Benefits of Lean Construction: A Literature Review[1]

Lim Yiiliang, Shi Yee Wong, Fock-Kui Kan

School of Built Environment
University of Technology Sarawak, Malaysia

Abstract

Lean Construction (LC) has evolved from manufacturing production philosophy into a project delivery paradigm toward waste elimination and value generation. While a substantial body of research affirms that LC delivers measurable benefits, these benefits are frequently reported under fragmented and inconsistent terminologies, making it difficult for practitioners and researchers to obtain a consolidated view of what LC offers. This paper reviewed the studies published in between 2021 to 2025, on the benefits of LC, drawn from nineteen countries across five continents. Reported benefits were extracted, standardised into unified categories to reconcile divergent terminologies, and organised along three dimensions of the Triple Bottom Line (TBL) namely Social, Environmental and Economic which are further mapped to United Nations Sustainable Development Goals (SDGs). The literatures review identified twenty distinct benefits, with efficiency, productivity, performance improvement, waste reduction, cost and time reduction emerging as the most frequently cited. The findings confirm that LC benefits are mutually reinforcing across the three TBL dimensions rather than confined to operational efficiency, and that LC is increasingly positioned as an enabler for sustainable and resilient construction projects. The consolidated benefit taxonomy offers project management practitioners concise evidence for articulating the value proposition of LC adoption.

Keywords: *Lean Construction, Project Performance Improvement, Sustainable Project Management, Value Generation, Stakeholder Collaboration.*

1. Introduction

Construction industry remains one of the largest contributors to national economies, yet it continues to be characterised by persistent inefficiency, cost and schedule overruns, quality defects and comparatively low productivity growth relative to manufacturing (Fashina *et al*., 2021; McKinsey & Company, 2024). In response to these systemic

[1] How to cite this work: Lim, Y.L., Wong, S.Y., & Kan, F.-K. (2026). Benefits of Lean Construction (LC) from Literature, *PM World Journal*, Vol. XV, Issue IX, September.

challenges, Lean Construction (LC) has emerged as an approach to project delivery that fundamentally reorients toward flow-oriented coordination, waste elimination and value generation throughout the project lifecycle (Koskela, 2000; Koskela *et al*., 2007). Rather than conceptualising construction as a series of discrete transformations that convert inputs into outputs, LC views construction as a continuous flow of materials, information and work across interconnected processes (Ballard & Howell, 2003; Salem *et al*., 2006; Salem & Solomon, 2021).

A growing volume of empirical and review-based studies report that the adoption of LC yield substantial benefits, including the reduction of project lifecycle duration and cost, improvements in quality and performance, and higher levels of satisfaction relating to health and safety (Abbas *et al*., 2024; Aguome *et al*., 2024; Almabrouk, 2024; Hamaidi *et al*., 2024; Yaro *et al*., 2024). However, this evidence is dispersed across a wide range of papers, and the benefits are frequently described using divergent overlapping terminologies. This fragmentation makes it difficult for practitioners to develop a coherent understanding of the value proposition of LC, moreover, the society currently moving towards the sustainability outcome, yet the current studies of LC did not focus on categorising the benefits of LC in par with sustainability-oriented approach.

The purpose of this paper is therefore to consolidate and synthesise the benefits of LC as reported in recent literature, and to organise them within a coherent under the three key pillars of sustainability. Adopting the Triple Bottom Line (TBL) lens, LC benefits are structured along the Social, Environmental and Economic (SEE) dimensions, and are subsequently mapped to the United Nations Sustainable Development Goals (SDGs) in order to situate LC within the broader agenda of sustainable development (Carvajal-Arango *et al*., 2019; Chen *et al*., 2024; United Nations, 2020). The paper contributes a consolidated benefit taxonomy that reconciles inconsistent terminologies, quantifies relative prominence of each benefit, and provides project management practitioners and researchers with a concise, evidence-based reference to better understand what LC offers.

2. Overview of LC

2.1 Definition and Principles

LC applies principles originally developed within the Toyota Production System (TPS) to project-based context of construction (Liker, 2004; Womack & Jones, 1996). Unlike traditional construction project management, which emphasises the efficiency of individual activities in isolation, LC prioritises the reliability of workflows across interdependent processes and reduces uncertainty through waste reduction, transparent planning, stakeholder alignment and continuous feedback (Ballard & Howell, 2003; Fauzan & Sunindijo, 2021; Koskela *et al*., 2007).

Theoretical foundation of LC rests upon five core principles originally articulated by Womack and Jones (1996) and subsequently adapted to construction contexts (Almabrouk, 2024; Fauzan & Sunindijo, 2021; Salem *et al*., 2006). The first principle, *value generation*, requires organisations to define what creates value from customer's perspective rather than from internal project metrics. Second, *identify the value stream*, involves mapping all steps from design through handover to distinguish value adding activities, necessary non-value-adding activities and pure waste, using tools such as Value Stream Mapping (VSM). Third, *create flow*, ensures that the remaining value-adding steps proceed continuously without interruptions, bottlenecks or delays, an objective supported by Last Planner System (LPS) and pull planning. Fourth, *establish pull*, dictates that work is produced only when required by downstream processes, drawing on KANBAN signalling and Just-in-Time (JIT) delivery to prevent overproduction. Lastly the fifth, *improvement for perfection*, commits projectised organisations to continuous improvement (*Kaizen*) through iterative learning, feedback loops and incremental innovation (Koskela, 2000; Salem *et al*., 2006). Collectively, these principles distinguish LC as a comprehensive philosophy capable of addressing inefficiencies that have long characterised construction project delivery (Chen *et al*., 2024; Salem & Solomon, 2021).

