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The Role Of Project Management And Technology Awareness On Infrastructure Performance Of Road And Bridge Projects In Libya

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Abstract

This analytical article explores the critical influence of project management and awareness of technology on the efficiency of road and bridge infrastructure projects in Libya. It highlights the universal importance of proficient project management strategies and technological expertise in reinforcing the efforts to develop infrastructure within the Libyan framework. Faced with hurdles in attaining peak infrastructure efficiency, Libya requires a detailed exploration of the dynamics between project management methodologies, awareness of technology, and the results of infrastructure projects. Drawing upon the Technological Acceptance Model, this study aims to explore the nexus between project management practices, awareness of technology, and infrastructure efficiency in Libya. The insights from this study are set to enrich existing knowledge on infrastructure efficiency by illustrating how technological awareness can serve as a critical factor in the interaction between project management practices and infrastructure outcomes. The study suggests that managers should prioritize enhancing their organization's grasp of technology to boost infrastructure efficiency. This research is poised to benefit both industry professionals and academic circles. It posits that a combination of robust project management practices and the integration of technological tools can significantly elevate infrastructure performance.

Article Info

Keywords:
Road and Transportation, project management, technological orientation, Infrastructure performance, Libya.

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INTRODUCTION

The Road and Bridge Authority (RBA) bears the essential duty of issuing licenses for all public and commercial vehicles and supervising the regulation and oversight of public transport networks. Initiating and completing infrastructure ventures related to roads and transport is a process that demands significant time (RBA, 2017). Globally, the sectors of transport and infrastructure are essential, contributing extensively to production, employment statistics, and the performance of the gross domestic product (GDP). Indeed, transport is a critical driver of economic progress in both advanced and emerging nations, emphasizing its central role in the broader economic landscape. Recent years have witnessed a surge in ambitious infrastructure endeavors in various emerging nations. Project management is employed as a strategy to tackle potential unpredictability linked with projects, as these uncertainties are frequently identified as chief reasons for delays and reduced performance in organizations (Aziz, Qasim, & Wajdi, 2017).

Globally, the Road and Transportation Project Management Cycle is instrumental, advocating for increased developmental projects to enhance road and transport networks. Ever since its inception as a principal entity in the Libyan government, infrastructure development has been crucial in driving Libya's growth and advancement (Al Nahyan, Sohal, Fildes, & Hawas, 2012). RBA's initiatives in Libya have paved the way for pioneering projects, setting elevated standards and serving as benchmarks for other bodies to follow. These initiatives include the introduction of advanced booths and bus shelters, contributing significantly to Libya's progression. By adopting project management methodologies and practices, infrastructure ventures in Libya have yielded favorable results, fostering business growth and customer loyalty (Haque, Saroar, Fattah, & Morshed, 2020).

Road transportation is fundamental to any economy, whether advanced or emerging, and holds economic significance by not only mitigating unemployment and poverty but also by spurring innovation (Herman et al, 2018). Boosting the efficiency of road and transportation networks is paramount for every nation (Dewan, 2018). Libya, along with many other countries, is witnessing an increase in road construction activities.

Investment in infrastructure plays a crucial role in strengthening and enhancing the economic landscape of Libya. The government of Libya has made significant investments in its infrastructure, particularly focusing on the transportation sector to improve the national road network and foster economic development (Al Nahyan et al., 2012). Additionally, efforts are being made to reform the governance of infrastructure, which includes making the process of project implementation more efficient and tackling issues related to delays and insufficient capacity. These reforms have been instrumental in elevating the use of public transportation within the country, with the percentage of journeys made via public transport increasing from 6% in 2006 to 17.5% in 2018. Furthermore, advancements in road infrastructure, coupled with ongoing public awareness initiatives, have led to a substantial reduction in the number of road fatalities, with a decline from 21.9 per 100,000 people in 2006 to just 2.4 per 100,000 in 2018, marking an 89% decrease (Suryani et al., 2021).

Technical shortcomings or lapses in contractual agreements, as well as design oversights, frequently result in problems that emerge after the defect liability period, leaving the Department of Roads with few options to hold contractors accountable. Conducting a detailed technical audit during the construction phase is essential for the Department of Roads to verify that all parties, including the client, receive exactly what was agreed upon (Maude & Aubry, 2018). This process involves a rigorous review of material quality and design fidelity to ensure they meet the original specifications, a step beyond what is typically done in post-construction evaluations. It's not uncommon for projects to experience delays, budget overruns, and failures to meet quality standards, leading to less than satisfactory results and discontent among stakeholders (Sutrisna & Goulding, 2019). These issues primarily impact the schedule and financial aspects of a project. The cost of correcting these errors, or rework, can account for 10-15% of the total contract value (Zamberi Ahmad & Ahmad, 2016). However, adopting more effective change management strategies can help in reducing these adverse outcomes.

While it may be challenging to obtain precise statistics on the success rates of road construction projects in Libya, it is estimated that up to 50% of infrastructure projects in the country face failure (Faridi & El Sayegh, 2006; Johnson & Babu, 2018). This significant rate of failure has led to an intensely competitive market for handling claims and disputes (Arcadis, 2018; Ojiako et al., 2018; Mishmish & El-Sayegh, 2018; Zaneldin, 2018). It has been documented that half of the construction projects in Libya encounter delays, failing to meet their scheduled timelines (Faridi & El-Sayegh, 2016). Further studies have identified the leading causes of

these construction delays, highlighting critical issues such as the approval process for drawings, poor initial planning, and sluggish decision-making by project owners as the main culprits in the Libyan construction industry. These findings emphasize the importance of skilled project management to overcome such challenges. The delay in owners' decision-making, together with inadequate early planning, a lack of labor, poor oversight, and deficient site management, are among the top reasons. Interestingly, contractor-related issues account for half of the top ten most critical delay factors, indicating that contractors may often be at fault for these delays (Faridi & El-Sayegh, 2016). Resource shortages have also been pinpointed as a significant cause of project postponements. The critical reasons for delays include not only a lack of labor but also issues with productivity and expertise.

