STM JOURNALS

Journal of
Construction Engineering, Technology & Management

ISSN: 2249-4723 (Online)
ISSN: 2347-7253 (Print)
Volume 15, Issue 1, 2025
January–April
DOI (Journal): 10.37591/JoCETM

https://journals.stmjournals.com/jocetm

Research JoCETM

The Construction Industry in Nigeria: Challenges, Information Requirements and Technological Constraints/Barriers

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Abstract

In recent times, the construction industry has undergone a substantial transformation, transitioning from its traditional paper-based service delivery methods to embrace electronic information transmission facilitated by Information Technology (IT), particularly in regions such as Nigeria. The implementation of technology in the construction industry in Nigeria is driven by several key factors that collectively contribute to enhanced efficiency, cost savings, and improved project outcomes. These drivers reflect the industry's evolving needs and the growing recognition of the benefits of technology adoption. However, the Nigerian construction industry in general and professionals in particular are facing the challenges of effectively utilizing the rapidly expanding technological environment in which it operates to its full advantage. Deploying a survey research strategy, data was collated to know the key barriers and constraints to the widespread adoption and utilisation of technology in the Nigerian construction industry. Several key issues were highlighted as the barriers hindering the widespread adoption of technology. The study outcome shows that lack of awareness is the main barrier, followed by the initial cost of purchasing soft wares. Other constraints uncovered include the complexity of the software and tools, the learning curve, the limited availability of IT infrastructure, as well as data security concerns. The study further revealed that resistance from traditionalists is a behavioural trait which underlies the constraints uncovered. The study outcome shows that spotlighting the cost benefits & monitoring and feedback are effective strategies that can mitigate the challenges associated with the technological implementation in Nigeria's construction industry. Construction professionals in Nigeria will need to adapt to changes in work patterns to improve their efficiency and develop new markets to maintain competitive advantage and enhance profitability through the adoption of IT.

Keywords: Barriers, challenges, construction industry, information, technology, professionals

INTRODUCTION

The construction industry plays a vital role in a country's economy by contributing a significant portion to its Gross Domestic Product (GDP). For instance, in developing countries like Nigeria, construction can make up as much as 12 to 14% of the GDP. In these countries, investments in construction projects can be as high as 50 to 60% of the national budget. In Nigeria, during the 1980s, the construction industry was the most significant contributor to the country's GDP, accounting for approximately 70% of it. This made the industry crucial for Nigeria's development efforts. Unfortunately, over the years, the construction industry has faced challenges such as low demand, consistently low productivity, and poor

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Received Date: December 12, 2024
Accepted Date: January 06, 2025
Published Date: January 10, 2025

Citation: Amadi Alolote Ibim. The Construction Industry in Nigeria: Challenges, Information Requirements and Technological Constraints/Barriers. Journal of Construction Engineering, Technology & Management. 2025; 15(1): 20–28p.

performance. These issues have led to a sharp decline in its contribution to the national economy, plummeting to just 1% of the GDP in 2002 [1-5].

Technology adoption, including Building Information Modeling (BIM) and digital construction management, is on the rise, driving innovation and efficiency in other spheres of the economy. Nigeria's construction industry is diverse and economically significant, yet it faces various challenges and opportunities, highlighting the need for efficient project execution, quality, and sustainability to support the country's continued economic growth and infrastructure development. The Nigerian construction industry in general and professionals in particular are facing the challenges of effectively utilizing the rapidly expanding technological environment in which it operates to its full advantage [6-8].

This study investigates the key barriers and constraints to the widespread adoption and utilization of technology in the Nigerian construction industry. The study is thus crucial because it helps us understand the barriers limiting the construction industry's potential contribution to the economy of Nigeria and what strategies can be implemented to improve its performance due to the challenges it has been facing [9-12].

The study began by outlining the aim, objectives, and background issues that spurred the creation of the theoretical framework. To tackle the study's key objectives, a systematic research methodology was employed, delving into the current landscape of construction technology. The investigation then extended to assess the applicability of these insights within the Nigerian context through a survey questionnaire. In the study, a thorough examination was conducted, evaluating the technological infrastructure within firms, gauging the extent of technology utilization, and discerning reasons hindering its effective implementation. The findings, a culmination of these efforts, yielded valuable insights that directly addressed the primary aim and objectives of the research, shedding light on the state of technology in the construction sector in Nigeria [13-17].

