

A REVIEW OF THE IMPACT OF PROJECT MANAGEMENT IN ENHANCING CIVIL ENGINEERING OUTCOMES IN NIGERIA

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Graphical abstract



Abstract

Every nation, including Nigeria, needs civil engineering projects to grow and enhance its infrastructure. Unfortunately, insufficient project management in Nigeria severely compromises these initiatives, creating problems with finances and operations. Key issues include escalating costs, a shortage of skilled labor, poor quality of services, and underdeveloped infrastructure, which contribute to delays, cost overruns, compromised project integrity, and notably, building collapses. This paper aims to clarify how effective project management can improve project delivery by reviewing existing research and data from online sources. We focus on project managers' roles in time and budget management, risk handling, sustainable building practices, and compliance with safety regulations. The analysis includes case studies and research findings from across Nigeria, highlighting the central role of project managers in ensuring projects are completed correctly, safely, and in line with planned objectives. This review indicates that strong project management contributes to better performance in construction firms and reduces errors. The integration of project management with technical acumen is presented as a necessary evolution for the civil engineering sector to meet contemporary demands and drive national growth. This will create a balanced approach that integrates comprehensive project management throughout the project lifecycle, tackling prevalent industry challenges and enhancing infrastructure development. In conclusion, this paper emphasizes that project management is key to improving civil engineering project outcomes. Hence, the urgent need for civil engineers in Nigeria to develop project management skills alongside their technical knowledge.

Keywords: Civil Engineering, Project Management, Sustainable Construction, Infrastructure Development, Construction Efficiency.

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1.0 INTRODUCTION

1.1. Background

Nigeria's civil engineering sector is critical to the country's infrastructural development and economic growth. However, the sector faces significant challenges, including frequent building collapses, project delays, cost overruns, and abandonment of projects. These issues have not only resulted in financial losses but also in loss of lives and property. For instance, the collapse of a 21-story building in Ikoyi, Lagos, in November 2021, which led to the loss of over 40 lives, underscores the dire consequences of these challenges [1]. Another report by the Building Collapse Prevention Guild (2024)

[2] states that Nigeria experienced 135 building collapse incidents and at least 26 deaths between 2022 and 2024. Such incidents highlight the urgent need for effective project management practices to enhance the outcomes of civil engineering projects in Nigeria.

Project management is a critical discipline that involves planning, executing, and overseeing projects to achieve specific goals within defined parameters such as time, cost, and quality. In the context of civil engineering, effective project management ensures that projects are completed on time, within budget, and to the required standards. It encompasses various aspects, including risk management, resource allocation, scheduling, and quality control [3]. The application of robust project management practices can mitigate many of the

issues plaguing Nigeria's civil engineering sector. For example, a study by Aibinu and Jagboro (2002) [4] found that effective project planning and scheduling significantly reduce delays and cost overruns in construction projects. Moreover, the adoption of project management methodologies such as Agile, Lean Construction, and the Critical Path Method can enhance efficiency and productivity [5].

In Nigeria, the gap between technical expertise in civil engineering and effective project management is stark. While the country has made strides in adopting advanced engineering techniques and technologies, project management practices have not kept pace. This gap has led to suboptimal project outcomes, with many projects failing to meet their intended objectives [6]. The need to bridge this gap is crucial for Nigeria's development. Implementing comprehensive project management practices can lead to better resource utilization, improved stakeholder satisfaction, and enhanced project outcomes. Furthermore, learning from international best practices in project management can provide a roadmap for Nigerian engineers and project managers to follow, thereby improving the overall quality and success rate of civil engineering projects in the country.

1.2. Literature Review

1.2.1. Historical Perspective of Project Management in Nigeria's Civil Engineering Sector

The history of project management in Nigeria's civil engineering sector is relatively recent compared to developed nations. Early construction projects in Nigeria, particularly during the pre-independence era, were managed with rudimentary techniques primarily focused on basic coordination and supervision. Post-independence, the rapid growth in urbanization and infrastructural needs led to an increased demand for structured project management practices [7]. However, it wasn't until the late 20th century that formal project management methodologies began to gain traction in Nigeria's civil engineering industry.

The adoption of project management principles was driven by the need to address the inefficiencies that plagued the sector, including frequent project delays and budget overruns. The establishment of the Nigerian Institute of Building (NIOB) in 1967 and the Project Management Institute (PMI) Nigeria Chapter in 2005 were significant milestones in promoting best practices in project management within the country [8].