Although numerous factors contributing to the delays in Libya's construction industry are consistent with those identified in earlier research, it has been noted that time and budget overruns are becoming predominant reasons for project holdups. Studies have pointed out that lack of labor, inefficiencies in productivity and skill, along with poor communication, are significant factors causing these delays (Ewedairo et al., 2018; Gharehgozli, de Vries, & Decrauw, 2019; Mahmud, Ogunlana, & Hong, 2021). The sectors of road and transportation are undergoing notable advancements and commercial growth (Hua Song et al., 2016). Infrastructure related to roads and transportation is acknowledged as a key driver of economic development (Abdulla Al Marzooqi & Zamberi Ahmad, 2018; Mainga, 2017). A variety of research efforts have been made to discern the elements that contribute to effective project management and the orientation of processes within organizational achievements (Al Nahyan et al., 2012; Mainga, 2017; Todorov & Akbar, 2018). Certain studies (Abdulla Al Marzooqi & Zamberi Ahmad, 2018; Taleb, 2020) have found a considerable positive impact of project management practices on the performance of infrastructure projects. Moreover, investigations have been made into the principal reasons behind project failures in Libya (Hussain, Ruikar, Enoch, Brien, & Gartside, 2017; Mwelu, Davis, Ke, & Watundu, 2020). Yet, the influence of technology awareness on the processes of project management and the performance of infrastructure remains an unexplored area in the existing literature on roads and transportation within the Libyan context.

The scarcity of scholarly work on roads and transportation within the Libyan context poses a notable obstacle to the enhancement of infrastructure efficacy. This analysis underscores the importance of essential project management practices tailored to the RBA setting, which are instrumental in bolstering their efficiency. Considering the limited resources available in Libya, adopting a more efficient project management approach is essential for improving market share and profitability derived from project successes (Marcel van, 2018). This study identifies and examines the synergies between project management, awareness of technological advancements, and organizational effectiveness in Libya. It explores various determinants that affect these processes and highlights their combined influence on the successful outcome of infrastructure projects in the country (Mainga, 2017). By leveraging project management techniques informed by technological awareness, this research aims to delineate a roadmap for achieving infrastructure development success in the Libyan roads and transportation sector.

LITERATURE REVIEW

Infrastructure Performance

Evaluating the performance of infrastructure revolves around assessing its effectiveness in providing the anticipated services to the community. This assessment is usually conducted via the "iron triangle" framework, which encompasses considerations of time, cost, and quality. It involves examining factors such as delays in completion, exceeding the budget, and the overall quality of the completed infrastructure (Irfan, Malik, & Kaka Khel, 2020).

Predicting the duration of the planning process for transportation infrastructure projects is complex, given the unique nature of each project. For instance, in Germany, approval procedures can take anywhere from 1 to 3 years in simpler cases, and up to 6 years or more in complex situations (Ismail, 2019). In some cases, the entire planning process can span over a decade, or even close to three decades in the most complex scenarios.

Construction endeavors frequently surpass their projected budgets and deadlines. Research, such as the study by Mahmud et al. (2021), indicates that approximately half of all construction projects experience budget overruns, with these overruns varying between 40% and 200%. Projects related to transportation infrastructure

are especially susceptible to these cost overruns. A review of 258 transportation infrastructure projects from 20 different countries found that rail projects had an average cost overrun of 44.7%, whereas road projects had a somewhat lower average overrun rate of 20.4%. Additionally, an analysis by the German Federal Parliament of 214 road construction projects identified cost deviations ranging from 10% to a remarkable 720% (Liyanage et al., 2017).

The Road and Bridge Authority of Libya is responsible for managing and developing the country's road and transportation infrastructure. In the last thirty years, Libya has experienced considerable development across multiple sectors throughout its seven regions, resulting in notable advancements within the construction sector. This progress encompasses the expansion of critical transportation infrastructure, including the construction of roads, bridges, airports, and seaports. However, many projects have encountered setbacks due to coordination challenges, slow decision-making, design flaws, and regulatory changes (Abdulla Al Marzooqi & Zamberi Ahmad, 2018). Despite these challenges, there's a lack of comprehensive scientific studies addressing the complexities of infrastructure development in Libya, pointing to a need for further research and intervention (Mangioni, 2018).

Numerous elements lead to construction project delays throughout the Middle East, encompassing issues related to management, finances, workforce, and design. In Jordan, the scarcity of skilled workers contributes to project postponements, a problem mirrored in other nations. Kuwait experiences delays due to poor project management, changes in design, financial issues, and a deficiency in owner expertise (Shebob et al., 2012; Sundaraj & Eaton, 2013). In Iran, the most critical factors causing delays are financial, managerial, and environmental issues (Alhammadi & Memon, 2020; P. X. W. Zou, Wang, & Fang, 2008). Financial limitations, lack of equipment, management difficulties, and modifications in orders are reasons for delays in Lebanon (Faridi & El-Sayegh, 2006). Meanwhile, in the Gaza Strip, delays are commonly due to inadequate funding, material supply hold-ups, and insufficient site resources (Saiful Islam & Trigunarsyah, 2017).

