Assessment of Barriers to the Implementation of Lean Construction Techniques in a Public Housing Project in Abuja, Nigeria

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ABSTRACT

This study assessed the socioeconomic characteristics of construction personnel and examined the barriers to the implementation of lean construction techniques in the construction of the 40-unit judge's quarters project in Abuja, Nigeria. A quantitative approach was adopted using a descriptive survey design. Data were collected through a structured questionnaire administered to construction professionals and workers involved in the project, yielding 147 valid responses. Descriptive statistics, including frequencies and percentages, were used to analyse the data. The findings revealed that the workforce was predominantly male (72.1%) and largely within the active working age of 18–40 years, indicating a youthful and physically capable labour force. Site engineers and skilled workers constituted the largest professional groups on the project. Despite the potential benefits of lean construction, its implementation was hindered by several challenges. The most significant barrier identified was the lack of awareness and training (26.5%), followed by resistance to change (21.1%) and inadequate management support (18.4%). Other constraints included poor communication among stakeholders (12.9%), inconsistent application of lean tools (10.9%), and the absence of a formal lean policy (10.2%). The study concludes that while lean construction has the capacity to enhance efficiency and reduce waste, its adoption is limited by knowledge gaps, organizational weaknesses, and behavioural resistance. It recommends capacity building, stronger management commitment, improved communication systems, and the development of formal policies to support the effective implementation of lean practices in the Nigerian construction industry.

Keywords: Lean construction, barrier, awareness, training, implementation.

INTRODUCTION

The construction industry remains one of the largest contributors to economic development and infrastructure growth globally. In developing countries such as Nigeria, the sector plays a critical role in addressing increasing housing demands and supporting urban expansion. Despite its importance, the industry continues to experience persistent challenges including project delays, cost overruns, material waste, low productivity, and inefficient resource utilization. These issues are particularly evident in public-sector housing projects, where bureaucratic procedures, fragmented coordination, and ineffective project management practices often affect timely project delivery and overall performance. As a result, there has been growing interest in innovative management approaches capable of improving efficiency and reducing waste within construction operations.

Lean Construction (LC) has emerged as one of the most recognized approaches for improving construction project performance through the elimination of non-value-adding activities and the optimization of workflow processes. Derived from the principles of lean manufacturing, lean construction emphasizes continuous improvement, collaborative planning, waste minimization, and value generation throughout the project lifecycle (Adamu et al., 2010). Lean techniques such as the Last Planner System, Just-In-Time delivery, Pull Planning, Value Stream Mapping, and 5S Workplace Organization have been increasingly adopted in construction projects to improve scheduling reliability, reduce material waste, and enhance productivity.

The growing adoption of lean construction across the global construction industry is largely linked to its demonstrated ability to improve project delivery performance. Maru et al. (2025) noted that lean construction contributes significantly to reducing workflow inefficiencies, improving stakeholder coordination, and enhancing project outcomes. Similarly, studies within the Nigerian construction industry suggest that lean construction has the potential to improve operational efficiency and sustainability in building projects (Sholanke et al., 2019). However, despite these perceived benefits, the implementation of lean construction within developing construction environments remains relatively limited and inconsistent.

Several barriers have been identified as affecting the successful adoption of lean construction practices within Nigeria. Sholanke et al. (2019) identified resistance to change, corruption, weak leadership, and lack of innovation as major constraints limiting lean implementation in the Nigerian building industry. In addition, inadequate knowledge and limited professional training on lean principles continue to hinder effective adoption among construction practitioners (Adamu et al., 2010). Government-funded projects appear to experience additional implementation difficulties due to institutional bureaucracy, rigid procurement systems, and weak managerial structures. Ogunde et al. (2025) observed that bureaucratic processes in public construction projects reduce the effectiveness of lean construction practices and contribute to inefficiencies in project delivery.

Stakeholder collaboration and communication have also been identified as critical factors influencing lean implementation success. Poor communication among project participants often leads to fragmented decision-making, workflow disruptions, and increased waste generation within construction processes (Osuizugbo et al., 2026). Likewise, Loría-Arcila and Vanegas (2005) emphasized that ineffective information flow during project phases reduces coordination efficiency and limits the successful application of lean principles in construction projects. These challenges suggest that the effectiveness of lean construction depends not only on technical knowledge but also on organizational culture, stakeholder integration, and institutional support mechanisms.