LITERATURE REVIEW

Nature and Challenges of the Construction Industry in Nigeria

The construction industry in Nigeria is a multifaceted and dynamic sector that plays a pivotal role in the nation's economic development. It encompasses a wide range of activities, including residential, commercial, industrial, and civil engineering projects, reflecting the broad spectrum of construction needs in the country. The industry is a significant contributor to Nigeria's Gross Domestic Product (GDP), generating employment, stimulating economic growth, and fostering infrastructure development. Government involvement is pronounced at federal, state, and local levels, with substantial investments in critical infrastructure projects such as roads, bridges, airports, and public buildings. Private sector firms are actively engaged in real estate development, commercial construction, and other construction-related activities, driving industry growth [18-22].

Rapid urbanization and population expansion lead to increased demand for housing, transportation networks, utilities, and public facilities, stimulating construction activities. Nigeria's vast infrastructure needs create substantial opportunities in the construction sector, including roads, railways, ports, and energy projects. The construction industry also presents investment opportunities for both domestic and foreign investors, contributing to economic development and job creation [23-25].

The construction industry consists of two parts: the organized formal sector and the unorganized informal sector. The formal sector includes businesses of various sizes, ranging from small to large, depending on their capital and annual turnover. Skilled and unskilled labour are both essential components of the workforce in both the formal and informal sectors, with efforts focused on training and workforce development. Regulatory challenges related to permits, land use regulations, and building code compliance must be addressed for efficient construction processes. Quality control and safety standards are a priority, and there's an emphasis on ensuring safe and high-quality construction.

Material sourcing, often relying on imported construction materials, is a key consideration, and efforts to encourage local material production are gaining attention [26-28].

Project financing can be a challenge, especially for large infrastructure projects, with public-private partnerships (PPPs) increasingly used to fund significant construction endeavours. Environmental sustainability and green building practices are gaining traction, reflecting the growing awareness of the need for eco-friendly construction. The legal and contractual framework is critical for project execution, and efficient dispute resolution mechanisms are vital. Challenges related to corruption are addressed through anti-corruption efforts and improved governance practices [29-31].

The construction industry in Nigeria grapples with a multitude of challenges that impact its efficiency and growth. Access to funding and investment, particularly for major infrastructure projects, remains a critical concern, requiring a concerted effort to attract private-sector investment and establish effective public-private partnerships (PPP). The regulatory framework governing construction is often marked by bureaucracy and inefficiency, necessitating reforms to streamline permitting processes, land use regulations, and building code compliance. Ensuring high-quality construction and compliance with safety standards is a persistent challenge, affecting both materials and workmanship [32-35].

Nigeria's infrastructure deficit looms large, demanding significant investment in essential areas such as roads, bridges, airports, ports, and energy projects. Corruption remains a major concern within the sector, leading to inflated project costs, substandard work, and a lack of transparency. Local material production and sourcing pose challenges in the face of heavy reliance on imported construction materials, potentially escalating project costs and timelines. The shortage of skilled labour necessitates extensive training and workforce development to meet the industry's demands [36-39].

A growing emphasis on environmental sustainability underscores the need for eco-friendly and green building practices to minimize the industry's environmental impact. Rapid urbanization and population expansion place increasing pressure on housing, transportation networks, utilities, and public facilities, driving substantial construction activities. Technology adoption, while on the rise, offers room for further integration of advanced construction technologies such as Building Information Modeling (BIM) and digital construction management. Project delays, often attributed to financing issues, regulatory hurdles, and weather-related challenges, remain a significant concern. Land disputes can disrupt construction projects, leading to legal complications and delays. Additionally, political instability and policy uncertainties can influence the industry's outlook and hinder long-term planning. Addressing these challenges is essential for the sustainable development of the construction industry in Nigeria and for achieving economic growth and infrastructure improvement [40-, 41].

Information Requirements and Technology in Construction

Information and technology in the construction industry in Nigeria are crucial for effective project planning, management, and decision-making. Accurate and timely information is essential for various stakeholders, including clients, contractors, quantity surveyors, architects, and project managers. Information requirements encompass a wide range of data, including project specifications, design drawings, budget estimates, and resource allocation plans.

In the context of Nigeria, where the construction industry is rapidly evolving and expanding, there is an increasing need for robust information management systems to ensure project success. Such systems can enhance transparency, reduce risks, and improve overall project efficiency. The importance of information in construction is underscored by the dynamic and complex nature of the industry. Effective information flow enables stakeholders to address challenges such as material sourcing, cost control, scheduling, and risk management.

As a result, there is a growing emphasis on implementing digital solutions, Building Information Modeling (BIM), and integrated project management systems to meet these information needs and

enhance the decision-making process. With the Nigerian construction sector's growing reliance on technology and advanced information systems, managing, sharing, and analyzing data effectively is essential for the industry's sustainable growth and development.