In conducting a comparative analysis of causes of delays, it is crucial to pinpoint delay factors that are common across different countries, such as Lebanon, Saudi Arabia, and the UAE, to facilitate a comparison that accurately reflects the most prevalent causes of delays in each country under their specific circumstances. The construction industry in the UAE has a distinct perspective and prioritization of delay causes compared to its counterparts in Saudi Arabia and Lebanon (Saiful Islam & Trigunarsyah, 2017). In both Lebanon and the UAE, contractors highlight issues such as delays in the decision-making by owners, the time taken for the preparation and approval of drawings, and the process of securing permits and approvals from relevant authorities. However, consultants in Lebanon perceive the process of obtaining permits as being less significant for projects in the UAE than in Lebanon (Rank 9 for the UAE as opposed to Rank 47 for Lebanon).

Research conducted by Jeong, Joo-Seong, & Jung, Eun-Young (2017) identified prevalent delays in emerging economies, pinpointing financial issues as a key concern. This encompasses problems related to the contractor's liquidity, postponements in receiving progress payments, and shortages in the owner's financing. Additionally, poor management of construction sites by contractors and obstacles in effective project planning and scheduling emerged as notable contributors to delays. Issues stemming from the project owner, especially regarding amendments to the project scope during construction, were identified as frequent and significant sources of project delays.

In developing countries, other common factors leading to project delays are identified as inadequate coordination and communication, delays in procurement processes, tardy arrival of materials and equipment at the construction site, shortages of materials and equipment, financial limitations on the part of the owner, restricted contractor expertise, a scarcity of labor, and a deficiency in skilled workforce availability.

Within the framework of Libya's Road and Bridge Authority, a variety of factors lead to prolonged construction timelines. In Ghana, the postponement of construction projects is frequently due to the owner not fulfilling financial commitments to contractors. In Saudi Arabia, the emphasis on financial scrutiny and the practice of selecting contractors based on the lowest bid are recognized as significant reasons for project delays in the government construction sector. Likewise, in Vanuatu, issues related to project ownership have been associated with schedule setbacks in construction projects.

Inclement weather conditions are recognized as a primary factor causing delays in some construction projects, whereas in Lagos State, Nigeria, the scarcity of adequate equipment supply has detrimentally affected contractor performance, resulting in project postponements. In Malaysia, factors such as poor planning,

inadequate site management, limited contractor knowledge, and issues with project financing and payments have been pinpointed as significant causes of delays in construction projects.

Research carried out in Ethiopia has uncovered that corruption, the absence of utilities at the construction site, rising costs of materials, the scarcity of high-quality materials, delayed design processes, and problems with design documents stand out as leading factors contributing to project delays. In Pakistan, poor management of construction sites, a lack of contractor proficiency, and poor communication between parties involved in the project have been identified as the foremost causes of delays in the construction of highways.

In developing nations such as Ghana, challenges related to irregular monthly payments, ineffective contract administration, inflation in material procurement costs, and financial difficulties encountered by contractors are marked as crucial contributors to delays in groundwater development projects. In Turkey, the lack of contractor expertise, poor site management and oversight, inadequate planning and scheduling of projects, changes to designs initiated by the owner during the construction phase, delays in the delivery of materials, and the unreliability of subcontractors are all identified as significant reasons for project postponements.

In the context of gas pipeline projects in Iran, obstacles including the contractor's challenges in acquiring imported materials, client-imposed unrealistic project timelines, slow material deliveries, land acquisition issues, and client requests for change orders or additional tasks have been pinpointed as primary factors causing delays. Research into construction project delays has uniformly identified issues such as the contractor's lack of experience, inadequate funding and payment delays for work already performed, problems arising from dealings with subcontractors, interventions by the project owner, and delayed decision-making processes on the part of the contractor.

Project Management Process

The selection of an efficient project management methodology is financially crucial for organizations. Business planning, as detailed by Walimuni, Samaraweera, and De Silva (2017), spans various domains, including financial management, human resources, marketing, product development, and technology. This multifaceted approach shapes the definition of project planning in this study.

Project management continues to evolve as a key discipline in today's business landscape (Martinsuo, Vuorinen, & Killen, 2019), especially within the realm of construction (Manamgoda et al., 2018). It adapts to the changing demands of various industries, regions, and uses (Ogbu & Adindu, 2020), and while it was once viewed as helpful but not essential for business achievement, its role has significantly transformed. Initially, its integration was occasional and sometimes met with resistance, primarily aimed at offering fundamental planning and scheduling training for lower and middle-tier employees. Such reluctance was due to the belief that project management could disrupt traditional organizational structures (Pålsson et al., 2017).

Zamberi Ahmad and Ahmad (2016) observed a deeper appreciation and understanding of project planning among entrepreneurs in the US compared to their counterparts in Croatia, attributing this difference to varying levels of familiarity with project planning across these regions. The US holds an advantage with its access to a wide array of professional service advisors, providing its business leaders with a competitive edge over those in Croatia and other Central Eastern European countries (CEEC). In similar research, Walimuni et al. (2017) investigated the reasons behind project failures, particularly in poor countries such as Jordan, which aligns with findings by Sutrisna & Goulding (2019) that pinpoint the absence of a project management strategy as a critical factor leading to project failures.

Zhang and Schramm (2020) contended that project failures often arise from inadequate project planning. Their review of twenty-five articles highlighted planning as a crucial determinant of project success or failure in sixteen studies, underscoring the fundamental role of planning in project outcomes. A well-defined project plan is instrumental in mitigating failure risks, as evidenced by Volden & Andersen (2018). Sendall et al. (2017) in their Chilean study, discovered that successful firms submit more precise project proposals, highlighting the criticality of meticulous planning in business triumph.