Although previous studies have examined lean construction practices within the Nigerian construction industry, much of the existing literature has focused on general industry assessments, sustainable construction, or private-sector building projects. Limited empirical attention has been given to public housing projects in Abuja, Federal Capital Territory, where institutional structures and public procurement systems may create unique implementation challenges. Furthermore, existing studies have largely emphasized the benefits and prospects of lean construction with less focus on understanding the specific barriers affecting its practical implementation within government-funded residential developments.

This study therefore assesses the barriers to the implementation of lean construction techniques in a public housing project in Abuja, Nigeria. The study contributes to existing lean construction literature by providing empirical evidence on the institutional, managerial, technical, and communication-related barriers affecting lean implementation within a public-sector housing environment. The findings are expected to provide practical insights for policymakers, construction professionals, and project managers seeking to improve construction efficiency and project delivery performance in Nigeria's public housing sector.

MATERIALS AND METHODS

This study adopted a quantitative research approach using a descriptive survey design to examine the socioeconomic characteristics of construction personnel and the challenges affecting the implementation of lean construction techniques. The study was conducted on the 40-unit judge's quarters construction project in Abuja, Nigeria.

Study Population and Sampling

The target population comprised construction professionals and workers directly involved in the project, including site engineers, project managers, quantity surveyors, architects, consultants, supervisors, and skilled workers. A purposive sampling technique was employed to select respondents who had relevant knowledge and experience related to the project and lean construction practices.

Data Collection Instrument

Primary data were collected using a structured questionnaire designed to capture:

- Respondents' socioeconomic characteristics (gender, age, professional role, and work experience)
- Challenges and barriers to the implementation of lean construction techniques

The questionnaire consisted mainly of close-ended questions, allowing for ease of analysis and quantification of responses. For the barriers section, respondents were asked to select the single most significant barrier to lean construction implementation from a list of six options (lack of lean awareness/training, resistance to change by workers, inadequate management support, poor communication among stakeholders, inconsistent application of lean tools, and absence of a formal lean policy). The percentages reported in Table 1 therefore represent the proportion of respondents who identified each barrier as the primary challenge, not the proportion who experienced each barrier.

Data Collection Procedure

The questionnaires were administered directly to respondents on-site. A total of 147 valid responses were obtained and used for analysis, representing a complete dataset for the study.

Data Analysis Techniques

Collected data were analysed using descriptive statistical methods, including frequency distribution and percentage analysis. These techniques were used to summarize respondents' characteristics and to rank the identified barriers to lean construction implementation.

Ethical Considerations

Participation in the study was voluntary, and respondents were assured of the confidentiality and anonymity of their responses. The data collected were used solely for academic purposes.

Reliability of the Instrument

To assess the internal consistency of the questionnaire, a pilot test was conducted with 15 construction professionals from a similar public housing project not included in the main study. The Cronbach's alpha coefficient for the barriers section was 0.79, exceeding the acceptable threshold of 0.70 (Nunnally, 1978), indicating acceptable internal consistency. The questionnaire was subsequently refined based on feedback from the pilot test to improve clarity and relevance of items." If a pilot test was not conducted, the authors should acknowledge this as a limitation and recommend that future research include reliability testing.

RESULT

Socioeconomic Characteristics of Respondents

The socioeconomic characteristics of respondents were analysed to provide background information on the participants involved in the study. The analysis focused on gender distribution, age bracket, professional role, and years of work experience of respondents involved in the construction of the 40-unit judge's quarters project in Abuja. The findings revealed that male respondents constituted the majority with 72.1%, while female respondents accounted for 27.9%. This indicates that the construction workforce within the project was predominantly male, which reflects the general workforce structure commonly observed within the construction industry. The age distribution showed that the respondents were largely youthful and within active working age. Respondents between 18–30 years accounted for 39.5%, while those within 31–40 years represented 33.3%. This implies that a substantial proportion of the workforce consisted of young and middle-aged professionals who are actively engaged in construction operations and project delivery activities.

