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Application of Lean Construction Principles to Improve Productivity in Building Projects

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Abstract

This paper examines how lean construction practices influence improvement in productivity of building projects based on the analysis of the qualitative interviews. The results have found four main themes, which include waste reduction, workflow optimisation, better management of resources and materials, and continuous improvement. The forms of inefficiencies identified in the interviews include delays, rework, poor coordination, and material shortage. As demonstrated in the analysis, the lean methods, such as the just-in-time delivery, co-planning, and process standardisation are useful to reduce the number of non-value-adding activities and increase project efficiency. Literature sources support the view that the implementation of lean principles results in a decrease in project delays, enhance resource utilisation and long-term productivity gains in construction projects.

Keywords: *Lean construction, productivity improvement, waste reduction, workflow optimisation, resource management, continuous improvement, construction projects*

Introduction

The construction sector is significant to economic development as it is the basis of infrastructure development, urbanisation, and housing development. Although considered an important industry, the industry has always been faced by a low level of productivity, poor project management, waste materials and delays in the delivery of projects. Relative to other industries like manufacturing, the rate of productivity growth has been rather slow in construction because of the disorganised project set-up, lack of alignment between stakeholders and absence of planning activities (Cucos and Turcan, 2025). These hurdles will tend to cause cost overruns, time wastages and even gross wastage in the construction projects.

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Lean construction derives its concepts from lean manufacturing, which aims at increasing value and reducing waste in project processes. Its philosophy is focused on the concept of continuous enhancement, management of workflows and the removal of non-value adding processes in the construction lifecycle. The construction teams can streamline and improve the overall project performance by applying lean principles to planning, scheduling, and project execution, thus causing a reduction of inefficiencies. According to recent research, lean construction allows enhancing the integration of project activities that lead to improved productivity, lower costs, and sustainable construction processes (Awad et al., 2021). Moreover, lean construction makes the construction processes consistent with creating value to clients by concentrating on activities that lead to the project results.

Material loss, incongruent waiting times, rework, surplus capital, and labor wastefulness are some of the construction wastes. These non-value adding tasks decrease productivity and extend the cost of the projects a great deal. Through research, the implementation of lean construction practices has been found to produce significant inefficiencies within a project since they respond to the common types of waste that include defects, overproduction, and waiting time resulting in the measurable project performance improvements (Riyanti et al., 2025). Equally, lean building systems focus on detecting and systematically removing waste to enhance operation efficiency and use of resources within a construction facility (Ikram et al., 2025). These strategies promote team analysis to determine the work flows, areas of work inefficiency and the remedial measures to improve the productivity and minimize the unnecessary project expenses.

Along with waste reduction, workflow optimization also belongs to the list of valuable elements of lean construction adding to the high productivity. Construction projects are usually characterized by various operations characterized by different trades carried out within restricted regions and periods of time. Unproductive scheduling and poor coordination tend to introduce workflow disruptions that cause idle workforce and resource contention and schedule overruns. Lean construction techniques have outlined these concerns by enhancing the work flow planning, balancing work events and optimizing the courses of activities in the course of the construction spaces. E.g., location-based scheduling and takt time planning would help to improve the continuity of the workflow and reduce the need of breaks in the execution of a project. The enhanced delivery of workflow is productive and allows for the enhancement of communication between the stakeholders of the project (Bragadin and Kähko, 2020).

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Another important aspect of lean construction is continuous improvement as it prompts project teams to consistently review the processes and introduce improvement in the project lifecycle. The monitoring performance of the organization and continuous learning process will enable the organization to understand areas of inefficiency and alter management processes and perform more effectively. Construction teams make knowledge sharing possible through lean tools and collaborative practices that enhance further coordination and informed decision making. Nevertheless, there is a plethora of projects that still employ the old ways of managing projects that cannot solve the waste and inefficiencies. The low levels of awareness, wrongful absence of strategized implementation plans and organizational opposition towards change remain in place as barriers to practicing lean in reality (Elmalky et al., 2024). Thus, this paper intends to discuss how lean construction principles have been used to enhance productivity among building projects. To be more specific, the research aims at defining the major lean practices that can help reduce the waste levels, examine how the optimization of workflow boosts the efficacy of particular project, and consider the place of continuous improvement in ensuring the better performance in construction.

Literature review

Lean Construction and Its Role in Improving Construction Productivity

Problems related to poor project planning, lack of coordination among the stakeholders, and fragmented construction processes have remained a challenge to the construction industry in terms of productivity. These issues have provided incentives to researchers and practitioners such that efficient management philosophies can be investigated to enhance operational performance within building projects. Lean Construction (LC) has become among the most impactful methods of enhancing the productivity of the construction industry in terms of waste minimisation, enhanced workflow stability, and collaboration within the project teams. Lean construction is implemented in accordance with the principles of lean production, which focus on value creation, constant improvement, and the removal of non-value-adding activities everywhere in the production process (Garcés and Pena, 2023).