1.2.2. Key Studies on Project Management in Civil Engineering

Several studies have explored the impact of project management on civil engineering outcomes in Nigeria. Aibinu and Jagboro (2002) [4] conducted a seminal study that examined the effects of construction delays on project delivery in the Nigerian construction industry. They identified inadequate planning and scheduling as major contributors to project delays, emphasizing the need for effective project management practices to mitigate these issues. Ogunsemi and Jagboro (2006) [6] developed a time-cost model for building projects in Nigeria, highlighting the correlation between project management practices and project performance. Their research

demonstrated that proper time and cost management could significantly enhance project outcomes, reducing the incidence of delays and cost overruns. Recent studies have also focused on the adoption of modern project management methodologies in Nigeria. For instance, Aibinu et al. (2019) [9] explored the application of Lean Construction principles in the Nigerian construction industry. Their findings indicated that Lean Construction could improve efficiency and reduce waste, leading to better project outcomes. Similarly, Olawale and Sun (2015) [10] investigated the use of risk management practices in Nigerian construction projects, concluding that effective risk management is crucial for the successful completion of projects.

Another study conducted in Ogun State provides compelling evidence of this assertion (Ogunde *et al.*, 2017) [11]. The research delves into the multifaceted role of the project manager, whose influence extends far beyond mere administrative duties. The study reveals that project managers are the linchpins of construction projects, holding the reins on critical aspects such as schedule adherence, budget management, and policy implementation. Their interpretative skills in deciphering project documents, regulations, and codes are indispensable for navigating the complex landscape of construction. Moreover, the active engagement of project managers in overseeing construction activities and monitoring work progress is identified as a vital contributor to project efficacy. This hands-on approach ensures that projects not only meet their intended goals but also adhere to the highest standards of quality and safety. The findings from Ogun State underscore a crucial reality: effective project management is intrinsically linked to enhanced outcomes in civil engineering endeavors. It is not simply an adjunct to the construction process but a fundamental success factor that can make or break the delivery of robust civil engineering projects.

In Delta State, Nigeria, the strategic application of project management has been scrutinized for its influence on the performance of the construction industry. A pivotal study by Emonena and Itoje (2024) [12] sheds light on this relationship, focusing on the impact of risk management and the role of monitoring and evaluation (M&E) in bolstering organizational performance. The researchers selected three construction firms in Asaba, Delta State, as their study subjects. They distributed a structured questionnaire to 169 purposively chosen respondents from these companies, gathering primary data for analysis. Employing statistical tools such as correlation analysis and analysis of variance (ANOVA), the study sought to quantify the effects of project management practices on organizational outcomes. The findings were unequivocal: risk management, along with rigorous monitoring and evaluation, significantly enhances the organizational performance of the construction companies under study. Notably, M&E practices were found to have a particularly positive and substantial impact on organizational performance metrics. The implications of this research are clear. For construction companies to elevate their performance, it is imperative to embrace and refine strategic project delivery mechanisms. The study advocates for a systematic application of project management methodologies throughout the entire project lifecycle, from inception to completion [12].

The evolving landscape of Nigeria's construction Industry, the post-Covid era presents unique challenges and opportunities for sustainable project performance. Isang and Ebiloma (2023) [13] delve into these issues, advocating for the

integration of sustainable construction principles to ensure long-term viability and resilience. They argue that the pandemic has underscored the need for adaptable and environmentally conscious project management strategies that can withstand unforeseen disruptions. Concurrently, Oke *et al.* (2023) [14] shed light on the critical area of risk management within the sector. Their research reveals a prevalent lack of knowledge among construction project participants, which often impedes the effective management of risks. This gap underscores the necessity for enhanced education and the adoption of global best practices to fortify the industry against potential pitfalls. Complementing this perspective, Obalemo (2021) [15] examines the influence of project management processes on the success of construction projects. The study highlights the correlation between well-managed project management processes and the achievement of viable projects, suggesting that the meticulous orchestration of these processes is instrumental in guaranteeing business success.

Further emphasizing the importance of professional development, Ogunde *et al.* (2017) [16] advocate for the institutionalization of construction project management practices. They recommend comprehensive training and skill modification programs for construction professionals, which are essential for the sustainability of construction project management systems in Nigeria. Akintola *et al.* (2023) [17] address the myriad challenges that lead to the ineffective practice of project management in Nigeria. They propose a multifaceted approach that includes the development of training programs, the establishment of standard regulation protocols, and the implementation of effective government policies. These measures are aimed at overcoming the barriers to effective project management and elevating the standard of civil engineering projects across the nation.