Project Management Process and Infrastructure Performance

The relationship between project management processes and the performance of infrastructure projects is closely connected. According to Ghobakhloo & Fathi (2020), project management involves the utilization of specific knowledge, skills, tools, and methods on project activities to achieve or surpass the expectations of stakeholders. It has grown from being a narrowly focused concept to becoming an all-encompassing system of

enterprise project management, incorporating every functional division (Babatunde, Ekundayo, Udeaja, & Abubakar, 2020). The maturity model for project management combines strategic management with the successful planning and execution of projects across six essential stages (design, planning, tendering, scoping, scheduling, and implementation), which includes practices for benchmarking and ongoing enhancement (Gerbov, Singh, & Herva, 2018).

The body of knowledge on construction project management is comprehensive, encompassing topics such as managing relationships with stakeholders, executing projects systematically, theories of organization, managing contracts, metrics for project success, tools for estimating costs, innovative approaches to project planning, best practices, and the influence of information technology and other technologies on managing projects. The interactions among key project participants—namely clients, architects, and builders—play an important role in determining the success of construction endeavors. The importance of managing stakeholder relationships effectively is recognized as a vital factor for the achievement of projects in the transportation infrastructure sector (Dolla & Laishram, 2018; Mahmud et al., 2021).

Elements that impact the effectiveness of infrastructure, often referred to as "pitfalls," are components of the project or its administration that, when adjusted, can enhance the project's chances for success. The assessment of infrastructure effectiveness is traditionally based on the "iron triangle" framework, which focuses on time, budget, and quality, although additional metrics have been suggested. The Project Management Institute identifies nine areas of knowledge within project management, highlighting the importance of a thorough project governance structure for evaluating the success of a project overall (Lehnert et al., 2017).

Technology Awareness

Awareness of technology involves dedication to Research and Development (R&D), the embracing of emerging technologies, and the utilization of cutting-edge advancements (Narayanaswami, 2017). Strategic orientations encourage practices within an organization expected to provide a competitive edge over the long term, in harmony with the company's comprehensive strategy (Duygu Seckin Halac, 2015).

In today's work setting, heavily influenced by technology, where tools for collaboration, networking, and managing projects are widely utilized, technology holds a crucial position in the realm of project management (Oeij, Van Vuuren, Dhondt, Gaspersz, & De Vroome, 2018). Even co-located teams often rely on electronic communication. Studies indicate that neglecting modern technology can impede business success, with its absence affecting project performance. Hence, technology is vital in assisting project managers, with numerous studies emphasizing the importance of technology in shaping project management leadership styles (Sergeeva, 2020).

Technology acts as a crucial enabler of project management. Information technology aids in the creation, application, distribution, and sharing of knowledge. Managing technological knowledge involves developing, codifying, and transmitting knowledge, incorporating databases, hardware, software, and intelligent devices (Mhatre, Thakkar, & Maiti, 2017).

Despite its potential benefits, the construction sector is recognized for its slow pace in adopting innovative technologies compared to other industries. A national study conducted by the Civil Engineering Research Foundation showed that the design and construction sector invests only 0.5% of its total earnings in research and development (R&D) (Civil Engineering Research Foundation, 2016). An evaluation of 219 finished projects across the United States examined how extensively technology was applied across 68 typical project tasks. These projects were analyzed for their overall expenses and adherence to schedules. Results demonstrated a more significant association between the use of technology and the success of projects, particularly in terms of cost and completion time, in medium and small-sized projects compared to larger ones. In essence, the application of technology had a positive impact on the overall success of medium and small projects (Okudan, Budayan, & Dikmen, 2021).

Back and Bell (1994) investigated the effects of electronic data interchange on the management of bulk materials. They designed a process model to contrast integrated and non-integrated systems, assessing the advantages of technological integration. Their findings indicated that incorporating technology into the bulk materials handling process significantly decreased cycle times. Although general project management software may lack specific capabilities for tasks like sizing and cost estimation, which specialized costing software might offer, nor do they tackle quality issues such as efficiency in defect resolution. Nevertheless, project

management software requires a higher level of managerial skill for its effective use. Haji Karimian et al. (2019) observed that modern project managers are equipped with an extensive range of digital tools. The use of computer-aided project management entails the delineation of specific tasks that different software solutions undertake, with a significant emphasis on the holistic integration of all project management systems with digital tools. The goal of computerization extends beyond basic project management tasks, although it might still demand a level of detail akin to manually preparing schedules, cost estimates, or critical analyses using software tools (Mahmud et al., 2021).

Technology Awareness and Infrastructure Performance

The rate of technological advancement in any given industry influences both the adoption of new technologies and the development of existing ones, with technologically focused companies dedicating resources to the acquisition of cutting-edge technologies and the innovation of their processes, products, and services (Azam, 2015). Studies by Caputo, Garcia-Perez, Cillo, and Giacosa (2019) have demonstrated a link between a company's awareness of technology and its infrastructure performance. The importance of technology awareness in fostering innovation is recognized (Chión, Charles, & Morales, 2020), yet there is a relative dearth of literature exploring the relationship between technological orientation and corporate performance (Bianchi, Glavas, & Mathews, 2017). In environments where technology rapidly changes, infrastructures with a strong focus on technology perform better because they are able to introduce innovative solutions to satisfy customer demands (Giovannetti, Cardinali, & Sharma, 2021). Firms that combine innovation in customer value with technological advancements are more likely to sustain profitability and achieve higher performance levels (Firdaus, 2021). Given the fast pace of technological progress in competitive markets like Dubai, it's essential for infrastructures to be open to experimenting with new technologies to maintain competitiveness (Giovannetti et al., 2021; Hirvonen, Laukkanen, & Salo, 2016). In Libya, infrastructure authorities maintain a positive stance towards technology, which significantly enhances their innovation capabilities, aligning with the findings of previous research (Hruby, Watkins-Mathys, & Hanke, 2016). Libyan infrastructure companies are keen on utilizing technology to advance their innovation efforts, understanding that technology policies and embracing new technologies are crucial in improving their internal operations and methodologies. This understanding drives them to invest in advanced technologies to foster innovation, making the embrace of technology a key factor of innovative activity within the infrastructure sector (Khin & Ho, 2020).