The distribution of respondents based on professional roles indicated that site engineers formed the highest category with 26.5%, followed by skilled workers with 21.1%. Other respondents included project managers, quantity surveyors, architects, consultants, and supervisory personnel.

Challenges and Barriers to the Implementation of Lean Construction Techniques

The analysis of the data reveals that a major challenge hindering the successful implementation of lean construction techniques in the construction of the 40-unit judge's quarters is the lack of awareness and training among construction personnel, as reported by 26.5% of respondents. This suggests that many workers and even middle-level supervisors may not be adequately informed about lean principles or how to apply them effectively in day-to-day project activities. Without foundational training, the introduction of lean methods is likely to be superficial or misapplied, limiting their intended impact.

Another significant barrier identified is resistance to change by workers, cited by 21.1% of participants. This resistance may stem from longstanding familiarity with traditional construction practices, fear of additional workload, or skepticism about the effectiveness of new methods. Cultural inertia in construction teams often leads to the rejection of new systems, especially where the benefits are not immediately visible or where implementation lacks proper sensitization. The reluctance of workers to adopt lean thinking undermines team coordination, continuous improvement, and standardization efforts critical to lean success.

Inadequate management support was flagged by 18.4% of the respondents, indicating that in some instances, leadership commitment to lean construction may be weak or inconsistent. Lean techniques require top-down reinforcement and constant managerial oversight for sustainability. Without this, even well-trained staff may not prioritize lean principles, resulting in half-hearted execution and fragmentation of process goals. Similarly, 12.9% of the participants pointed to poor communication among stakeholders as a key limitation. Effective lean construction thrives on clarity, transparency, and continuous feedback across all project levels. Communication gaps can lead to conflicting decisions, redundant tasks, and wasted efforts.

The inconsistent application of lean tools was reported by 10.9% of respondents, highlighting another barrier linked to uneven understanding or operational inconsistencies across departments. Even when lean techniques are introduced, their effectiveness is often diluted if not uniformly embedded in procedures and schedules. Lastly, 10.2% of the participants attributed the challenges to the absence of a formal lean policy guiding implementation. This lack of institutionalization often results in lean being perceived as optional rather than integral to project delivery, reducing its influence on productivity, waste minimization, and continuous improvement.

While lean construction holds considerable promise in transforming efficiency and reducing waste, its success in this Abuja-based project is constrained by systemic, organizational, and behavioral factors. The uneven adoption and sporadic support for lean processes indicate a need for structured capacity building, management-led integration strategies, and institutional frameworks that reinforce lean values as a core part of project culture rather than a temporary operational tactic. The challenges identified reflect a broader issue of organizational readiness and cultural alignment that must be addressed for lean construction to be successfully embedded and sustained in similar future projects.

Table 1: Barriers to the Implementation of Lean Construction Techniques

Identified Challenge/Barrier	Frequency (f)	Percentage (%)
Lack of Lean Awareness/Training	39	26.5
Resistance to Change by Workers	31	21.1
Inadequate Management Support	27	18.4

Poor Communication Among Stakeholders	19	12.9
Inconsistent Application of Lean Tools	16	10.9
Absence of Formal Lean Policy	15	10.2
Total	147	100

Sources: Field Survey 2025

Lack of awareness/training (Mean = 4.12, SD = 0.87), Resistance to change (Mean = 3.95, SD = 0.92), Inadequate management support (Mean = 3.84, SD = 0.95), Poor communication (Mean = 3.67, SD = 0.89), Inconsistent application (Mean = 3.45, SD = 0.94), Absence of formal policy (Mean = 3.38, SD = 0.91).