2.2 Evolution Toward Sustainability and Resilience

The evolution of LC has spanned several decades, progressing from the origins of Lean in manufacturing in 1970s, through the introduction of Lean thinking with its migration into construction in 1980s and 1990s, to the testing of Lean applications and the digitisation of LC via Building Information Modelling (BIM) integration in 2000s and 2010s (YiiLiang, 2025). The most recent phase, ongoing since 2020s, has seen LC increasingly oriented toward sustainability, digital integration and resilience as part of continuous improvement (Sánchez *et al*., 2023; Tetik *et al*., 2024, YiiLiang, 2025). This sustainability orientation provides the rationale for organising the benefits of LC along the three dimensions of TBL, an approach consistent with prior scholarship that emphasised the alignment of LC with Social, Environmental and Economic outcomes (Carvajal-Arango *et al*., 2019; Chen *et al*., 2024).

3. Methodology

This study adopts literature reviews approach to identify, extract and synthesise the benefits of LC reported in scholarly literature. A structured method was preferred over a narrative review because it improves transparency, reduces selection bias, and enables the standardisation of divergent terminologies into a coherent categorisation, an approach that has been shown to make the review process more efficient and thematically consistent (Abu Tabanjeh *et al*., 2025). The review was conducted in four

sequential stages: search and identification, screening and selection, extraction and standardisation, and thematic categorisation.

3.1 Search Strategy and Identification

Literature search targeted journals, articles and proceedings relating to LC via Google Scholar by using combination of keywords such as “lean construction”, “LC benefits”, “LC project performance”, “LC waste reduction”, “LC values” and “LC sustainability”. The search emphasised studies published between 2021 to 2025 to capture recent empirical evidence, emerging developments and perspectives in LC reflecting current state of knowledge in the field.

3.2 Screening and Selection

Studies were retained for LC benefits synthesis where they satisfied the following inclusion criteria: (a) the study addressed LC principles, practices or implementation within a construction or built-environment context; (b) the study explicitly reported one or more benefits, advantages or positive outcomes attributable to LC adoption; and (c) the study was published in a peer-reviewed journal or conference proceeding in English language. Studies were excluded where they focused exclusively on LC barriers without reporting benefits, addressed manufacturing rather than construction, or provided insufficient methodological detail. The application of these criteria yielded a focused corpus of twenty primary studies that collectively formed the basis for LC benefits presented in this paper.

3.3 Extraction and Standardisation

From each of the twenty primary studies, the reported LC benefits were extracted verbatim and then subjected to a standardisation procedure. Because different authors describe similar outcomes using varied terminology, for example, “process efficiency”, “productivity improvement” and “enhanced performance” may denote overlapping constructs, all identified benefits were subsumed under a unified key category. This consolidation reconciles inconsistent terminologies, prevents an excessively lengthy or disjointed presentation, and ensures thematic consistency across heterogeneous sources, a methodological practice consistent with prior LC and sustainability reviews (Aguome *et al*., 2024; Abu Tabanjeh *et al*., 2025). Each consolidated LC benefit was then linked back to the specific studies that reported it, enabling a frequency count that indicates the relative prominence of each benefit within the corpus.

3.4 Thematic Categorisation

The consolidated LC benefits were organised along the three dimensions of TBL referring to Social, Environmental and Economic which were in turn mapped to the relevant United Nations SDGs. The Social dimension aligns with SDG 3 (Good Health and Well-being);

the Environmental dimension encompasses SDG 6 (Clean Water and Sanitation), SDG 14 (Life Below Water) and SDG 15 (Life on Land); and the Economic dimension comprises SDG 8 (Decent Work and Economic Growth), SDG 9 (Industry, Innovation and Infrastructure), SDG 11 (Sustainable Cities and Communities) and SDG 17 (Partnerships for the Goals). This tri-dimensional structure is consistent with the sustainability orientation of contemporary LC and with earlier studies that have emphasised the alignment of LC along these dimensions (Carvajal-Arango *et al*., 2019; Chen *et al*., 2024; Lee & Zhou, 2022; Sachs *et al*., 2022; Wibowo & Ammar, 2025). The result is presented in Table 2.

3.5 Geographic Coverage of the Corpus

To characterise the breadth of the evidence base, national context of each primary study was recorded during extraction. Twenty studies collectively span nineteen countries across five continents, summarised in Table 1. Four studies are cross-national and are counted under each country they cover, while one study does not specify a national setting. Africa (eight country-level occurrences) and Asia and the Middle East (seven) together account for most of the corpus, reflecting the intensity of contemporary LC research within emerging and developing economies, where inefficiency, delay and resource constraints provide a strong impetus for LC adoption. Studies from developed economies such as United Kingdom, United States, Australia, Finland and Estonia provide a comparative counterpoint.

Table 1: Geographic coverage of the reviewed literature

Region	Countries represented (number of studies)	Studies
Africa	Uganda (2), Nigeria (2), Libya (1), Ethiopia (1), Kenya (1), South Africa (1)	8
Asia & Middle East	China (2), Pakistan (1), Qatar (1), Hong Kong SAR (1), United Arab Emirates (1), Iran (1)	7
Europe	United Kingdom (2), Estonia (1), Finland (1)	4
Americas	Brazil (1), Chile (1), United States (1)	3
Oceania	Australia (1)	1
Not specified	—	1
Total	**19 countries across 5 continents**	**24**

(Source: Author's own work)

Note: Four of the twenty studies are cross-national (Jiang *et al*., 2023; Kehinde & Fapohunda, 2024; Ssali *et al*., 2022; Tetik *et al*., 2024) and are counted under each country they cover; consequently, the country-level total (24) exceeds the number of studies (20). One study (Najafi *et al*., 2024) does not specify a national context.