Anyanwu *et al.*, (2021) [18] underscore the pivotal role of effective estimation and tendering processes in construction project delivery. Their empirical analysis delineates a robust relationship between these processes and the successful execution of construction projects. The proficiency of procurement professionals in estimation and tendering is posited as a determinant of project delivery quality, suggesting that the acumen of these professionals is integral to the procurement phase. In a parallel vein, Opara (2020) [19] elucidates a spectrum of variables that are instrumental to the fruition of construction projects. The study's methodical survey distills these variables into discrete categories encompassing project management, planning, cost, time, quality, contract administration, safety, and professional practice. Collectively, these variables account for a significant majority (72.57%) of the variance in project success, thereby reinforcing the assertion that meticulous project management is indispensable for optimal outcomes.

The Lagos-Ibadan Expressway project, one of the most significant infrastructure upgrades in Nigeria, showcases the benefits of strategic project management. The project faced numerous setbacks but was brought back on track through the implementation of rigorous project controls and stakeholder management strategies, leading to enhanced project delivery and performance [20]. The Abuja Mass Transit Rail project, another landmark initiative, was completed successfully due to the adoption of an integrated project management approach. This approach included effective risk management, quality

control, and an emphasis on timely communication among all parties involved [21].

More recent studies have further elaborated on the application of project management methodologies. Dada and Adeyemi (2024) [22] explore the use of agile project management in Nigerian construction projects. Their study found that agile methodologies, which emphasize flexibility and iterative progress, could be beneficial in managing the dynamic and often unpredictable conditions of construction projects in Nigeria.

A further analysis by Bamidele and Olatunji (2023) [23] investigates the impact of stakeholder management in large-scale construction projects. Their research highlights that involving all stakeholders early in the project and maintaining open communication channels throughout the project lifecycle leads to better project outcomes.

Adebayo *et al.* (2023) [24] also contribute significantly to the literature by examining the role of digital tools and technologies in project management. They demonstrate that digitalization can streamline project planning, improve communication, and enhance decision-making processes, ultimately contributing to better project performance.

2.0 METHODOLOGY

This study employs a systematic literature review (SLR) approach to examine the impact of project management on civil engineering outcomes in Nigeria. The review was conducted following established guidelines for evidence-based engineering research, ensuring a comprehensive and structured assessment of relevant literature. To gather the necessary data, an extensive search was carried out using academic databases such as Scopus, ScienceDirect, SpringerLink, JSTOR, and Google Scholar, as well as reputable Nigerian institutional repositories. Keywords and search terms such as "Project Management in Nigeria," "Civil Engineering Outcomes," "Construction Delays Nigeria," "Lean Construction Nigeria," "Infrastructure Development," and "Risk Management Construction Nigeria" were used to identify relevant studies. The inclusion criteria for selecting articles were: studies specifically focused on Nigeria's civil engineering and construction sector, peer-reviewed journal articles or official reports, and publications written in English that discussed the application of project management in civil engineering contexts. Conversely, studies that were not directly related to civil engineering or project management, lacked empirical data, or were opinion-based editorials were excluded. An initial pool of 70 articles was identified from the search. After screening the titles and abstracts for relevance, 60 articles were shortlisted for further evaluation. A thorough review of the full texts, based on factors such as methodological clarity, relevance to the Nigerian context, and scholarly rigor, resulted in the final selection of 51 high-quality sources for analysis. Data from the selected literature were then extracted and analyzed using thematic analysis. This involved coding relevant content from each article and grouping the codes into recurring descriptive themes. From these, broader analytical themes were developed, providing insight into how project management practices influence civil engineering outcomes in Nigeria.

Thematic analysis revealed six major themes: Time and Cost Management, Risk Management, Sustainable Construction Practices, Quality and Safety Standards, Stakeholder Engagement, and Digital Tools and Technological Integration. These themes reflect the recurring concerns and recommendations across the reviewed studies and provide the foundation for the discussion on the role of project management in enhancing civil engineering performance in Nigeria.

3.0 RESULT AND DISCUSSION

3.1. Successful Civil Engineering Projects Enabled by Effective Project Management

Several notable civil engineering projects in Nigeria have been successfully completed due to the application of effective project management practices. These projects demonstrate how robust planning, stakeholder engagement, and the use of advanced project management tools can lead to the timely, cost-effective, and high-quality delivery of infrastructure.

