A Review of the Current State of Lean Construction in Nairobi City County

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ABSTRACT

The construction industry in Nairobi City County, Kenya, plays a critical role in urban development but continues to face challenges related to inefficiencies, cost overruns, and waste generation. Lean Construction (LC), a philosophy derived from the Toyota Production System, offers a framework for enhancing productivity through waste minimization and value creation. This article reviews the current state of LC implementation in Nairobi City County by drawing on both global literature and empirical findings from recent field research. The study reveals that while awareness of LC is relatively high (70%), actual implementation remains low (36%), with tools such as 5S, Just-in-Time (JIT), and the Last Planner System (LPS) being partially applied. The most significant waste sources identified were inventory waste (58%), labour inefficiency (53%), and waiting time (41%). Barriers to implementation include lack of awareness, resistance to change, fragmented supply chains, and inadequate training. The findings highlight the potential of LC in addressing inefficiencies, but greater institutional support, capacity building, and policy integration are necessary to realize its full benefits in Nairobi's construction sector.

Keywords: Lean Construction, Waste Management, Nairobi City County, 5S, Just-in-Time, Last Planner System

INTRODUCTION

The construction industry contributes significantly to Kenya's economic growth, accounting for approximately 7% of the national GDP. However, the sector is characterized by inefficiencies manifested in project delays, cost overruns, and high levels of material waste. This study focuses on Nairobi City County, as Kenya's capital and largest urban area; it is at the forefront of the country's construction activities as evidenced by NCA that it records the highest number of building permits (NCA, n. d). The county's construction projects are often large-scale and complex, making them prime candidates for lean construction techniques. The county experiences rapid urbanization and infrastructural development, resulting in a high volume of construction projects. However, like the rest of the country, Nairobi's construction sector is plagued by inefficiencies and waste levels are particularly high, undermining both profitability and sustainability. The implementation of lean construction techniques in Nairobi could provide a model for the rest of the country. According to Wachira (2020), a case study done of Nairobi City County's construction projects reveals that adopting lean construction can lead to significant waste reduction and enhanced efficiency. Studies show that projects, which have implemented lean methodologies, such as pull planning and value stream mapping, have reported a 30% reduction in waste and a 20% decrease in project delays. These results underscore the potential of lean construction to transform the construction landscape in Nairobi and beyond (Nganga, 2020).

Lean Construction (LC) has emerged as an alternative project management philosophy aimed at reducing waste and enhancing efficiency. Originating from the Toyota Production System, LC emphasizes value

generation for the client while systematically eliminating non-value-adding activities (Koskela, 1992). Lean construction aims to improve efficiency, reduce waste, and enhance quality and safety on construction sites. Internationally, the adoption of lean construction has demonstrated significant improvements in project delivery and waste management. For instance, a study by Azhar et al. (2013) highlighted that lean construction techniques reduced construction waste by up to 60% and improved project completion times by 30% in several case studies across the United States and Europe. Globally, lean tools such as 5S, Just-in-Time (JIT), Kaizen,and the Last Planner System (LPS) have demonstrated effectiveness in improving project delivery. However, the uptake of these tools in Africa, and specifically Nairobi, remains relatively low. This review explores the current state of LC adoption in Nairobi, drawing on both empirical findings and literature.

LITERATURE REVIEW

Lean Construction was derived from Lean Production whose foundation commenced with the introduction of Toyota Production System (TPS) spearheaded by Taiichi Ohno of Toyota Motor Company (Ohno, 1988). TPS aimed at removing any kind of waste and inconsistency in the production system. TPS consists of two pillars that are Just-in-Time (JIT) and Jidoka (Ohno, 1988; Liker, 2004; [Jasti et al., 2014]). According to Sacks et al. (2020), the foundation of lean construction was formed through the proposition of the transformation–flow–value (TFV) theory by Koskela (1992) and the development of the lean project delivery system by Ballard (2003). TFV refers to the conceptualization of the production process through three key elements, which are transformation that is, production of inputs into outputs; flow which is movement that is reliable and continuous; and value, that is, what the customer needs and pays for it ([Ajayi et al., 2019]; Nguyen & Arkhavian, 2019;). Lean project delivery system, according to Ballard and Howell (2023), links five phases of the lifecycle, which are project definition, lean design, lean supply, lean assembly, and use. The lean project delivery system addresses construction as production, and reliable production management is of prime importance in lean project delivery systems, which is realized by utilizing the last planner system. Globally, the implementation of lean construction varies significantly across regions. In developed economies, lean practices are often integrated with digital technologies such as Building Information Modelling (BIM) ([Sacks et al., 2020]). In contrast, African contexts face structural and institutional barriers, including inadequate training and fragmented project delivery systems (Aigbavboa & Thwala, 2019).

Studies in Uganda and Nigeria have reported similar challenges, where lean awareness is moderate but adoption is weak due to cultural resistance and resource limitations ([Alinaitwe et al., 2019]). In Kenya, while lean principles have been acknowledged in academic discourse, empirical evidence of widespread application remains limited.