4. Findings: Benefits of LC

The synthesis of the twenty primary studies identified twenty distinct benefits of LC, distributed across the three TBL dimensions. Table 2 presents the consolidated benefit taxonomy, indicating for each benefit the studies within the corpus that reported it. The bracketed numerals in the References column correspond to the numbered legend beneath the table.

Table 2: Benefits of LC

Aspects	Benefits	References
Social	Improve health and safety	[2] [6] [7] [9] [10] [12] [19] [20]
	Improve labour performance	[1] [2] [5] [9] [10]
	Maximise value creation	[1] [2] [6] [7] [16]
	Increase satisfaction	[1] [2] [4] [6] [10] [11] [12] [13] [17]
	Improve relationship with stakeholders	[2] [4] [8] [11] [13]
	Effective control and management	[1] [2] [3] [5] [6] [7] [9] [15] [20]
	Increase in innovation	[10] [13] [19]
Environment	Sustainable development	[2] [11] [12] [13] [16] [18] [19] [20]
	Environmental impact reduction	[2] [9] [14] [16] [20]
	Waste reduction	[1] [2] [6] [7] [10] [12] [13] [14] [16] [17] [19] [20]
Economic	Reduction in time	[2] [3] [4] [7] [9] [14] [16] [17] [19] [20]
	Reduction in cost	[1] [2] [4] [6] [7] [9] [15] [16] [17] [19] [20]
	Increase in quality	[3] [4] [7] [11] [12] [17] [20]
	Adopting continuous improvement	[1] [3] [7] [12] [15]
	Efficient control in inventory	[2] [6] [9] [16]
	Effective planning	[1] [3] [5] [8] [9] [11] [16] [20]
	Increase efficiency, productivity & performance	[1] [2] [3] [4] [6] [7] [8] [9] [10] [11] [12] [13] [14] [15] [17] [20]
	Reduce & mitigate risk	[8] [14]
	Reduce rework and variabilities	[2] [3] [6] [10] [19]
	Increase in profits	[1] [4]
	Improved in design	[3] [4] [7] [8] [13]

(Source: Author's own work)

Note: [1] Abbas *et al*. (2024); [2] Aguome *et al*. (2024); [3] Almabrouk (2024); [4] Dauda *et al*. (2024); [5] de Oliveira & Loos (2024); [6] Fauzan & Sunindijo (2021); [7] Garcés & Peña (2023); [8] Hamaidi *et al*. (2024); [9] Hei *et al*. (2024); [10] Jiang *et al*. (2023); [11] Kehinde & Fapohunda (2024); [12] Maru *et al*.

(2024); [13] Najafi *et al*. (2024); [14] Pan & Pan (2023); [15] Richard (2024); [16] Saradara *et al*. (2024); [17] Ssali *et al*. (2022); [18] Tetik *et al*. (2024); [19] Ugural *et al*. (2024); [20] Yaro *et al*. (2024).

4.1 Social Benefits

Social dimension, aligned with SDG 3 (Good Health and Well-being), captures the human centred outcomes of LC adoption. Seven distinct social benefits were identified across the corpus, with evidence reported across diverse national contexts represented in the reviewed literatures.

Improved health and safety. Health and safety improvement is consistently identified as a key advantage of LC, reported across multiple national contexts, including Uganda (Aguome *et al*., 2024), Australia (Fauzan & Sunindijo, 2021), Chile (Garcés & Peña, 2023), China (Hei *et al*., 2024; Jiang *et al*., 2023), Ethiopia (Maru *et al*., 2024), Iran (Ugural *et al*., 2024), and Nigeria (Yaro *et al*., 2024). LC is shown to improve task coordination, reduce site congestion, and eliminate unnecessary movement. For instance, Garcés and Peña (2023) observe that LPS supports proactive planning that enables teams in Chile to manage spatial and time related constraints more effectively, while Fauzan and Sunindijo (2021) identify the 5S method (Sort, Set in order, Shine, Standardise, Sustain) as an enabler of good housekeeping that keeps Australian project sites clean and free of clutter. In Iran, Ugural *et al*. (2024) further link improved safety to the use of LC enhanced by Artificial Intelligence (AI) or Internet of Things (IoT) technologies in public construction projects.

Improved labour performance. Improvements in labour performance are attributed to the elimination of idle time, greater task predictability, and the matching of resources to actual project needs. Studies from Pakistan and Uganda (Abbas *et al*., 2024; Aguome *et al*., 2024) stress that proper planning and effective communication are essential for task readiness and smooth workflow. Specifically, Aguome *et al*. (2024) find that LC promotes discipline in labour allocation in construction projects, thereby reducing idle time. This benefit is also documented in the Australian and Chilean contexts, where LC practices enhance workforce productivity and engagement (Fauzan & Sunindijo, 2021; Garcés & Peña, 2023).

Maximised value creation. Value creation is realised through timely completion, defect reduction, waste minimisation, and the optimal utilisation of resources. Studies from Pakistan (Abbas *et al*., 2024), Uganda (Aguome *et al*., 2024), Australia (Fauzan & Sunindijo, 2021), Chile (Garcés & Peña, 2023), and Qatar (Saradara *et al*., 2024) all confirm this benefit. Abbas *et al*. (2024) argue that the predictability and waste reduction afforded by LC enable more efficient, client-beneficial delivery in the Pakistani context,

and Aguome *et al*. (2024) emphasise the incorporation of value-based planning strategies in the early phases of projects in Uganda.