In today's world, the importance of being aware of technological advancements is paramount. Technologies such as voice transmission, messaging, and video conferencing are essential in the development of information and communication technology (ICT) tools, particularly for facilitating communication during project execution (Nakata & Antalis, 2015; Stezano & Oliver Espinoza, 2019). The improvement of infrastructure performance is significantly dependent on advancements in information technology. ICTs are crucial for enhancing the efficiency of infrastructure. Industry experts highlight the critical role of IT in communication, a viewpoint that is consistent across different economies utilizing these technological platforms. In the era of digital transformation, such an approach is instrumental in improving the performance of projects. Moreover, studies from around the globe have confirmed the link between various IT tools and the enhancement of infrastructure performance (Mamun, 2018; Stezano & Oliver Espinoza, 2019; Wang, 2020).

Technological Awareness, Project Management Process, and Infrastructure Performance

For smaller-scale infrastructure projects, premature scaling and excessive expansion can create unsustainable scenarios, leading to the downfall of some firms. This is because rapid enlargement and growth can deplete capital resources, causing financial strain on the infrastructure. Having ample funding is vital for maintaining sufficient inventory levels during periods of swift growth and expansion. Consequently, the failure of the business can often be a direct outcome of such rapid expansion and growth (Norris & Ciesielska, 2019). A study analyzing significant infrastructure projects used cost overruns and the overestimation of benefits as metrics to assess project performance. It was discovered that cost overruns have been a consistent issue across many large-scale capital projects dating back to the early 20th century. Despite advancements in cost estimation and control methodologies, the study determined that the prevalence of cost overruns has remained unchanged over the last seventy years (Buli, 2017).

Alsadi and Aloulou (2021) highlighted the importance of integrating project management practices from the highest levels of leadership to those directly involved in project execution. This approach highlights the significance of not only project management but also other management domains, such as information technology (IT) management, in influencing the outcome of projects. The IT Management Institute (2018) defines IT management as a critical component of overall business management, emphasizing that it falls under the purview of the board of directors and senior executives. This domain covers the leadership, organizational structures, and processes essential for maintaining the organization's IT infrastructure in alignment with its strategic goals and objectives. Proper IT management, supported by technology, plays an important role in organizational achievement by ensuring the security and reliability of information (Bianchi et al., 2017). It enables IT managers and service providers to develop cohesive plans that integrate business and IT strategies, assign roles and duties, set priorities, and orchestrate IT endeavors, and evaluate their impact and results (Filieri, 2015). The main aim of IT management is to harmonize IT initiatives with business goals, while also facilitating the maintenance of IT operations (Al-Omoush, Al Attar, Saleh, & Alsmadi, 2020). Research consistently shows that strategic alignment between IT and project initiatives leads to enhanced organizational performance (Kurniawan, Budiastuti, Hamsal, & Kosasih, 2021).

A study revealed that technology utilization had a profound impact on enhancing the connection between comprehensive project success and integration management, with a correlation coefficient of 0.343 and a significance level below 0.01. The outcomes from a partial correlation analysis underscored technology's mediating influence on the nexus between seven key project management responsibilities and the overall achievement of the project. This analysis underlined the importance of digital tools in bridging project management activities with project success. As a result, the company aimed to boost project outcomes by investing in advanced electronic devices, such as computers, to better integrate the project management framework (Nakata & Antalis, 2015). Wang (2020), in concurrence with Nakata and Antalis (2015), found that employing a range of digital tools significantly improved construction efficiency and project outcomes. These observations suggest that superior project results are attainable when robust project management techniques are implemented alongside efficient use of technology (Project Management Institute, 2018). The study emphasized the critical role of embracing technology within construction firms for achieving better project performance.

CONCLUSION

In conclusion, a thorough understanding of the factors contributing to project delays is essential for effective project management and successful infrastructure development. The challenges faced in the construction industry, including those in Libya, span a wide range of aspects from financial constraints to inadequate management practices and resource shortages. By addressing these issues and implementing strategic measures, stakeholders in the Road and Bridge Authority of Libya can significantly enhance the performance and timely completion of critical infrastructure projects, ultimately contributing to the overall development and prosperity of the nation.