Technology in the construction industry, often referred to as ConTech, has ushered in a new era of innovation and efficiency. This transformative force encompasses a broad spectrum of tools and techniques designed to enhance every facet of construction projects. Central to this transformation is Building Information Modeling (BIM), which provides a digital representation of a project's physical and functional characteristics. BIM fosters collaboration, aids in visualizing projects, and streamlines coordination, leading to more accurate and efficient project planning and execution.

Additionally, digital project management systems and mobile applications have revolutionized project oversight, enabling real-time communication, document sharing, and collaborative work environments that improve project delivery. Furthermore, construction technology extends to 3D printing for creating building components, drones for site surveys and inspections, augmented and virtual reality for immersive design review and training, and the Internet of Things (IoT) for real-time monitoring and resource optimization. These technologies collectively improve efficiency, reduce waste, enhance worker safety, and facilitate sustainable construction practices.

The integration of information management tools and technology into the construction industry has revolutionized its operations. Technology plays a pivotal role in enhancing efficiency and effectiveness across various facets of construction. This includes the management of costs, labour, and time, ultimately impacting project outcomes. Notable technological advances in the industry are contributing to streamlined processes and improved project management.

For instance, Building Information Modeling (BIM) and digital construction management systems have become increasingly vital in enhancing project planning, coordination, and communication. Technology has also facilitated the automation of routine tasks, reducing the need for manual labour and enhancing overall productivity. Additionally, it has introduced innovative construction materials and techniques, improving the sustainability and environmental impact of projects. These technological advancements are shaping a more dynamic and competitive construction sector, necessitating a tech-savvy approach to remain relevant and efficient.

Constraints/Barriers Affecting the Widespread Utilization of Technology

Respondents were asked to choose which areas they feel from their experience are the key barriers constraining the use and wide adoption and utilisation of technology, from the survey data shows that lack of awareness is one of the main barriers, initial cost and availability other constraints like data security and concern, complexity from Learning curve and IT infrastructure can be easily tackled. Through this research solutions and remedies will be recommended to help eliminate all constraints and barriers limiting the use of technology.

The widespread adoption and utilization of technology in the construction industry face various challenges, constraints, and barriers that hinder its seamless integration into the profession. Firstly, one significant challenge is the resistance to change within the industry. Traditional methods and established workflows are deeply ingrained, and professionals may be hesitant to embrace new technologies due to a fear of unfamiliarity or concerns about potential disruptions to their accustomed processes.

There are financial barriers associated with the acquisition and implementation of advanced technologies. High initial costs for software, hardware, and training programs can pose a significant challenge, particularly for smaller firms or individual practitioners. Additionally, the ongoing need for updates and maintenance further strains budgets. This financial constraint often hampers the ability of professionals to invest in state-of-the-art tools that could enhance their efficiency and accuracy.

Shortage of skilled personnel poses a considerable barrier to the widespread adoption of technology in the construction industry. The industry requires professionals who possess not only traditional surveying expertise but also proficiency in handling and interpreting data, utilizing BIM (Building Information Modeling), and leveraging advanced software. The shortage of individuals with these dual skill sets limits the industry's capacity to fully harness the potential benefits of technological advancements, creating a barrier to the comprehensive integration of technology into professional practices. Overcoming these challenges will be crucial for unlocking the full potential of technology and ensuring its broader acceptance in the field.

METHOD OF STUDY

A questionnaire survey was carried out to know the key barriers and constraints to the widespread adoption and utilisation of technology in the Nigerian construction industry. The research employs a random sampling technique to select a representative sample from this population of construction professionals, ensuring that the data collected is reflective of the broader context. Questionnaires were issued to young/experienced professionals. Due to the unavailability of some persons, digital questionnaires were sent to them through Google Forms that way they can easily answer and submit the questions without stress, this is also another effect of technology as it helped save time. The questionnaire consisted of two sections. Following the data collection process, the next crucial step was to transform the collected data into valuable insights that can inform decision-making. This process commenced with coding and categorizing the data into distinct groups, enabling the creation of tables and charts to graphically represent the information collated. Subsequently, the study advanced to the presentation of statistical findings, including the calculation of the relative importance index to enable the ranking of the barriers/constraints identified. The influence of each factor was assessed by the respondents on a rating scale from 1 to 5. The Mean affecting score was calculated using the Relative Importance formula.

Where, F= frequency (f; 0 to 105) FX= frequency * rate score (x; 1to5) FX/F.