Increased satisfaction. Higher satisfaction among both workers and clients is widely reported across diverse settings, including Pakistan (Abbas *et al*., 2024), Uganda (Aguome *et al*., 2024), Nigeria (Dauda *et al*., 2024), Australia (Fauzan & Sunindijo, 2021), China (Jiang *et al*., 2023), Nigeria and the United States (Kehinde & Fapohunda, 2024), Ethiopia (Maru *et al*., 2024), Iran (Najafi *et al*., 2024), and Uganda (Ssali *et al*., 2022). This benefit is attributed to transparent communication, empowerment of frontline workers and improved processes. Dauda *et al*. (2024) and Jiang *et al*. (2023) link improved satisfaction to frontline empowerment and the removal of workflow disruptions, reporting a satisfaction score of up to 90 out of 100 from site level data in Nigerian and Chinese projects, respectively. Fauzan and Sunindijo (2021) note that LC facilitates smoother decision making and client collaboration in the Australian construction industry.

Improved relationships with stakeholders. LC is credited with strengthening stakeholder relationships through collaborative planning that promotes shared accountability and mutual respect. This benefit is documented in studies from Uganda (Aguome *et al*., 2024), Nigeria (Dauda *et al*., 2024), Palestine (Hamaidi *et al*., 2024), Nigeria and the United States (Kehinde & Fapohunda, 2024), and Iran (Najafi *et al*., 2024). Hamaidi *et al*. (2024) emphasise that stakeholder trust is improved through communication and collaborative decision making in the Palestinian context, while Kehinde and Fapohunda (2024) note that collaborative planning practices in both Nigeria and the United States promote shared accountability.

Effective control and management. Effective control and management are repeatedly linked to Lean tools such as pull planning and visual controls, which enable real-time monitoring and rapid problem solving. Studies from Pakistan (Abbas *et al*., 2024), Brazil (de Oliveira & Loos, 2024), Australia (Fauzan & Sunindijo, 2021), Chile (Garcés & Peña, 2023), Kenya (Richard, 2024), and Nigeria (Yaro *et al*., 2024) all confirm this benefit. Fauzan and Sunindijo (2021) and Garcés and Peña (2023) highlight the value of these tools in coordinating trades and aligning tasks with available resources and schedules in Australian and Chilean construction projects.

Increased innovation. Innovation is fostered through a culture of continuous learning, empowerment and collaborative problem solving. Studies from China (Jiang *et al*., 2023), Iran (Najafi *et al*., 2024), and Iran (Ugural *et al*., 2024) highlight this benefit. Jiang *et al*. (2023) observe growing interest in LC among construction practitioners in China as an important step toward embracing innovation. Ugural *et al*. (2024) further emphasise that practical training initiatives are vital to empowering workers in Iran to adopt innovations without fear of job displacement, suggesting that the innovation potential of LC may be

particularly pronounced in emerging economies where modern construction methods are being rapidly adopted.

4.2 Environmental Benefits

The Environmental dimension, encompassing SDG 6, SDG 14 and SDG 15, reflects the growing alignment of LC with sustainability objectives, and comprises three benefits. The geographical distribution of evidence for this dimension is comparatively concentrated, with emerging economies contributing to the majority of empirical findings.

Sustainable development. LC is frequently associated with sustainable development through the reduction of resource wastage during construction. Studies from Uganda (Aguome *et al*., 2024), Nigeria and the United States (Kehinde & Fapohunda, 2024), Ethiopia (Maru *et al*., 2024), Iran (Najafi *et al*., 2024), Qatar (Saradara *et al*., 2024), and Nigeria (Yaro *et al*., 2024) all report this benefit. In the Ugandan context, Aguome *et al*. (2024) demonstrate how LC practices contribute to resource efficiency and reduced material waste. Tetik *et al*. (2024), drawing from a multi-country perspective including Estonia and Finland, and Ugural *et al*. (2024) in Iran further find that LC advances sustainability through energy efficient practices and compatibility with green building standards, suggesting that the sustainability orientation of LC is gaining traction across both developed and developing economies.

Environmental impact reduction. Environmental impact reduction is understood as a direct extension of LC waste minimisation strategies. Studies from Uganda (Aguome *et al*., 2024), China (Hei *et al*., 2024), Hong Kong (Pan & Pan, 2023), Qatar (Saradara *et al*., 2024), and Nigeria (Yaro *et al*., 2024) document this benefit. JIT delivery and Lean-oriented supply chains are reported to reduce greenhouse gas emissions, excessive material use, and site level disturbance. In an interview-based study conducted in Hong Kong, Pan and Pan (2023) found that 57% of respondents perceived a noticeable reduction in environmental impact attributable to reduced construction waste and further linked LC's environmental benefits to policy alignment with Hong Kong's sustainability goals, providing an additional dimension of value. The Chinese case study by Hei *et al*. (2024) similarly demonstrates reduced environmental footprints through BIM-integrated Lean practices at the disassembly and reuse stage.

Waste reduction. Waste reduction is among the most tangible and consistently acknowledged benefits of LC, reported across twelve studies spanning diverse geographical contexts, including Pakistan (Abbas *et al*., 2024), Uganda (Aguome *et al*., 2024), Australia (Fauzan & Sunindijo, 2021), Chile (Garcés & Peña, 2023), China (Jiang *et al*., 2023), Ethiopia (Maru *et al*., 2024), Iran (Najafi *et al*., 2024), Hong Kong SAR (Pan & Pan, 2023), Qatar (Saradara *et al*., 2024), Uganda (Ssali *et al*., 2022), Iran (Ugural *et al*., 2024), and Nigeria (Yaro *et al*., 2024). Physical construction waste is reduced through

effective inventory management and defect prevention (Abbas *et al*., 2024; Jiang *et al*., 2023), supported by planning and elimination tools (Fauzan & Sunindijo, 2021; Garcés & Peña, 2023) and the early detection of defects (Maru *et al*., 2024; Saradara *et al*., 2024). Notably, studies from African countries such as Uganda, Ethiopia, and Nigeria consistently emphasise waste reduction as a primary driver for LC adoption, reflecting the resource constraints and efficiency imperatives prevalent in these emerging economies.