3.1.1 Abuja Light Rail Project

The Abuja Light Rail Project as shown in Figure 1 stands as a testament to effective project management in Nigeria's transportation sector. Initiated to improve urban mobility in the Federal Capital Territory, the project employed meticulous planning and scheduling techniques. The use of the Critical Path Method (CPM) and Program Evaluation and Review Technique (PERT) facilitated efficient time management, ensuring project milestones were met as scheduled [25]. Stakeholder engagement was prioritized, with regular consultations and feedback mechanisms that ensured inclusivity and reduced resistance to the project. Additionally, budget adherence was achieved through value engineering and effective cost control measures. This ensured that the project, though delayed initially, was eventually delivered with significant improvements in urban transit infrastructure.



Figure 1 Abuja light rail

3.1.2 Lagos-Ibadan Expressway Expansion

The Lagos-Ibadan Expressway as shown in Figure 2, one of Nigeria's busiest highways, underwent significant expansion to accommodate increasing traffic demands. Effective project

management was crucial in coordinating the activities of multiple contractors and stakeholders. The project utilized Earned Value Management (EVM) to monitor progress and control costs, ensuring that the project remained within budget and on schedule [26]. Quality assurance measures, including regular inspections and material testing, were implemented to maintain construction standards. Risk management played a significant role, particularly in mitigating disruptions caused by weather conditions and right-of-way issues. This project demonstrates how proper project scheduling, cost control, and quality management can transform critical infrastructure and enhance road safety and efficiency.



Figure 2 Lagos-ibadan expressway

3.1.3 Zungeru Hydroelectric Power Project

The Zungeru Hydroelectric Power Project (Figure 3), a 700MW facility, exemplifies the application of comprehensive project management in the energy sector. The project faced challenges such as funding constraints and environmental concerns. Through effective stakeholder management, including negotiations with financiers and local communities, these challenges were addressed. Environmental Impact Assessments (EIAs) were conducted to identify potential adverse effects, and mitigation strategies were implemented accordingly [27]. The project adopted a phased execution strategy that allowed concurrent work on multiple aspects, thereby reducing overall construction time. Furthermore, the integration of health and safety management protocols helped minimize site accidents and ensure worker well-being.



Figure 3 Zungeru Hydroelectric Power

3.1.4 Second Niger Bridge

The Second Niger Bridge project aimed to alleviate traffic congestion and enhance connectivity between the southeastern and southwestern regions of Nigeria (Figure 4). Project management practices played a pivotal role in its execution. A comprehensive risk management plan was developed to anticipate and address potential issues, such as funding delays and construction challenges. The project also emphasized quality control, with stringent standards set for materials and workmanship. Regular stakeholder meetings facilitated smooth communication and conflict resolution. This project illustrates the benefits of proactive risk assessment and quality assurance in delivering high-impact national infrastructure [28].



Figure 4 Second Niger bridge

3.1.5 Lekki Deep Sea Port

The Lekki Deep Sea Port, inaugurated in 2023, is one of the most significant maritime infrastructure projects in West Africa (Figure 5). The project was executed under a Build-Own-Operate-Transfer (BOOT) model, with effective scheduling, environmental compliance, and stakeholder engagement [29]. Project managers used Earned Value Management (EVM) to monitor progress and control cost deviations.



Figure 5 Lekki deep sea port

3.1.6 Warri–Itakpe Railway

Completed in 2020 after decades of delay, this railway project was revived through robust planning and phased execution strategies (Figure 6). Effective use of Gantt charts and CPM for task coordination helped deliver the 276 km track within the revised budget and timeline. Risk management strategies, especially in securing right-of-way and ensuring safety compliance, were key [30].



Figure 6 Warri-itakpe railway

3.1.7 Azura-Edo Power Plant

Commissioned in 2018, the 461 MW Azura-Edo Power Plant was executed using international project management frameworks (Figure 7). The project featured a strong focus on HSE (Health, Safety, and Environment) compliance, real-time progress tracking, and cost risk analysis. Stakeholder engagement was also critical, involving local communities and international financiers [31].



Figure 7 Azura-Edo power plant

3.1.8 Umaru Musa Yar'Adua Expressway (Airport Road, Abuja)

Completed in 2014, this 10-lane expressway project focused on expanding access from the city center to the airport (Figure 8). Project scheduling tools, quality control processes, and contractor coordination helped ensure timely delivery. The project also incorporated sustainability elements like drainage, lighting, and pedestrian walkways [32].