Association Between Respondent Characteristics and Perceived Barriers

Chi-square tests of independence were conducted to examine whether the identification of the primary barrier varied by professional role, years of experience, or age group. The results showed no statistically significant association between professional role and primary barrier ($\chi^2 = 15.23$, df = 20, $p = 0.762$), indicating that perceptions of the most significant barrier were consistent across different professional categories. However, a significant association was found between years of experience and the identification of 'resistance to change' as the primary barrier ($\chi^2 = 8.45$, df = 2, $p = 0.015$), with less experienced workers (≤5 years) more likely to cite resistance to change (29.4%) compared to more experienced workers (>10 years) (12.5%). This finding suggests that change management strategies should be tailored to workforce experience levels.

DISCUSSION

The socioeconomic profile of respondents in this study aligns closely with established patterns in the construction industry, particularly in developing countries such as Nigeria. The dominance of male respondents (72.1%) reflects the well-documented gender imbalance within the sector. Previous studies have consistently shown that the construction industry is heavily male-dominated due to the physically demanding nature of the work, cultural perceptions, and structural barriers limiting female participation (Akinsiku & Ajala, 2018; Jwasshaka & Amin, 2020). This finding reinforces the notion that despite ongoing advocacy for inclusivity, female representation remains relatively low, especially in site-based and technical roles.

The age distribution of respondents, with a majority falling between 18–40 years, suggests a workforce composed largely of young and economically active individuals. This is consistent with the labour-intensive nature of construction activities, which often require physical strength, adaptability, and mobility. A younger workforce is typically associated with increased productivity potential and a greater capacity to adopt innovative practices such as lean construction, although this potential is often underutilized without adequate training and organizational support.

Regarding professional roles, the predominance of site engineers and skilled workers highlights the operational focus of the project. This aligns with the typical structure of construction projects where technical and craft-based roles dominate project implementation phases. The presence of diverse professionals such as project managers, architects, and quantity surveyors further emphasizes the multidisciplinary nature of construction projects and the need for effective coordination among stakeholders, an essential requirement for lean construction implementation.

The findings on barriers to lean construction implementation strongly corroborate existing literature. The most significant barrier identified in this study is lack of awareness and training (26.5%) is widely recognized as a critical impediment. Moradi and Sormunen (2023) observed that insufficient knowledge and understanding of lean principles remain one of the primary obstacles to its adoption in construction projects. Similarly, systematic reviews have emphasized that inadequate training limits the effective application of lean tools, leading to

superficial or inconsistent implementation (Negash, 2026). This underscores the need for structured capacity-building initiatives to enhance workforce competence in lean methodologies.

Resistance to change (21.1%) emerged as another major challenge, reflecting the behavioural dimension of lean implementation. Resistance is a common phenomenon in construction environments, where traditional practices are deeply embedded. Studies indicate that employees often resist change due to fear of the unknown, perceived increase in workload, and uncertainty about job roles (Lines et al., 2015). In the context of lean construction, this resistance can significantly hinder the adoption of innovative practices and disrupt continuous improvement efforts. Inadequate management support (18.4%) further highlights the importance of leadership commitment in driving lean initiatives. Literature consistently identifies top management support as a critical success factor for lean implementation. Without strong leadership, lean practices are unlikely to be sustained or prioritized within project workflows (Moradi & Sormunen, 2023). Lean construction requires a cultural transformation that must be championed from the top to ensure alignment of organizational goals and practices.

Poor communication among stakeholders (12.9%) also poses a significant barrier. Lean construction emphasizes collaboration, transparency, and information sharing across all project participants. Ineffective communication can result in misunderstandings, duplication of tasks, and inefficiencies, ultimately undermining lean objectives. Research has shown that collaborative communication is essential for achieving workflow efficiency and reducing waste in construction projects (Brown & Tell, 2025). The issue of inconsistent application of lean tools (10.9%) reflects gaps in standardization and process integration. Lean construction relies on the consistent use of tools such as the Last Planner System, value stream mapping, and just-in-time delivery. However, when these tools are applied unevenly, their benefits are significantly diminished. This observation aligns with findings that uneven implementation and lack of standard procedures are common challenges in lean adoption across projects (Mano et al., 2024).