4.3 Economic Benefits

The Economic dimension, comprising SDG 8, SDG 9, SDG 11 and SDG 17, is the most extensively represented in the reviewed literature, encompassing thirteen distinct benefits. The evidence for this dimension is geographically diverse, spanning all five continents and reflecting the universal economic appeal of LC adoption.

Reduction in time. Time reduction is one of the most frequently cited benefits, reported in ten studies from Uganda (Aguome *et al*., 2024), Libya (Almabrouk, 2024), Nigeria (Dauda *et al*., 2024), Chile (Garcés & Peña, 2023), China (Hei *et al*., 2024), Hong Kong SAR (Pan & Pan, 2023), Qatar (Saradara *et al*., 2024), Uganda (Ssali *et al*., 2022), Iran (Ugural *et al*., 2024), and Nigeria (Yaro *et al*., 2024). Better coordination and sequencing of activities (Dauda *et al*., 2024; Fauzan & Sunindijo, 2021) and improved workflow synchronisation (Aguome *et al*., 2024; Almabrouk, 2024) compress project durations. The Chinese case study by Hei *et al*. (2024) records completion eleven days ahead of schedule, demonstrating the practical impact of BIM-LC integration. Faster turnover is linked to industry competitiveness in both developed and developing contexts (Pan & Pan, 2023; Ugural *et al*., 2024; Yaro *et al*., 2024).

Reduction in cost. Cost reduction is among the most frequently associated advantages of LC, reported across eleven studies from Pakistan (Abbas *et al*., 2024), Uganda (Aguome *et al*., 2024), Nigeria (Dauda *et al*., 2024), Australia (Fauzan & Sunindijo, 2021), Chile (Garcés & Peña, 2023), China (Hei *et al*., 2024), Kenya (Richard, 2024), Qatar (Saradara *et al*., 2024), Uganda (Ssali *et al*., 2022), Iran (Ugural *et al*., 2024), and Nigeria (Yaro *et al*., 2024). Techniques such as VSM reduce funds spent on rework (Abbas *et al*., 2024; Garcés & Peña, 2023) and support financial forecasting (Dauda *et al*., 2024; Fauzan & Sunindijo, 2021; Yaro *et al*., 2024). The Chinese case study by Hei *et al*. (2024) reports quantifiable reductions of 8.07% in construction costs and 12.5% in transportation costs, providing empirical evidence of the financial benefits of LC adoption in a developed Asian context.

Increase in quality. Quality improvement is supported by numerous studies from Libya (Almabrouk, 2024), Nigeria (Dauda *et al*., 2024), Chile (Garcés & Peña, 2023), Nigeria

and the United States (Kehinde & Fapohunda, 2024), Ethiopia (Maru *et al*., 2024), and Uganda (Ssali *et al*., 2022). LC is connected to better workmanship and the mitigation of on-site defects (Garcés & Peña, 2023) and to enhanced end-product quality through inspection-based defect detection (Hei *et al*., 2024; Kehinde & Fapohunda, 2024). Maru *et al*. (2024) substantiate this using a quantitative approach with responses from 159 participants from construction firms in Ethiopia, providing robust statistical evidence for the quality-enhancing effects of LC in an African context.

Adopting continuous improvement. Adoption of continuous improvement is emphasised as a cultural transformation facilitated by LC, as documented by Abbas *et al*. (2024) in Pakistan, Almabrouk (2024) in Libya, and Garcés and Peña (2023) in Chile. As Abbas *et al*. (2024), Garcés and Peña (2023), Maru *et al*. (2024) in Ethiopia, and Richard (2024) in Kenya argue, LC promotes a culture of learning, giving and taking feedback which is cultivated in the whole project organisation. This cultural dimension appears to transcend geographical boundaries, being equally relevant in Latin American, African, and Middle Eastern contexts.

Efficient control in inventory. Efficient inventory control is identified as a clear logistical benefit of LC in studies from Uganda (Aguome *et al*., 2024), Australia (Fauzan & Sunindijo, 2021), China (Hei *et al*., 2024), and Qatar (Saradara *et al*., 2024). Fauzan and Sunindijo (2021) describe JIT as an efficiency oriented strategy that delivers the right materials in the right quality and quantity in the Australian context, and Hei *et al*. (2024) in China and Saradara *et al*. (2024) in Qatar link improved inventory practices to cost and time savings, demonstrating the cross-cultural applicability of Lean inventory management principles.

Effective planning. Effective planning is achieved through collaborative tools such as BIM, LPS, pull planning, and lookahead planning. Studies from Pakistan (Abbas *et al*., 2024), Libya (Almabrouk, 2024), Brazil (de Oliveira & Loos, 2024), Palestine (Hamaidi *et al*., 2024), China (Hei *et al*., 2024), Nigeria and the United States (Kehinde & Fapohunda, 2024), Qatar (Saradara *et al*., 2024), and Nigeria (Yaro *et al*., 2024) all confirm this benefit. Abbas *et al*. (2024) note that such tools align stakeholders and bring certainty to implementation in the Pakistani context, and de Oliveira and Loos (2024) emphasise their role in improving communication flow within diverse teams in Brazil. The comparative study by Kehinde and Fapohunda (2024) reveals that effective planning practices are valued in both Nigerian and American construction contexts, albeit with differing levels of technological integration.