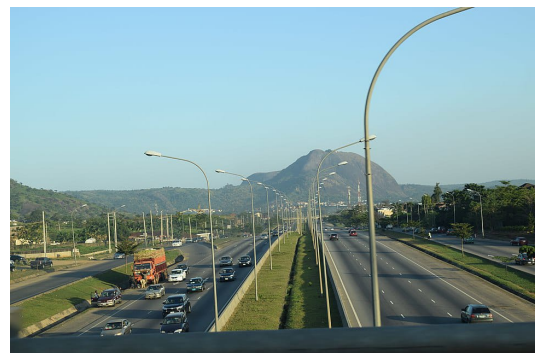


Figure 8 Umaru Musa Yar'Adua Expressway

3.1.9 Lagos Blue Line Rail Project (Phase 1)

Commissioned in 2023, Phase 1 of the Lagos Blue Line (Figure 9) stretches from Marina to Mile 2. Despite long delays, its eventual success was due to improved stakeholder coordination, revised scheduling, and strict safety compliance. The use of technology for signaling and monitoring improved reliability and reduced post-completion defects [33].



Figure 9 Lagos blue rail line

3.1.10 Lekki–Epe Expressway

This was Nigeria's first toll road under a PPP scheme, completed in 2011 (Figure 10). The project applied international project management standards including environmental impact assessment, value engineering, and regular stakeholder consultation. A robust monitoring and evaluation framework ensured that the project met its timeline and quality goals [34].



Figure 10 Lekki–Epe Expressway

3.2. Impact of Effective Project Management on Key Civil Engineering Outcomes

Effective project management is critical in determining the success of civil engineering projects, particularly in a developing country like Nigeria, where infrastructure development is both a necessity and a challenge. This discussion delves into the significant impacts of project management on civil engineering outcomes, focusing on how these practices have led to successful project delivery, improved quality and safety, cost efficiency, and stakeholder satisfaction in Nigeria. It also addresses the challenges in implementing these practices and the opportunities for further enhancing civil engineering outcomes through effective project management.

3.2.1 Successful Project Delivery and Time Management

Timely project delivery is a cornerstone of successful civil engineering outcomes, and project management plays a pivotal role in achieving this. In Nigeria, infrastructure projects are often plagued by delays due to factors such as inadequate planning, poor resource allocation, and unforeseen challenges. However, projects that have employed robust project management practices have demonstrated significantly better adherence to timelines.

For instance, the Abuja Light Rail Project is a testament to the effectiveness of advanced project management techniques. The project management team utilized the Critical Path Method (CPM) and Program Evaluation and Review Technique (PERT) to meticulously plan and schedule the project activities. These methods enabled the team to identify critical tasks and potential bottlenecks early on, allowing for proactive adjustments that kept the project on track. Moreover, the use of project management software provided real-time updates and facilitated communication among the team members, further reducing the likelihood of delays [3] [22]. This focus on time management is crucial in a country where infrastructure development is rapidly expanding. Delays in project delivery not only increase costs but also have a ripple effect on the economy, delaying the benefits that such projects are intended to bring. By ensuring that projects are completed on time, effective project management directly enhances the timeliness and reliability of civil engineering outcomes in Nigeria.

3.2.2 Cost Efficiency and Budget Management

Cost overruns are a common issue in civil engineering projects, particularly in environments where there are fluctuations in material costs, changes in scope, or inefficiencies in resource management. Effective project management addresses these challenges by providing tools and frameworks for meticulous budget planning, monitoring, and control.

The Nigerian Liquefied Natural Gas (NLNG) Train 7 Project is an excellent example of how project management can lead to cost efficiency. The project employed Earned Value Management (EVM) to continuously monitor both the cost and schedule performance. EVM is a project management technique that integrates scope, cost, and schedule to assess project performance and progress. By comparing the planned value (budgeted cost) with the actual cost and earned value (work completed), the project team could identify variances and take corrective actions before they escalated [23]. The result was a project that remained within budget, avoiding the common pitfall of cost overruns. This not only enhanced the financial sustainability of the project but also ensured that resources were used efficiently. In the broader context of Nigeria's civil engineering sector, where funding is often limited, the ability to manage costs effectively is essential for the successful completion of infrastructure projects. Effective project management thus plays a crucial role in ensuring that projects are not only completed but are done so in a financially sustainable manner.

3.2.3 Quality and Safety Enhancement

In the realm of civil engineering, quality and safety are paramount. Poor quality construction can lead to structural

failures, while inadequate safety measures can result in accidents and loss of life. Effective project management enhances both these outcomes by ensuring that projects adhere to established standards and best practices.