REFERENCES

Abdulla Al Marzooqi, F., & Zamberi Ahmad, S. (2018). Unasco: Exploring The Market For Sustainable Business. Emerald Emerging Markets Case Studies, 8(3), 1-19. Doi:10.1108/Eemcs-08-2017-0201

Al Nahyan, M. T., Sohal, A. S., Fildes, B. N., & Hawas, Y. E. (2012). Transportation Infrastructure Development In The Uae. Construction Innovation, 12(4), 492-514. Doi:10.1108/14714171211272234

Alhammadi, A., & Memon, A. (2020). Inhibiting Factors of Cost Performance in UAE Construction Projects. International Journal of Sustainable Construction Engineering and Technology, 11. doi:10.30880/ijscet.2020.11.02.014

Al-Omoush, K. S., Al Attar, M. K., Saleh, I. H., & Alsmadi, A. A. (2020). The drivers of E-banking entrepreneurship: an empirical study. International Journal of Bank Marketing, 38(2), 485-500. doi:10.1108/IJBM-03-2019-0113

Alsadi, A. K., & Aloulou, W. J. (2021). Impacts of strategic orientations on Saudi firm performance: is supply chain integration a missing link? The International Journal of Logistics Management, 32(4), 1264-1289. doi:10.1108/IJLM-02-2020-0080
Azam, M. S. (2015). Diffusion of ICT and SME Performance. In E-Services Adoption: Processes by Firms in Developing Nations (Vol. 23A, pp. 7-290): Emerald Group Publishing Limited.
Babatunde, S. O., & Perera, S. (2017). Cross-Sectional Comparison Of Public-Private Partnerships In Transport Infrastructure Development In Nigeria. Engineering, Construction And Architectural Management, 24(6), 875-900. Doi:10.1108/Ecam-11-2015-0186
Bianchi, C., Glavas, C., & Mathews, S. (2017). SME international performance in Latin America. Journal of Small Business and Enterprise Development, 24(1), 176-195. doi:10.1108/JSBED-09-2016-0142
Bianchi, C., Glavas, C., & Mathews, S. (2017). SME international performance in Latin America. Journal of Small Business and Enterprise Development, 24(1), 176-195. doi:10.1108/JSBED-09-2016-0142
Buli, B. M. (2017). Entrepreneurial orientation, market orientation and performance of SMEs in the manufacturing industry. Management Research Review, 40(3), 292-309. doi:10.1108/MRR-07-2016- 0173
Caputo, F., Garcia-Perez, A., Cillo, V., & Giacosa, E. (2019). A knowledge-based view of people and technology: directions for a value co-creation-based learning organisation. Journal of Knowledge Management, 23(7), 1314-1334. doi:10.1108/JKM-10-2018-0645
Chión, S. J., Charles, V., & Morales, J. (2020). The impact of organisational culture, organisational structure and technological infrastructure on process improvement through knowledge sharing. Business Process Management Journal, 26(6), 1443-1472. doi:10.1108/BPMJ-10-2018-0279
Dewan Md Zahurul Islam (2018), "Prospects For European Sustainable Rail Freight Transport During Economic Austerity", Benchmarking: An International Journal, Https://Doi.Org/10.1108/Bij-12-2016- 0187.
Dolla, T., & Laishram, B. S. (2018). Procurement of low carbon municipal solid waste infrastructure in India through public-private partnerships. Built Environment Project and Asset Management, 8(5), 449-460. doi:10.1108/BEPAM-10-2017-0087
Ewedairo, K., Chhetri, P., & Jie, F. (2018). Estimating transportation network impedance to last-mile delivery. The International Journal of Logistics Management, 29(1), 110-130. doi:10.1108/IJLM-10-2016-0247
Faridi, A. S., & El-Sayegh, S. M. (2006). Significant factors causing delay in the UAE construction industry. Construction Management and Economics, 24(11), 1167-1176. doi:10.1080/01446190600827033
Filieri, R. (2015). From market-driving to market-driven. Marketing Intelligence & Planning, 33(3), 238-257. doi:10.1108/MIP-02-2014-0037
Firdaus, A. (2021). Determination Of Organisational Essential Needs As The Basis For Developing A -Based Performance Measurement. Isra International Journal Of Islamic Finance, 13(2), 229-250. Doi:10.1108/Ijif-11-2017-0041
Gerbov, A., Singh, V., & Herva, M. (2018). Challenges in applying design research studies to assess benefits of BIM in infrastructure projects. Engineering, Construction and Architectural Management, 25(1), 2-20. doi:10.1108/ECAM-12-2016-0260
Gharehgozli, A., De Vries, H., & Decrauw, S. (2019). The Role Of Standardisation In European Intermodal Transportation. Maritime Business Review, 4(2), 151-168. Doi:10.1108/Mabr-09-2018-0038
Ghobakhloo, M., & Fathi, M. (2020). Corporate survival in Industry 4.0 era: the enabling role of lean-digitized manufacturing. Journal of Manufacturing Technology Management, 31(1), 1-30. doi:10.1108/JMTM- 11-2018-0417 Giovannetti, M., Cardinali, S., & Sharma, P. (2021). Sales technology and salespeople's ambidexterity: an ecosystem approach. Journal of Business & Industrial Marketing, 36(4), 615-629. doi:10.1108/JBIM- 01-2020-0034
Haji Karimian, S., Mbachu, J., Egbelakin, T., & Shahzad, W. (2019). Improving Efficiency In Roading Projects: A New Zealand Study. Engineering, Construction And Architectural Management, 26(5), 827-849. Doi:10.1108/Ecam-02-2018-0060
Haque, M. N., Saroar, M., Fattah, M. A., & Morshed, S. R. (2020). Public-Private Partnership for achieving sustainable development goals: a case study of Khulna, Bangladesh. Public Administration and Policy, 23(3), 283-298. doi:10.1108/PAP-04-2020-0023

Herman Fithra , Sirojuzilam , Sofyan M. Saleh , Erlina (2018), Effect Of Freight Transportation For Regional Development In The North Zone Of Aceh, In (Ed.) Proceedings Of Micoms 2017 (Emerald Reach Proceedings Series, Volume 1) Emerald Publishing Limited, Pp.35 – 42

Hirvonen, S., Laukkanen, T., & Salo, J. (2016). Does brand orientation help B2B SMEs in gaining business growth? Journal of Business & Industrial Marketing, 31(4), 472-487. doi:10.1108/JBIM-11-2014-0217

Hruby, J., Watkins-Mathys, L., & Hanke, T. (2016). Antecedents and Outcomes of a Global Mindset: A Thematic Analysis of Research from 1994 to 2013 and Future Research Agenda. In Advances in Global Leadership (Vol. 9, pp. 213-280): Emerald Group Publishing Limited.