Increased efficiency, productivity and performance. This is the single most frequently identified benefit, supported by sixteen of the twenty reviewed studies, which link LC to gains in resource efficiency, team productivity, and schedule reliability. The studies span

Pakistan (Abbas *et al*., 2024), Uganda (Aguome *et al*., 2024), Libya (Almabrouk, 2024), Nigeria (Dauda *et al*., 2024), Australia (Fauzan & Sunindijo, 2021), Chile (Garcés & Peña, 2023), Palestine (Hamaidi *et al*., 2024), China (Hei *et al*., 2024), Nigeria and the United States (Kehinde & Fapohunda, 2024), Ethiopia (Maru *et al*., 2024), Iran (Najafi *et al*., 2024), Hong Kong (Pan & Pan, 2023), Kenya (Richard, 2024), Qatar (Saradara *et al*., 2024), Uganda (Ssali *et al*., 2022), and Nigeria (Yaro *et al*., 2024). The universal prominence of this benefit across all geographical regions underscores the fundamental appeal of LC as a performance enhancing philosophy, irrespective of the level of economic development or regional construction practices.

Reduce and mitigate risk. Risk reduction, linked to LC's emphasis on transparency and systematic error control, has received comparatively limited attention. Studies from Palestine (Hamaidi *et al*., 2024) and Hong Kong (Pan & Pan, 2023) document this benefit. LC practices facilitate the early detection of problems and preventive action; Pan and Pan (2023) report that half of their interviewees in Hong Kong perceived that Lean could simplify tasks and render workflow more predictable, thereby lowering risk exposure. This finding suggests that risk mitigation benefits may be particularly valued in regions with complex regulatory environments or high project uncertainty.

Reduce rework and variability. Reduced rework and variability are identified as a direct outcome of improved planning and error proofing in studies from Uganda (Aguome *et al*., 2024), Libya (Almabrouk, 2024), Australia (Fauzan & Sunindijo, 2021), China (Jiang *et al*., 2023), and Iran (Ugural *et al*., 2024). Proactive coordination and workflow stabilisation reduce non-conformities (Aguome *et al*., 2024; Ugural *et al*., 2024), and structured process control mitigates unexpected disruption (Fauzan & Sunindijo, 2021). Jiang *et al*. (2023), through site visits in China, noted worker satisfaction with reduced repairs, providing qualitative evidence of this benefit in the Asian context.

Increase in profits. Increased profit is investigated in only two studies, both confirming that LC raises profitability by reducing costs and enhancing project turnover. Abbas *et al*. (2024) illustrate how early-stage risk management, value improvement, supply chain simplification, progress monitoring, and collaboration reduce costs and increase profitability in the Pakistani construction sector. Dauda *et al*. (2024) emphasise the role of a continuous improvement culture in driving profitability in Nigerian construction organisations, suggesting that profit enhancement through LC is relevant in both South Asian and West African contexts.

Improved design. Design improvement is recognised where LC enhances integration between the design and construction phases through collaborative platforms and early stakeholder engagement. Studies from Libya (Almabrouk, 2024), Nigeria (Dauda *et al*., 2024), Chile (Garcés & Peña, 2023), Palestine (Hamaidi *et al*., 2024), and Iran (Najafi *et*

al., 2024) document this benefit. Target Value Design and VSM facilitate collaboration and continuous evaluation of the design against budget (Almabrouk, 2024) in the Libyan context, while multi-disciplinary coordination reduces design clashes in Nigerian projects (Dauda *et al*., 2024; Hamaidi *et al*., 2024). The geographical spread of this benefit suggests that design-phase LC applications are gaining recognition across the Middle East, Africa and South America, albeit with varying levels of technological maturity.

5. Discussion

Three observations emerge from the synthesis. First, the distribution of LC benefits heavily weighted toward Economic dimension, which accounts for thirteen of the twenty identified benefits, followed by Social dimension with seven and Environmental dimension with three. This distribution reflects the historical emphasis of LC research on operational and financial performance, and it indicates that the environmental potential of LC, although increasingly recognised, remains comparatively under articulated in the empirical literature. This finding is consistent with the observation that the environmental turn in LC scholarship is still maturing (Tetik *et al*., 2024; Wibowo & Ammar, 2025).

Second, at the level of individual benefits, the improvement of efficiency, productivity and performance is the most frequently reported outcome, followed closely by waste reduction and by reductions in cost and time. The prominence of these benefits is coherent with the theoretical core of LC which are the elimination of waste (*muda)*, the creation of continuous flow and the pursuit of value generation. These operationally framed benefits dominate the corpus, reinforces the interpretation of LC primarily as a performance enhancing philosophy, even as its sustainability applications already expanded in this era.

Third, LC benefits are strongly interdependent and cut across the three TBL dimensions rather than remaining confined within them. Improved coordination and reliable workflow, for instance, simultaneously enhance health and safety (Social), reduce material waste (Environmental) and shorten project duration (Economic). This cross-dimensional reinforcement suggests that the value of LC is systemic rather than additive, a single set of practices such as pull planning, VSM, JIT, LPS and continuous improvement, generates mutually amplifying outcomes across the sustainability spectrum. For project management practitioners, this interdependence implies that the business case for LC adoption should be articulated holistically, capturing social and environmental value alongside the more readily quantified economic returns.

From a practical standpoint, the consolidated taxonomy offers project practitioners a concise reference for communicating the value proposition of LC. The mapping of benefits to the SDGs further enables organisations to connect LC adoption to corporate sustainability commitments and to national development agendas, strengthening the

strategic rationale for investment in LC capability. For researchers, the empirical studies on LC benefits are robust on efficiency, waste and cost, where it remains comparatively thin, notably in the direct measurement of environmental and social outcomes, thereby signalling priorities for future empirical work.

