is further underscored by a very low *p*-value (<0.001) and a high *t*-value (9.499), indicating that the effectiveness of the planning stage is a critical predictor of the project's success. This finding highlights the pivotal role of thorough and effective planning in achieving successful project outcomes.

Lastly, Table 4 in the research summarizes the results of hypothesis testing regarding various factors influencing the Planning Stage of the Bahrain Metro Project and their overall impact on the project's success. The first hypothesis, concerning the significant relationship between stakeholder engagement and the Planning Stage, is supported, as indicated by a *p*-value of 0.001. This underscores the crucial role of stakeholder engagement in the planning process of the project. The second hypothesis, which postulated a significant relationship between risk management practices and the Planning Stage, is not supported. The

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p-value of 0.203 suggests that risk management practices may not have a direct or significant impact on the Planning Stage as initially hypothesized. Financial investment, procurement methods, technical specifications, and project ridership all show a significant relationship with the Planning Stage, as supported by their respective *p*-values (<0.001, <0.001, 0.034, and 0.013). These results highlight the importance of these factors in effective planning. Planning Stage's Influence on Project Success: The final hypothesis, asserting the significant influence of the Planning Stage on the project's success, is strongly supported with a *p*-value of less than 0.001. This finding emphasizes the criticality of the Planning Stage in determining the overall success of the Bahrain Metro Project.

Table 3. Coefficients of multiple regression

Model		Unstandardized B	Coefficients std. error	Standardized coefficients beta	*t*	Sig.
1	(Constant)	2.022	0.218		9.275	<0.001
	Planning stage	0.534	0.056	0.437	9.499	<0.001

Dependent Variable: Project Success

Table 4. Summary of hypothesis testing results

Hypotheses	*P*-value	Decision
H3: Financial investment allocation is significantly related to the Planning Stage of the Bahrain Metro Project.	<0.001	Supported
H4: Procurement methods are significantly related to the Planning Stage of the Bahrain Metro Project.	<0.001	Supported
H7: The Planning Stage, characterized by Direct Cost, Indirect Cost, Time, and Resource allocation, significantly influences the success of the Bahrain Metro Project.	<0.001	Supported
H1: Stakeholder engagement is significantly related to the Planning Stage of the Bahrain Metro Project.	0.001	Supported
H6: Project ridership forecasts are significantly related to the Planning Stage of the Bahrain Metro Project.	0.013	Supported
H5: Technical specifications are significantly related to the Planning Stage of the Bahrain Metro Project.	0.034	Supported
H2: Risk management practices are significantly related to the Planning Stage of the Bahrain Metro Project.	0.203	Not Supported

Based on the research findings, a suggested framework for the success of the Bahrain Metro Project should focus on enhancing stakeholder engagement, requiring a strategic approach that encompasses not just the project team, but also the broader community, government entities, and relevant organizations. This process involves constant dialogue, feedback, and collaboration, ensuring that the project aligns with broader community needs, environmental considerations, and policy objectives. Active stakeholder involvement aids in identifying additional success metrics like community satisfaction, which might not be immediately apparent. This comprehensive engagement helps in building trust, ensuring transparency, and fostering a sense of ownership among all stakeholders, ultimately contributing to the project's acceptance and success.

Secondly, the role of risk management in the project's overall success, despite its indirect relationship with the planning stage, is critical. Developing a comprehensive risk management strategy is essential for the successful execution of the Bahrain Metro Project. This strategy should encompass systematic identification, analysis, and response to potential risks, ensuring they are managed proactively. Effective risk management involves not just recognizing risks but also understanding their potential impact and

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implementing measures to mitigate them. This approach is crucial in preventing cost overruns, delays, and quality issues. Regular reviews and updates to the risk management plan are necessary to address new risks as the project evolves. By integrating risk management into every phase of the project, from inception through completion, the project can navigate uncertainties more effectively, enhancing its likelihood of success.

The management of financial resources and procurement processes is critical in large-scale projects like the Bahrain Metro. Detailed financial planning ensures the allocation of funds is in line with project requirements, preventing overspending and enabling efficient use of resources. Effective procurement methods are equally important, as they determine the quality, timeliness, and cost-effectiveness of the materials and services acquired for the project. A strategic approach to procurement, including the selection of suppliers and contract management, plays a key role in maintaining project standards and timelines.

In the fast-evolving landscape of infrastructure development, the ability to adapt technical specifications to changing needs and technological advancements is crucial for the Bahrain Metro Project. This involves ensuring that the specifications for materials, systems, and construction methodologies are not only in line with current industry standards but also flexible enough to incorporate new technologies and methodologies as they emerge. This flexibility is key to managing unforeseen technical challenges and ensuring the project remains at the forefront of technological advancements. It also means that the project can adapt to environmental and safety standards that may evolve over the course of its development, ensuring long-term sustainability and efficiency.