RESEARCH METHODOLOGY

This review draws on both secondary literature and primary research conducted in Nairobi City County. A mixed-methods design was adopted to provide a comprehensive perspective. Survey research through Structured questionnaires were administered to 132 construction professionals, including contractors, project managers, site supervisors, engineers, Architects and quantity surveyors. A five-point Likert scale was used to assess awareness, familiarity and implementation, of lean practices. 10 semi-structured interviews were conducted with senior engineers, Contractors and project managers to capture deeper insights into challenges and opportunities of lean adoption. Additionally, Direct observations were carried out across eight active building construction sites to verify the extent of lean application in practice and to identify visible sources of waste. Quantitative data were analyzed using descriptive statistics (SPSS) and Chi-square tests to examine relationships between lean practices and waste reduction. Qualitative data from interviews and observations were coded thematically to capture emerging patterns. This methodology ensured triangulation of findings, enhancing both reliability and validity.

RESULTS AND DISCUSSION

Awareness Levels

Survey data showed that 70% of construction professionals in Nairobi are aware of LC principles. This demonstrates growing recognition of LC as a viable approach to project management. However, awareness is often theoretical rather than practical, with limited exposure to structured lean training programs.

Table 4.1: Awareness of Lean

	No. of Respondents	Frequency
Aware	92	69.69
Unaware	40	30.30

Source: Study survey, 2025

Ayarkwa et al. (2021) argue that awareness is critical for effective uptake of lean construction practices in emerging markets. This shows that most of the respondents (70%) were aware of lean construction in the industry

Implementation of Lean Tools

Table 4.2 shows the level of implementation of lean construction within building sites as reported by the respondent's. The data showed that 38% of the respondents implemented lean construction moderately within their construction sites. Whereas 25% of the respondents indicated that they rarely implemented lean construction practices.

Table 4.2: Level of Lean Implementation

	No. of Respondents	Percentage
Yes, extensively	16	12.12%
Yes, Moderately	50	37.88%
Rarely	33	25%
Not at all	20	15.15%
Not sure	13	9.84%

Source: Study survey, 2025

A study done by Ahmed et. al. (2020), showed that the level of lean construction implementation in Sri Lanka was not rigid and the awareness minimal, whereas a comparison with the United Kingdom Construction Industry showed that awareness was increased and implementation of lean construction practices were also more evident. Additionally, a study done by Marhani et. Al. (2019) showed that with increased awareness of lean construction practices, there was an increased implementation of lean practices within construction sites.

A review of the familiarity and extent of implementation of Lean construction practices within the construction sites showed that that JIT Material delivery, Value engineering, 5S site organization for improving site organization, Modular construction, and visual management and are the most familiar lean construction practices. Additionally, Value engineering, 5S site organization, JIT Material Delivery for minimizing excess inventory and storage costs, and The Last Planner system for enhancing scheduling accuracy and reducing waiting time often used within building sites

Other tools such as Value Stream Mapping (VSM), Kaizen, and Total Quality Management (TQM) were rarely implemented, reflecting a gap between awareness and comprehensive application.

These findings align with Ballard & Tommelein (2021), who asserted that JIT and 5S were easier to adopt due to their simplicity and immediate impact. Conversely, tools like VSM and Pull Planning require more training and cultural change, often lacking in Nairobi's construction ecosystem (Nganga, 2020). [Zhang et al., 2021] emphasized on stakeholder collaboration through Last Planner System (LPS) and Value engineering were extensively used due to their effectiveness in reducing reworks and defects through collaborative planning.

Challenges in Implementation

Key barriers to the implementation of Lean practices within Nairobi City County was identified as Lack of awareness and training rated as the most significant challenge to implementation. Unfamiliarity with lean tool, Poor collaboration and communication, and resistance to change rated as significant challenges as well. High initial implementation costs, Inadequate management support, lack of skilled personnel and limited resources rated as moderately significant challenges. Cultural barriers ranked the lowest.

A Chi-square test of independence conducted indicated that lack of awareness/training, unfamiliarity with tools, and poor collaboration were the most dominant challenges, consistent with findings by Olarewaju & Abdul-Aziz (2020), who found awareness and training as the top barriers in Nigeria; as well as Alaloul et al. (2020), whose study showed that limited collaboration and fragmented communication to be critical challenges in implementing lean construction.

CONCLUSION AND RECOMMENDATIONS

The results revealed that Nairobi City's construction industry is familiar with lean concepts, however, its worth in waste management has not been fully leveraged. The data supports the assertion that lean construction, when effectively implemented, can significantly reduce waste and subsequent inefficiencies on building sites. The partial use of lean construction practices such as JIT delivery, 5S and value engineering already contributes to more efficient practices. The research underscores the need for systemic and strategic interventions in training, policy integration, and demonstration projects to bridge the current implementation gap.

Furthermore, this review establishes that while awareness of LC in Nairobi City County is relatively high, practical implementation remains low.

To enhance the implementation of lean construction within construction building sites within Nairobi City County the following recommendations can be taken up:

Capacity Building: Introduce continuous professional development (CPD) programs on LC.

Policy Integration: Mainstream LC practices into national construction codes and procurement guidelines. Pilot Projects: Launch government-supported pilot lean projects to showcase benefits.

Collaboration: Encourage partnerships between contractors, suppliers, and academia to localize lean practices.

The findings underscore the need for a coordinated approach to embed LC into Kenya's construction industry, ensuring improved efficiency, cost savings, and sustainability.

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