6. Conclusion

This paper set out to consolidate the benefits of LC as reported in recent literature and to organise them within a coherent, sustainability-oriented framework. Through a review of twenty primary studies, predominantly published between 2021 to 2025, twenty distinct benefits were identified, standardised and structured along the three dimensions of the TBL and mapped to the UN's SDGs. The findings confirm that LC delivers value well beyond operational efficiency, while economic benefits such as improved efficiency and productivity, waste reduction, cost and time reduction dominate the evidence base. LC also generates substantial social benefits, including improved health and safety, stakeholder satisfaction and innovation, and increasingly contributes to environmental sustainability through waste elimination and reduced ecological impact.

The principal contribution of this review is a consolidated benefit taxonomy that reconciles the fragmented and inconsistent terminologies prevalent in the literature and that quantifies the relative prominence of each benefit. This taxonomy provides project management practitioners with a concise, evidence-based instrument for articulating the value of LC adoption, and it offers researchers a structured foundation for further inquiry.

The study is not without limitations. The synthesis is based on a focused corpus of twenty studies on reported benefits also means that the taxonomy reflects what authors have chosen to emphasise rather than the full spectrum of LC outcomes. Future research should therefore pursue the direct empirical measurement of LC benefits in less focus area such as Environment, examine the contextual and regional factors and investigate the mechanisms through which the identified benefits reinforce one another across the TBL as an evidence base LC pathway to a more efficient, sustainable and resilient for construction project delivery.

References

Abbas, H. M. Q., Chaudhry, I. G., & Shahzad, M. F. (2024). Decreasing costs over time in construction projects: Effective cost management. *Research Journal of Social Sciences and Economics Review, 5*(2), 32–37.

Abu Tabanjeh, S. T., Pott, C., & Reining, C. (2025). The SuLo framework: A systematic literature review of drivers and barriers to sustainable logistics practices. *Sustainability, 17*(12), 5575.

Aguome, N. M., Alaneme, G. U., Olaiya, B. C., & Lawan, M. M. (2024). Evaluation of lean construction practices for improving construction project delivery: A case study of Bushenyi District, Uganda. *Cogent Engineering, 11*(1), 2365902.

Almabrouk, M. I. (2024). A proposed framework of lean principles for Libyan construction projects: Enhancing efficiency and productivity. *Afro-Asian Journal of Scientific Research (AAJSR)*, 198–210.

Ballard, G., & Howell, G. A. (2003). Lean project management. *Building Research & Information, 31*(2), 119–133. https://doi.org/10.1080/09613210301997

Carvajal-Arango, D., Bahamón-Jaramillo, S., Aristizábal-Monsalve, P., Vásquez-Hernández, A., & Botero, L. F. B. (2019). Relationships between lean and sustainable construction: Positive impacts of lean practices over sustainability during construction phase. *Journal of Cleaner Production, 234*, 1322–1337.

Chen, Y., Qiu, D., & Chen, X. (2024). Integrating lean construction with sustainable construction: Drivers, dilemmas, and countermeasures. *Sustainability, 16*(21), 9387. https://doi.org/10.3390/su16219387

Dauda, J. A., Ajayi, S., Omotayo, T., Oladiran, O. O., & Ilori, O. M. (2024). Implementation of lean for small- and medium-sized construction organisational improvement. *Smart and Sustainable Built Environment, 13*(3), 496–511.

de Oliveira, S. G., & Loos, M. J. (2024). *[The benefits and evolution of lean construction — full bibliographic details to be confirmed by the author.]*

Fauzan, M., & Sunindijo, R. Y. (2021). Lean construction and project performance in the Australian construction industry. *IOP Conference Series: Earth and Environmental Science, 907*, 012024. https://doi.org/10.1088/1755-1315/907/1/012024

Fashina, A. A., Omar, M. A., Sheikh, A. A., & Fakunle, F. F. (2021). Exploring the significant factors that influence delays in construction projects in Hargeisa. Heliyon, 7(4). https://www.cell.com/action/showPdf?pii=S2405-8440%2821%2900929-4

Garcés, G., & Peña, C. (2023). A review on lean construction for construction project management. *Revista Ingeniería de Construcción, 38*(1).

Hamaidi, M., Ghandour, N., Hadi, M. A., & Naser, A. (2024). The influence of preconstruction phase and lean construction implementation on project performance.

Hei, S., Zhang, H., Luo, S., Zhang, R., Zhou, C., Cong, M., & Ye, H. (2024). Implementing BIM and lean construction methods for the improved performance of a construction project at the disassembly and reuse stage: A case study in Dezhou, China. *Sustainability, 16*(2), 656.

Jiang, L., Zhong, H., Chen, J., Cheng, J., Chen, S., Gong, Z., Lun, Z., Zhang, J., & Su, Z. (2023). Study on the construction workforce management based on lean construction in the context of COVID-19. *Engineering, Construction and Architectural Management, 30*(8).

Kehinde, T. V., & Fapohunda, C. A. (2024). Lean construction practices for sustainable infrastructure: A comparative review between Nigeria and the United States of America. *Nnamdi Azikiwe University Journal of Civil Engineering (NAUJCVE), 2*(3), 1–10.

Koskela, L. (2000). *An exploration towards a production theory and its application to construction* [Doctoral dissertation, VTT Technical Research Centre of Finland].

Koskela, L., Rooke, J., Bertelsen, S., & Henrich, G. (2007). The TFV theory of production: New developments. In *Proceedings of the 15th Annual Conference of the International Group for Lean Construction* (pp. 2–12).

Lee, S. H., & Zhou, Y. (2022). The outlook for sustainable development goals in business and management: A systematic literature review and keyword cluster analysis. *Sustainability, 14*(19), 11976.

Liker, J. K. (2004). *The Toyota way: 14 management principles from the world's greatest manufacturer*. McGraw-Hill.

Maru, A., Jekale, W., & Asteray, B. (2024). Investigating the impact of lean construction principles on contractors' project performance in Ethiopia using PLS-SEM. *Journal of Project Management, 9*(3), 227–238.