Hua Song, Kangkang Yu, Anirban Gangly, Rabia Turson. (2016) "Supply Chain Network, Information Sharing And Sme Credit Quality", Industrial Management & Data Systems, 116(4), Pp.740 – 758

Hussain, R. S., Ruikar, K., Enoch, M. P., Brien, N., & Gartside, D. (2017). Process mapping for road works planning and coordination. Built Environment Project and Asset Management, 7(2), 157-172. doi:10.1108/BEPAM-08-2016-0041

Ismail, Z.-A. (2019). Optimising the safety of road transport workers on IBS building construction projects: a review. Social Responsibility Journal, 15(6), 837-851. doi:10.1108/SRJ-09-2018-0240

Johnson, R., & Babu, R. (2018). Time and cost overruns in the UAE construction industry: a critical analysis. International Journal of Construction Management, 20, 1-10. doi:10.1080/15623599.2018.1484864 Koul, P., Verma, P., & Arora, L. (2021). Road infrastructure development under PPP model in India: a credit rating perspective. Built Environment Project and Asset Management, 11(2), 266-283. doi:10.1108/BEPAM-08-2020-0137

Kurniawan, R., Budiastuti, D., Hamsal, M., & Kosasih, W. (2021). Networking capability and firm performance: the mediating role of market orientation and business process agility. Journal of Business & Industrial Marketing, 36(9), 1646-1664. doi:10.1108/JBIM-01-2020-0023

Lehnert, M., Linhart, A., & Roeglinger, M. (2017). Exploring the intersection of business process improvement and BPM capability development. Business Process Management Journal, 23(2), 275-292. doi:10.1108/BPMJ-05-2016-0095

Lenahan O'connell, Juita-Elena (Wie) Yusuf, Khairul Azfi Anuar, (2018) "Beyond New Roads And Bridges: Understanding Public Preferences For Investing In Urban Non-Automobile Transportation Infrastructure", Journal Of Public Budgeting, Accounting & Financial Management, 30(2), Pp.175-190.

Liyanage, C., Dias, N., Amaratunga, D., & Haigh, R. (2017). Current context of transport sector in South Asia. Built Environment Project and Asset Management, 7(5), 490-505. doi:10.1108/BEPAM-10-2016-0051

Mahmud, A. T., Ogunlana, S. O., & Hong, W. T. (2021). Key Driving Factors Of Cost Overrun In Highway Infrastructure Projects In Nigeria: A Context-Based Perspective. Journal Of Engineering, Design And Technology, 19(6), 1530-1555. Doi:10.1108/Jedt-05-2020-0171

Mainga, W. (2017). Examining project learning, project management competencies, and project efficiency in project-based firms (PBFs). International Journal of Managing Projects in Business, 10(3), 454-504. doi:10.1108/IJMPB-04-2016-0035

Mamun, A. A. (2018). Diffusion of innovation among Malaysian manufacturing SMEs. European Journal of Innovation Management, 21(1), 113-141. doi:10.1108/EJIM-02-2017-0017

Manamgoda, M. G. N., Perera, B. A. K. S., & Perera, C. S. R. (2018). Impact of interest rates of bank loans on road construction: the case of Sri Lanka. Journal of Engineering, Design and Technology, 16(4), 518-532. doi:10.1108/JEDT-12-2017-0133

Mangioni, V. (2018). Evaluating the impact of the land acquisition phase on property owners in megaprojects. International Journal of Managing Projects in Business, 11(1), 158-173. doi:10.1108/IJMPB-08-2017- 0090

Marcel Van Assen, (2018) "Process Orientation And The Impact On Operational Performance And Customer-Focused Performance", Business Process Management Journal, 24(2).

Martinsuo, M. M., Vuorinen, L., & Killen, C. (2019). Lifecycle-oriented framing of value at the front end of infrastructure projects. International Journal of Managing Projects in Business, 12(3), 617-643. doi:10.1108/IJMPB-09-2018-0172

Maude Brunet, Monique Aubry, (2018) "The Governance Of Major Public Infrastructure Projects: The Process Of Translation", International Journal Of Managing Projects In Business, 11(1), Pp.80-103.