The Eko Atlantic City project illustrates the role of project management in enhancing quality and safety. The project management team implemented Building Information Modeling (BIM), a digital tool that allows for the creation of a 3D model of the project. BIM facilitated better coordination among various stakeholders, including architects, engineers, and contractors, by providing a common platform for information sharing. This reduced the likelihood of errors during construction, which are often a source of quality issues [24].

Additionally, the project's focus on environmental sustainability and adherence to international safety standards ensured that the final output met high-quality benchmarks. For example, the project incorporated rigorous testing and quality assurance processes to ensure that materials and construction methods met the required specifications. Safety was also a priority, with the implementation of comprehensive safety management plans that included regular safety audits, training for workers, and the use of personal protective equipment (PPE) [25]. This emphasis on quality and safety is particularly important in Nigeria, where there have been numerous instances of building collapses and other infrastructure failures due to substandard construction practices. By integrating quality and safety management into the project management process, civil engineering projects in Nigeria can achieve outcomes that are not only durable and reliable but also safe for the public.

3.2.4 Stakeholder Satisfaction and Engagement

Stakeholder satisfaction is a critical, yet often overlooked, aspect of project success. Effective project management ensures that all stakeholders, including government agencies, investors, local communities, and end-users, are actively engaged and satisfied with the project outcome. This is particularly important in Nigeria, where infrastructure projects often involve multiple stakeholders with diverse interests. The Lekki Deep Sea Port project serves as an example of how effective stakeholder management can lead to project success. The project management team adopted a participatory approach, involving stakeholders in key decision-making processes. Regular consultations and communication ensured that the concerns and expectations of all parties were addressed, which helped secure necessary approvals and mitigated potential conflicts [29].

Stakeholder engagement was further enhanced by the use of project management tools that facilitated transparency and accountability. For instance, stakeholders were given access to project dashboards where they could monitor progress, review reports, and provide feedback. This level of involvement not only built trust among stakeholders but also ensured that the project was aligned with their expectations and needs. In the Nigerian context, where infrastructure projects often face delays due to conflicts and lack of stakeholder buy-in, effective stakeholder management is crucial. It not only helps in smooth project execution but also ensures that the final output meets the needs of the end-users, thereby enhancing the overall success of the project.

3.2.5 Long-Term Sustainability and Impact

Sustainability is an increasingly important outcome in civil engineering, particularly in developing countries like Nigeria, where infrastructure needs to be resilient and capable of supporting long-term economic growth. Effective project management contributes to sustainability by ensuring that projects are designed and executed with long-term goals in mind. The rehabilitation of the Third Mainland Bridge is an example of how project management can enhance the sustainability of infrastructure projects. The project management team employed a phased approach to minimize traffic disruptions while ensuring that the rehabilitation work did not compromise the structural integrity of the bridge. This approach not only extended the bridge's lifespan but also reduced the need for future repairs, thereby contributing to its long-term sustainability.

Sustainable project management practices also involve the consideration of environmental impacts. For example, in the Eko Atlantic City project, the management team implemented environmental impact assessments and incorporated green building practices to reduce the project's carbon footprint. Such practices are critical in ensuring that infrastructure projects do not adversely affect the environment and that they contribute positively to the overall ecosystem. In the context of Nigeria's rapid urbanization and growing infrastructure needs, the sustainability of civil engineering projects is of utmost importance. By integrating sustainability into the project management process, civil engineering projects can deliver outcomes that are not only functional and cost-effective but also environmentally responsible and capable of withstanding future challenges.

3.3. Challenges in Implementing Project Management Practices in Nigeria

Despite the recognized benefits of project management, its implementation in Nigeria's civil engineering sector faces significant challenges that impede successful project delivery and infrastructure development.

3.3.1 Lack of Skilled Project Managers

The shortage of professionally trained project managers remains a major challenge. According to Ofori (2018) [35], many Nigerian construction projects are overseen by civil engineers lacking formal project management training, resulting in cost overruns, schedule delays, and substandard outcomes.

3.3.2 Inadequate Regulatory Enforcement

Nigeria's regulatory frameworks, including the National Building Code, suffer from poor enforcement. Olanrewaju and Abdul-Aziz (2015) [36] argue that weak institutional frameworks allow substandard practices, especially in rural and semi-urban projects, which contributes to the high rate of building collapses [37].