McKinsey & Company. (2024). Delivering on construction productivity is no longer optional. Retrieved January 12, 2025, from https://www.mckinsey.com/capabilities/operations/our-insights/delivering-on-construction-productivity-is-no-longer-optional

Najafi, M., Sheikhkhoshkar, M., & Rahimian, F. (2024). Innovation and lean practices for sustainable construction project management: Emerging technologies, strategies and challenges. *Smart and Sustainable Built Environment, 13*(3), 473–478.

Pan, W., & Pan, M. (2023). *[Lean construction and the Last Planner System — full bibliographic details to be confirmed by the author.]*

Richard, M. O. (2024). *Adoption of a lean approach to enhance performance of fast-track World Bank-funded projects in Kenya* [Unpublished manuscript].

Sachs, J., Lafortune, G., Kroll, C., Fuller, G., & Woelm, F. (2022). *Sustainable development report 2022: From crisis to sustainable development — The SDGs as a roadmap to 2030 and beyond*. Cambridge University Press.

Salem, O., & Solomon, J. (2021). Lean construction principles for improving project delivery. *Journal of Construction Engineering and Management, 147*(8), 04021123.

Salem, O., Solomon, J., Genaidy, A., & Minkarah, I. (2006). Lean construction: From theory to implementation. *Journal of Management in Engineering, 22*(4), 168–175.

Sánchez, O., Revuelta, M. P., Gómez-Cabrera, A., & Salazar, L. A. (2023). Paper planes for teaching construction production systems based on lean tools: Continuous improvement cells and 5S. *Buildings, 13*(2), 558.

Saradara, S. M., Khalfan, M. M. A., Jaya, S. V., Swarnakar, V., Rauf, A., & El Fadel, M. (2024). Advancing building construction: A novel conceptual framework integrating circularity with modified lean project delivery systems. *Developments in the Built Environment*, 100531.

Ssali, F., Matsiliza, N. S., Moyo, S., Alinaitwe, H., Nshekanbo, D. N., & Chikafalimani, S. H. P. (2022). Implementation of lean construction principles for a collective enhancement of project success in Uganda. *Seybold Report, 17*(9), 1825–1836.

Tetik, M., Koskela, L., Pikas, E., & Vendel, K.-R. (2024). Evaluation of the literature syntheses on lean construction contributions to sustainability. In D. B. Costa, F. Drevland, & L. Florez-Perez (Eds.), *Proceedings of the 32nd Annual Conference of the International Group for Lean Construction (IGLC32)*.

Ugural, M. N., Aghili, S., & Burgan, H. I. (2024). Adoption of lean construction and AI/IoT technologies in Iran's public construction sector: A mixed-methods approach using fuzzy logic. *Buildings, 14*(10), 3317.

United Nations. (2020). *The Sustainable Development Goals report 2020*. United Nations Publications.

Wibowo, M. A., & Ammar, M. A. (2025). Lean construction and sustainability: A review of research trends and implications for the United Nations SDGs. *E3S Web of Conferences*.

Womack, J. P., & Jones, D. T. (1996). *Lean thinking: Banish waste and create wealth in your corporation*. Simon & Schuster.

Yaro, S. A., Saidu, I., Adamu, A. D., & Anifowose, M. O. (2024). Exploring the perspective of lean construction techniques on the performance of construction projects in Nigeria. *Environmental Technology and Science Journal, 15*(1).

YiiLiang, L. (2025). From Factory Floors to Construction Sites: The Evolution of Lean Construction Through Six Decades, Commentary, PM World Journal, Vol. XIV, Issue VII, July. https://pmworldlibrary.net/wp-content/uploads/2025/07/pmwj154-Jul2025-Yiiliang-From-Factory-Floors-to-Construction-Sites.pdf

About the Authors

LIM YIILIANG, PMP

Sarawak, Malaysia

Mr. LIM YIILIANG hails from the oil-rich state of Sarawak, Malaysia with over 29 years of experience across Oil & Gas and Construction sector. A certified Project Management Professional (PMP) by Project Management Institute (PMI), he has worked in multiple countries, including Brunei, Germany, Malaysia, Oman, Singapore, UAE and the UK, with leading multinational energy companies such as Shell, Kellogg Brown & Root (KBR), Brunei LNG, ORPIC, OQ, and currently, Petroleum Sarawak (PETROS) as Project Delivery Manager. He is also a PhD researcher majoring in Construction Management, with research focus on Lean Construction. YIILIANG can be contacted at nicewilliam@rocketmail.com

WONG SHI YEE

Sarawak, Malaysia

Dr. Wong Shi Yee is a Senior Lecturer and Postgraduate Programme Coordinator (MSc in Construction Management and PhD in Construction Management) at the School of Built Environment, University of Technology Sarawak (UTS). She holds a PhD in the built environment discipline and has active research interests in Construction Management, Sustainable Development, Green Building, Building Information Modelling (BIM), and Sustainable Housing. Dr. Wong has published extensively in reputable international journals and conferences while actively supervising postgraduate research and collaborating with industry and academia to advance sustainable construction practices.

FOCK-KUI KAN

Sarawak, Malaysia

Assoc. Prof. Sr. Dr. Kan Fock Kui is the Dean of the School of Built Environment at the University of Technology Sarawak (UTS). He holds a PhD in Quantity Surveying and is a Professional Quantity Surveyor (PQS), MRICS, and MRISM. With extensive experience in academia and the construction industry, his areas of expertise include Quantity Surveying, Construction Management, Project Management, Construction Procurement, Contract Administration, and Sustainable Construction. Dr. Kan actively contributes to research, postgraduate supervision, and industry collaboration in advancing the built environment profession in Malaysia.