Mhatre, T. N., Thakkar, J. J., & Maiti, J. (2017). Modelling critical risk factors for Indian construction project using interpretive ranking process (IRP) and system dynamics (SD). International Journal of Quality & Reliability Management, 34(9), 1451-1473. doi:10.1108/IJQRM-09-2015-0140
Mwelu, N., Davis, P. R., Ke, Y., & Watundu, S. (2020). Compliance mediating role within road construction regulatory framework. Journal of Public Procurement, 20(3), 209-233. doi:10.1108/JOPP-12-2018- 0052
Nakata, C., & Antalis, E. (2015). Enhancing market exchanges at the base of the pyramid. International Marketing Review, 32(6), 762-782. doi:10.1108/IMR-07-2015-0172
Nakata, C., & Antalis, E. (2015). Enhancing market exchanges at the base of the pyramid. International Marketing Review, 32(6), 762-782. doi:10.1108/IMR-07-2015-0172
Narayanaswami, S. (2017). Urban transportation: innovations in infrastructure planning and development. The International Journal of Logistics Management, 28(1), 150-171. doi:10.1108/IJLM-08-2015-0135
Norris, D., & Ciesielska, M. (2019). Towards a framework for innovation orientation within business and management studies. Journal of Organizational Change Management, 32(1), 123-144. doi:10.1108/JOCM-02-2018-0051
Oeij, P. R. A., Van Vuuren, T., Dhondt, S., Gaspersz, J., & De Vroome, E. M. M. (2018). Mindful infrastructure as antecedent of innovation resilience behaviour of project teams. Team Performance Management: An International Journal, 24(7/8), 435-456. doi:10.1108/TPM-09-2017-0045
Ogbu, C. P., & Adindu, C. C. (2020). Direct risk factors and cost performance of road projects in developing countries. Journal of Engineering, Design and Technology, 18(2), 326-342. doi:10.1108/JEDT-05- 2019-0121
Okudan, O., Budayan, C., & Dikmen, I. (2021). Development of a conceptual life cycle performance measurement system for build–operate–transfer (BOT) projects. Engineering, Construction and Architectural Management, 28(6), 1635-1656.
Pålsson, H., Winslott Hiselius, L., Wandel, S., Khan, J., & Adell, E. (2017). Longer and heavier road freight vehicles in Sweden. International Journal of Physical Distribution & Logistics Management, 47(7), 603-622. doi:10.1108/IJPDLM-02-2017-0118
Saiful Islam, M., & Trigunarsyah, B. (2017). Construction Delays in Developing Countries: A Review. Journal of construction engineering and project management, 7. doi:10.6106/JCEPM.2017.3.30.001
Sendall, M. C., Crane, P., McCosker, L., Fleming, M., Biggs, H. C., & Rowland, B. (2017). Truckies and health promotion: using the ANGELO framework to understand the workplace's role. International Journal of Workplace Health Management, 10(6), 406-417. doi:10.1108/IJWHM-09-2017-0070
Sergeeva, N. (2020). Towards more flexible approach to governance to allow innovation: the case of UK infrastructure. International Journal of Managing Projects in Business, 13(1), 1-19. doi:10.1108/IJMPB-10-2018-0216
Shebob, A., Dawood, N., Shah, R. K., & Xu, Q. (2012). Comparative study of delay factors in Libyan and the UK construction industry. Engineering, Construction and Architectural Management, 19(6), 688-712. doi:10.1108/09699981211277577
Stezano, F., & Oliver Espinoza, R. (2019). Innovation capabilities and performance of biotechnology firms. Management Research: Journal of the Iberoamerican Academy of Management, 17(4), 445-473. doi:10.1108/MRJIAM-11-2018-0880
Sundaraj, G., & Eaton, D. (2013). Quantifying robustness in PFIs. Journal of Financial Management of Property and Construction, 18(1), 26-52. doi:10.1108/13664381311305069
Suryani, E., Hendrawan, R. A., Adipraja, P. F. E., Wibisono, A., & Dewi, L. P. (2021). Urban mobility modeling to reduce traffic congestion in Surabaya: a system dynamics framework. Journal of Modelling in Management, 16(1), 37-69. doi:10.1108/JM2-03-2019-0055
Sutrisna, M., & Goulding, J. (2019). Managing information flow and design processes to reduce design risks in offsite construction projects. Engineering, Construction and Architectural Management, 26(2), 267-284. doi:10.1108/ECAM-11-2017-0250
Taleb, H. M. (2020). The Potential Of Implementing A Toxicity Tax For Heavily Polluting Vehicles In The United Arab Emirates. Transforming Government: People, Process And Policy, 14(1), 101-123. Doi:10.1108/Tg-08-2019-0073

Todorov, K., & Akbar, Y. H. (2018). Basics of Strategic ManagementEtihad Rail: A New Way to Change a Business Landmark in the United Arab EmiratesCase Study: Inchcape plc. Part 3. In Strategic Management in Emerging Markets (pp. 109-161): Emerald Publishing Limited.
Volden, G. H., & Andersen, B. (2018). The hierarchy of public project governance frameworks. International Journal of Managing Projects in Business, 11(1), 174-197. doi:10.1108/IJMPB-04-2017-0040
Walimuni, P. C., Samaraweera, A., & De Silva, L. (2017). Payment mechanisms for contractors for better environmental hazard controlling in road construction projects. Built Environment Project and Asset Management, 7(4), 426-440. doi:10.1108/BEPAM-11-2016-0069
Wang, F. (2020). Digital Marketing Capabilities In International Firms: A Relational Perspective. International Marketing Review, 37(3), 559-577. Doi:10.1108/Imr-04-2018-0128
Zamberi Ahmad, S., & Ahmad, N. (2016). Etihad Rail: a new way to change a business landmark in the United Arab Emirates. Emerald Emerging Markets Case Studies, 6(3), 1-16. doi:10.1108/EEMCS-01-2015- 0008
Zhang, X., & Schramm, H.-J. (2020). Assessing the market niche of Eurasian rail freight in the belt and road era. The International Journal of Logistics Management, 31(4), 729-751. doi:10.1108/IJLM-12-2019- 0351
Zou, P. X. W., Wang, S., & Fang, D. (2008). A life-cycle risk management framework for PPP infrastructure projects. Journal of Financial Management of Property and Construction, 13(2), 123-142. doi:10.1108/13664380810898131.