3.3.3 Corruption and Mismanagement of Funds

Public infrastructure projects are frequently marred by corruption. Iyagba and Adenuga (2019) [38] noted that

embezzlement and misappropriation of project funds result in the abandonment of civil engineering projects and significant economic loss.

3.3.4 Political Interference and Instability

Project continuity in Nigeria is often disrupted due to political transitions. As noted by Aibinu and Jagboro (2002) [4], inconsistent leadership and shifting political priorities undermine long-term infrastructure planning.

3.3.5 Resistance to Innovation

Resistance to digital tools and modern management approaches limits project efficiency. Musa et al. (2016) [39] emphasized that reluctance to adopt BIM and other innovations negatively impacts performance.

3.4. Enhancing Civil Engineering Outcomes through Project Management in Nigeria

The enhancement of civil engineering outcomes in Nigeria is contingent upon a comprehensive approach that addresses the sector's unique challenges and capitalizes on its opportunities.

3.4.1 Professional Training and Certification

Capacity building in project management should be mandatory for engineers. Certifications like PMP and PRINCE2 should be integrated into civil engineering education [40]. This will bridge the skills gap and ensure competency.

3.4.2 Strengthening Regulatory Institutions

Government regulatory bodies must be empowered to enforce building codes and monitor compliance. Akinradewo et al. (2018) [41] suggested that digital platforms for monitoring and evaluation can enhance transparency.

3.4.3 Promote Public-Private Partnerships (PPPs)

Effective PPPs bring innovation, risk-sharing, and efficiency into public infrastructure projects [42]. PPPs can also increase funding and reduce dependence on the public purse.

3.4.4 Digitization and Technology Adoption

Embracing BIM, mobile project management apps, and cloud-based dashboards can streamline communication and improve project tracking [43].

3.4.5 Policy Continuity and Institutional Memory

Independent infrastructure agencies with long-term mandates can insulate projects from political instability. Olawale and Sun (2010) [10] stressed that continuity is critical for sustained development.

3.4.6 Community and Stakeholder Inclusion

Including community members and stakeholders in project planning fosters ownership and ensures sustainability [44].

3.5 Lessons from the United States: A Benchmark for Nigeria

The United States presents a range of best practices in project management that Nigeria can adopt to improve civil engineering outcomes:

3.5.1 Institutionalized Project Management Frameworks

Institutions such as the Project Management Institute (PMI) have formalized project management practices in the U.S. The PMBOK Guide has been widely accepted as a standard (PMI, 2021), leading to consistency and predictability in infrastructure development [45]

3.5.2 Strong Legal and Regulatory Systems

Robust legal systems ensure adherence to safety, environmental, and quality standards. According to Chan et al. (2010) [46], enforced building codes and rigorous contract compliance minimize malpractices.

3.5.3 Integration of Technology and Data

American civil engineering projects frequently employ Building Information Modeling (BIM), Geographic Information Systems (GIS), and automated scheduling. Azhar et al. (2012) [47] showed that BIM significantly improves coordination, clash detection, and design visualization.

3.5.4 Emphasis on Stakeholder Engagement

In the U.S., public consultations and community engagement are integrated into the project lifecycle. Olander and Landin (2008) [48] noted that this enhances transparency and fosters public acceptance.

3.5.5 Dedicated Infrastructure Funding

Stable and dedicated funding for infrastructure is a priority. Infrastructure projects benefit from consistent appropriations and financing mechanisms [49]. Nigeria can emulate this model to reduce overdependence on international loans and donor agencies.

3.6 Future Outlook: Integration of Technology in Project Management for Civil Engineering in Nigeria

The future of civil engineering in Nigeria is increasingly intertwined with the adoption and integration of advanced project management technologies. As the country seeks to bridge infrastructure gaps and meet the rising demands for sustainable development, leveraging technology has emerged as a transformative solution to enhance project outcomes.

The future of civil engineering in Nigeria is increasingly dependent on the integration of advanced project management technologies. As the country strives to close its infrastructural

gaps, the application of modern technological tools such as Building Information Modeling (BIM), Artificial Intelligence (AI), drones, cloud computing, and real-time data analytics in project management is expected to significantly transform civil engineering outcomes.

Building Information Modeling (BIM) has been recognized globally as a revolutionary tool in improving project efficiency, reducing errors, and enhancing collaboration among stakeholders. In Nigeria, the gradual adoption of BIM is beginning to reshape design and construction workflows. A study by Olatunji et al. (2020) [50] emphasized the transformative potential of BIM in the Nigerian construction industry, noting its ability to minimize waste, improve cost control, and reduce construction delays through real-time visualization and coordination among stakeholders. Their findings suggest that wider adoption of BIM could lead to a 30–40% improvement in project delivery timelines.