RESULTS AND DISCUSSION OF FINDINGS

Key issues were highlighted and based on their experience, the respondents were asked to select which of them they feel are the barriers that hinder the widespread adoption of technology (Table 1). From the survey carried out on this research, a lot of construction professionals believe that technology is slowly shaping traditional methods and practices, but to what extent? There are still some barriers and constraints affecting its impact and the widespread adoptions, (65 out of 105) the professionals from the survey strongly agree that lack of awareness is one of the key barriers and constraints affecting the use of technology in the construction industry. From the results of the investigation, this translates into more than 68.5% strongly agreeing that lack of awareness is a key constraint with this investigation, it is very easy to eliminate such constraints one of which is by creating awareness such as webinars and online resources, workshops and training sessions.

Table 1. Key barriers/constraints to the utilization of technology.

Challenges/ Constraints	Strongly Disagree	Disagree	Average	Agree	Strongly Agree
Lack of awareness	4	6	10	22	65
Initial cost	4	4	9	30	59
Availability	4	7	13	26	56
Integrated challenges	3	6	16	27	54
Data and security concern	5	10	8	29	54
Complexity from learning curves	3	5	11	35	52
Resistance from traditionalists	8	8	11	27	52
Limited it infrastructure	4	6	12	33	52

Table 2. Ranking of key barriers/constraints.

Challenges/ constraints	Total no.	Mean affecting score	Rank
Lack of awareness	105	4.38	1ST
Initial cost	105	4.32	2ND
Complexity from the learning curve	105	4.24	3RD
Availability	105	4.20	4TH
Integrated challenges	105	4.20	5TH
Data and security concern	105	4.14	6TH
Resistance from traditionalists	105	4.04	7TH
Limited it infrastructure	105	4.04	8TH

Table 3. Effective strategies for mitigating the challenges associated with technology implementation.

Effective Strategies	Strongly Disagree	Disagree	Average	Agree	Strongly Agree
Monitoring and feedbacks	2	7	15	30	53
Training and education	1	4	15	33	55
Data security	2	5	15	34	50
Cost benefits	1	5	15	34	53

Table 2 shows that lack of awareness is one of the main barriers, with a mean score of 4.38 ranking first on the table. The initial cost is second on the table, with a mean score of 4.32. This is followed by complexity from the learning curve, with a mean score of 4.24, ranking third on the table. Availability and integrated challenges rank fourth and fifth on the table, with a mean score of 4.20. Data and security concerns, Resistance from traditionalists and limited IT infrastructure are ranked lowest with a mean score rating from 4.14 to 4.04.

Mitigating the challenges associated with technology implementation in the construction industry requires a strategic approach. Professionals were asked to choose which strategies from their years of experience would actively mitigate the challenges associated with technology implementation in Nigeria (Table 3).

The survey has shown that a lot of professionals feel that training and education in the use of technological tools and software will help mitigate the challenges. Many professionals complained about data security, hence cloud-based software was introduced to help mitigate the issues. Also, monitoring and feedback will help to combat and mitigate the challenges. By implementing these strategies, professional practices in the construction industry can navigate the challenges associated with technology adoption and create a culture that embraces the advantages of digital tools.

CONCLUSION

From this research, it has been shown that the initial cost, availability and integrated challenges are also key barriers and a good number of professionals strongly agree. Without any doubt soft wares are expensive and hardly available to everyone, the cost of the soft wares should be affordable and made available to everyone. These challenges often involve the seamless integration of different processes, technologies, or methodologies in professional practices. They may encompass issues related to data synchronization, collaboration among project stakeholders, and interoperability of software tools. There are different remedies and solutions to eliminate all these constraints, the issues lies with the necessary bodies to adopt and implement it.

The study outcome shows that highlighting the cost benefits & monitoring and feedback are both effective strategies that can mitigate the challenges associated with the technological implementation in Nigeria's construction industry. Cost benefits and monitoring/feedback mechanisms are indeed effective strategies for mitigating challenges associated with technological implementation. Demonstrating the

cost benefits of implementing technology in construction is a persuasive strategy. By highlighting how technology can lead to cost savings, improved efficiency, and reduced errors, stakeholders are more likely to support and embrace technological changes. Establishing robust monitoring and feedback mechanisms ensures ongoing evaluation of the technological implementation. This allows for the identification of challenges early on and provides insights for continuous improvement.

This is in addition to other strategies such as training and ensuring data security. As the study outcome shows, a good number of professionals agree that these strategies are effective. Both training and data security play crucial roles in mitigating challenges associated with technological implementation. By combining training initiatives that empower users with the knowledge and skills to effectively use the technology and robust data security measures, organizations can create a resilient and capable workforce while safeguarding critical information in construction processes. Via the implementation of these strategies, organizations can address concerns related to the initial investment in technology while simultaneously fostering an environment of continuous improvement, adaptability, and user satisfaction in the realm of construction.

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