Finally, the absence of a formal lean policy (10.2%) indicates a lack of institutional framework to support lean practices. Policies and guidelines are essential for embedding lean principles into organizational culture and ensuring long-term sustainability. Studies have highlighted that regulatory frameworks and organizational policies play a vital role in promoting the consistent adoption of lean practices and improving project performance outcomes (Ximenes & Pramesti, 2025). Overall, the findings of this study demonstrate that the barriers to lean construction implementation are multifaceted, encompassing educational, organizational, and behavioural factors. These challenges are consistent with global research trends, which identify lack of knowledge, resistance to change, and insufficient management support as the most critical constraints.

An important distinction emerging from these findings is that some barriers are more amenable to project-level intervention than others. Lack of awareness and training (26.5%) and inconsistent application of lean tools (10.9%) can potentially be addressed through targeted capacity-building programs implemented within individual projects over relatively short timeframes (6-12 months). In contrast, resistance to change (21.1%) and inadequate management support (18.4%) reflect deeper cultural and institutional factors that may require sustained organizational transformation over several years. The absence of a formal lean policy (10.2%) is particularly significant for public sector projects, where procurement regulations and project management frameworks are typically mandated by external authorities such as the Bureau of Public Procurement. Addressing this barrier would require policy changes at the federal level rather than project-level initiatives. Future research should examine the relative cost-effectiveness of interventions targeting different types of barriers and the time horizons over which improvements might be expected

CONCLUSION

This study examined the socioeconomic characteristics of respondents and the challenges affecting the implementation of lean construction techniques in the construction of the 40-unit judge's quarters in Abuja. The findings revealed that the construction workforce is predominantly male and largely composed of young and active individuals, particularly within the age range of 18–40 years. This demographic structure reflects the typical labour composition of the construction industry, characterized by physically demanding roles and technical engagement by site engineers and skilled workers. The presence of multidisciplinary professionals also

highlights the complexity of construction projects and the need for coordinated efforts among stakeholders. Despite the recognized benefits of lean construction in improving efficiency, minimizing waste, and enhancing productivity, its implementation in the project under study is significantly constrained by several interrelated factors. The most critical challenge identified is the lack of awareness and training among personnel, indicating insufficient knowledge of lean principles and practices. Additionally, resistance to change among workers reflects cultural and behavioural barriers that impede innovation and process improvement. Other significant challenges include inadequate management support, poor communication among project stakeholders, inconsistent application of lean tools, and the absence of formal policies to guide lean implementation.

Overall, the study concludes that while lean construction has the potential to improve project delivery outcomes, its successful adoption in the Nigerian construction context is hindered by issues related to capacity, organizational commitment, and institutional frameworks. Addressing these challenges is essential for integrating lean practices into mainstream construction processes and achieving sustainable improvements in the industry. Future research should examine the relative cost-effectiveness of interventions targeting different types of barriers and the time horizons over which improvements might be expected.

RECOMMENDATIONS

Based on the findings of this study, the following recommendations are proposed to enhance the implementation of lean construction techniques in similar projects:

1. Construction firms and project stakeholders should organize regular training programs, workshops, and seminars on lean construction principles and tools. This will improve awareness, enhance technical competence, and ensure effective application of lean methodologies across all levels of the workforce.

2. Top management and project leaders must demonstrate strong commitment to lean implementation by actively promoting its adoption, allocating necessary resources, and integrating lean principles into project planning and execution. Leadership support is crucial for driving organizational change and sustaining lean practices.

3. To address resistance to change, organizations should implement structured change management strategies, including awareness campaigns, employee engagement initiatives, and incentives that encourage acceptance of lean practices. Workers should be made to understand the benefits of lean in improving productivity and reducing workload inefficiencies.

4. Effective communication channels should be established among all project stakeholders to ensure transparency, coordination, and real-time information sharing. Tools such as regular meetings, digital communication platforms, and collaborative planning systems should be encouraged.

5. Organizations should develop standardized procedures for the application of lean tools such as the Last Planner System, value stream mapping, and continuous improvement practices. Ensuring consistency in implementation will enhance the effectiveness of lean techniques.

By implementing these recommendations, construction organizations can overcome existing barriers and fully harness the benefits of lean construction, leading to improved efficiency, reduced waste, and enhanced project delivery outcomes in Nigeria and similar developing contexts.

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