Artificial Intelligence (AI) and machine learning algorithms are increasingly being applied to project management to enhance predictive analytics, risk management, and decision-making. Ogunsemi and Jagboro (2021) [51] explored the implications of AI in project scheduling and resource optimization in Nigerian construction firms. They highlighted the potential of AI tools to analyze historical project data and forecast delays, cost overruns, and productivity challenges more accurately.

Furthermore, drone technology has proven invaluable in site surveying, progress monitoring, and safety inspection. According to Oladimeji et al. (2022), drone integration in construction project management in Nigeria enabled the collection of accurate topographic data in real time, enhancing the precision of designs and reducing the risks associated with manual site inspections.

Cloud-based project management platforms like Procore and Primavera P6 are also gaining traction in Nigeria, particularly among multinational construction firms. These platforms facilitate real-time collaboration, documentation, and information sharing among dispersed project teams. Adebayo and Ogundipe (2024) [24] argue that cloud technology not only improves project transparency and accountability but also boosts stakeholder confidence through timely communication and reporting.

Despite these promising trends, challenges such as low digital literacy, high costs of implementation, and resistance to change hinder the widespread adoption of technology in project management across Nigeria. However, with increasing government interest in smart infrastructure, support from international development agencies, and growing demand for quality infrastructure, the outlook remains optimistic.

The National Building Code of Nigeria is gradually incorporating provisions that promote the use of digital technologies in design and construction, signaling a positive shift. Public-private partnerships (PPPs) are also fostering innovation, with firms now more willing to invest in capacity building and technological integration.

In conclusion, the future of project management in Nigeria's civil engineering sector will be largely shaped by how well these advanced technologies are embraced. Integrating BIM, AI, drones, and cloud-based platforms will not only enhance efficiency, safety, and sustainability but also position Nigeria to meet global infrastructure standards.

4.0 CONCLUSION AND RECOMMENDATION

4.1. Conclusion

In conclusion, the enhancement of civil engineering outcomes in Nigeria through the critical role of project management cannot be overstated. The integration of strategic project management, sustainable construction practices, and a robust cost-benefit evaluation framework is imperative for the advancement of the sector. The evaluation of civil engineering infrastructures for economy and sustainable construction is crucial for Nigeria's development. Furthermore, the empowerment of the engineering profession, is essential to overcome the emerging issues and challenges in Nigeria. By adopting these practices and principles, the civil engineering sector in Nigeria can achieve not only improved project performance and delivery but also contribute significantly to the nation's sustainable development and economic growth. It is through such concerted efforts that the civil engineering sector can truly realize its potential in shaping a resilient and prosperous future for Nigeria.

4.2. Recommendations

In addressing the gap between project management and civil engineering within Nigeria, it is imperative to adopt a holistic approach that not only enhances technical competencies but also strategically applies project management principles. This approach is essential for overcoming barriers posed by organizational culture, such as employee behavior and operational routines, which significantly impede the effective execution of projects. To this end, specific recommendations include;

- Implementing comprehensive training programs for project managers, integrating project management software, and fostering a culture of collaboration between engineers and project managers. These training programs should cover both foundational and advanced project management topics, tailored to the nuances of civil engineering projects. The integration of project management software is crucial for efficient planning, resource allocation, and progress tracking, complemented by hands-on training to ensure proficiency.
- A collaborative culture is vital, necessitating interdisciplinary teams, regular workshops, and a mentorship program to bridge the knowledge gap between professions. Strategic implementation steps involve detailed stakeholder engagement plans, problem-driven project selection criteria, and employee motivation initiatives. These steps should include a stakeholder analysis to identify interests, a communication strategy for regular updates, and quarterly meetings to discuss progress. The project selection process should prioritize projects based on their potential impact, involving community representatives and conducting feasibility studies to ensure alignment with local needs.
- Lastly, employee motivation can be fostered through performance-based rewards, career advancement opportunities, and a positive work environment that values contributions and promotes work-life balance. By focusing on these areas and providing specific implementation

steps, Nigeria can significantly improve its project outcomes, leading to more efficient, sustainable, and economically viable infrastructure development.

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Conflicts of Interest

The author(s) declare(s) that there is no conflict of interest regarding the publication of this paper

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