Implementing a dynamic planning process is essential in managing the inherent uncertainties in large-scale infrastructure projects. This process involves regularly revisiting and adjusting the project's scope, budget, timeline, and resource allocation in response to both internal developments and external factors. By adopting a flexible planning approach, the project can adapt to new challenges, opportunities, and changes in the project environment, including shifts in stakeholder expectations, market dynamics, and regulatory landscapes. This dynamic planning ensures that the project remains aligned with its objectives, even as it navigates the complexities and uncertainties typical of large-scale infrastructure projects.

Implications

This study discovered that while previous research emphasized risk management as a major driver of project success (Qazi & Dikmen, 2019; Viswanathan et al., 2020; Bahadorestani et al., 2020), the findings here show that risk management had no significant impact on the planning stage of the Bahrain Metro Project. Instead, stakeholder engagement, financial investment, procurement methods, technical specifications, and project ridership had stronger influences. This divergence from earlier studies highlights the importance of context-specific factors in large-scale projects. The study contributes new understanding by proving that in public-private mega projects like the Bahrain Metro, the assurance of adequate funding, the efficiency of procurement, and the quality of early stakeholder collaboration outweigh traditional risk management practices during the planning phase. These findings are essential because they suggest that project planners must prioritize financial structuring and stakeholder processes over rigid risk protocols when operating in rapidly urbanizing contexts. Theoretical contributions of this study include refining the understanding of success factors by showing that not all commonly accepted practices, such as intensive risk management, universally guarantee planning success. Practically, the study offers direct strategies for practitioners in similar infrastructure projects to recalibrate their focus towards financial governance and strategic partnerships. For policymakers, this study signals the need for regulatory frameworks that facilitate better procurement transparency and stakeholder accountability. For future research, the findings open a path to further investigate under what conditions risk management may regain significance or how financial and stakeholder dimensions can be optimized for different types of infrastructure projects. By highlighting these differences, the study provides a more precise foundation for improving planning practices in mega-project management. New methods for managing public-private collaboration in

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infrastructure projects are leveraging real-time digital platforms for better security and control (Zindros et al., 2025).

CONCLUSION

This study aimed to investigate the critical success factors influencing the planning stage of the Bahrain Metro Project. The need for this study arose from gaps in previous research, where challenges in financial management, stakeholder engagement, and procurement were often overlooked despite being key drivers in large infrastructure projects. To address this, a quantitative research methodology was used, involving a structured questionnaire distributed to 385 professionals directly engaged in the project. Using regression analysis, the study identified that stakeholder engagement, financial investment, procurement methods, and technical specifications were significantly related to planning success, while risk management showed no direct impact. Additionally, the planning stage itself significantly influenced the overall project success. These findings carry important theoretical, practical, and future research significance. Theoretically, the study challenges existing models that overemphasize risk management without sufficient empirical basis in public-private mega projects. Practically, the findings provide immediate strategies for project managers and government agencies to enhance project success by investing efforts early into financial planning, transparent procurement, and active stakeholder dialogue. For future research, this study establishes a basis for comparative studies across different cultural and regional contexts to better understand how these factors behave globally. Ultimately, this research strengthens the academic conversation on large-scale project planning while offering real-world guidance for better management of public infrastructure projects like the Bahrain Metro Project.

LIMITATIONS

The research relies on the data available at the time of the study. Future developments, technological advancements, and unforeseen socio-economic changes could impact the relevance and applicability of the findings. Additionally, the reliance on quantitative data may overlook qualitative aspects such as personal experiences and perceptions, which could provide deeper insights into the project's impact and challenges. This limitation highlights the need for ongoing research and the potential value of incorporating qualitative methods to capture a more holistic view of such large-scale projects.

FUTURE RESEARCH RECOMMENDATIONS

Future studies could benefit from a comparative approach, analyzing similar infrastructure projects in different geographical and cultural contexts. This would provide a broader understanding of how regional and cultural factors influence project planning and execution. Such comparative research could yield valuable insights into best practices and strategies that are universally effective, as well as those that need to be tailored to specific contexts. Additionally, examining projects in various stages of development could offer a longitudinal perspective on the evolution of project management strategies and their long-term outcomes. Future studies should consider integrating interviews, focus groups, and case studies to gather insights from project stakeholders, including community members, project managers, and policymakers. This qualitative data can reveal the underlying motivations, perceptions, and attitudes that drive stakeholder behaviour and decisions, providing a more comprehensive view of the factors contributing to the success or failure of large-scale infrastructure projects.

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CONFLICT OF INTEREST STATEMENT

Two of the authors, Nurul Hayati Abdul Halim and Izdihar Tharazi are the Section Editor and the Assistant Manging Editor of the Journal of Mechanical Engineering (JMechE), respectively. Both authors have no other conflict of interest to note.

AUTHORS' CONTRIBUTION

The authors confirm equal contributions in each part of this work. All authors reviewed and approved the final version of this work.

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