Lean construction is an approach that transforms project management on the basis of traditional forms of task-based project management to process-based production management. Lean construction does not consider construction as a succession of disconnected activities, but rather, project delivery is a unified production system, and continuity and the coordination of the

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working flows of the activities are required to enhance productivity. Evidence demonstrates that lean thinking in construction as a production strategy may contribute to considerable improvement in efficiency by leading to more efficient planning and decreasing variability in the process (Kulkarni et al., 2023).

The other significant aspect of lean construction is its orientation toward the creation of value to project stakeholders. The lean methodologies serve to maximise construction in accordance with the expectations of the clients with reduced resource wastage. This strategy will make the construction operations work on value delivery, and not just on the execution of tasks. Investigations have shown that lean construction creates better project performance through the increase of reliability of the plan and the implementation of the production control systems in the project management practices (Gazali et al., 2025).

Moreover, lean construction encourages team decision-making and effective interaction between project teams. Lean construction enhances the coordination of various trades and project stakeholders by attracting stakeholder involvement in setting the plan and in problem-solving activities. This combination method is crucial in the current construction setting where projects may have many contractors, designers and suppliers operating concurrently.

Waste Reduction in Lean Construction

One of the guiding principles of lean construction is waste reduction, which is very important in enhancing the productivity of building projects. In construction management, waste can be described as any process involving the investment of resources without value addition to the end product. Examples of common types of waste in construction would be waiting time, material waste, movement of workers or materials that are unnecessary, overproduction and also rework as a result of errors in design or execution (BIRCHIT, 2021).

The lean construction recognises these wastes and offers methodical means of getting rid of them. Studies show that waste minimisation measures have a big impact on making sure that projects are efficient due to the reduction of activities which are not required and enhancing the use of resources during construction activities (Suseelan and Vadivel, 2024). Lean construction methods also enable project managers to find out the sources of possible waste early on in the project lifecycle, thus corrective measures can be taken before they occur, affecting the project's performance.

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The presence of a large ratio of activities in construction projects that are not necessarily positive to value creation is high. Research shows that much of the construction activities are composed of non-value-add activities, including waiting, re-work, and inefficient coordination that impact productivity and project performance negatively (Wandahl et al., 2021). As an illustration, ineffective planning will tend to waste a lot of waiting time for materials or equipment, and ineffective coordination between various trades can cause rework or inefficiency. These wastages underscore the disjointed nature of the classical construction methods. Lean construction reduces them by increasing the visibility of its processes and providing an opportunity to observe the workflows continually so that the teams of the project can understand inefficiency and enhance interaction within its construction processes (Hei et al., 2024).

It has been shown by empirical studies that, with the introduction of lean techniques, it is possible to significantly decrease the amount of non-value-adding processes that occur during the process of construction. Indicatively, research on lean construction implementation revealed that the application of lean tools minimised the existence of non-value-added activities in the project and reduced the total project cycle time, which achieved enhanced productivity outcomes (Kulkarni et al., 2023).

Sustainable construction practices are fostered through lean construction as the waste of materials is minimized and resource is used more efficiently. Lean construction waste management plans not only promote environmental sustainability but also lead to better performance of a project. Through planning construction with waste minimisation, the project teams are able to reduce the loss of resources and, at the same time, maintain the quality and schedules of the project (Rosli et al., 2023).

Workflow Optimisation and the Last Planner System

Another critical part of lean construction is workflow optimization which serves as an important factor in improving productivity. Normally, construction projects consist of various interdependent activities that have to be synchronised within the various teams and workstations. The working of trades may work inefficiently or be poorly coordinated, giving way to project completion delays (Akintoye et al., 2025).

Lean construction is aimed at enhancing the reliability of the workflow by making sure that construction work is adequately ordered and synchronised. The Last Planner System (LPS) is one of the most used tools to attain this goal. Last Planner System is a cooperative planning and

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production control technique, which allows construction teams to be more effective in their task planning and guarantee the performance of work actions according to schedule (Belayutham et al., 2022).

The Last Planner System enhances reliability in the planning process through the participation of the workers and supervisors who are in charge of performing tasks in the planning process. This partnership strategy is seen to make work schedules realistic and achievable. Studies have revealed that the use of the Last Planner System boosts productivity and more effective communication among project teams and a stable workflow in construction projects (Power et al., 2021).

Other performance measures proposed by the Last Planner System include Planned Per cent Complete (PPC) that measures the consistency of the weekly work plans. The use of PPC enables project teams to detect any disruption in the workflow and take corrective measures in a very short duration. Research has established PPC values to be linked to better efficiency of projects and management of resources (Gazali et al., 2025).

The adoption of digital technologies to improve the lean administration of workflow is also emphasised in modern studies. It is possible to integrate digital platforms with lean production control systems and ensure that project teams can track the progress of the project in real time and enhance coordination of the stakeholders (McHugh et al., 2025). The use of digital tools enhances transparency in the construction processes and enables the teams to find the bottlenecks more efficiently.

Visual planning tools form the other significant part of workflow optimisation. The visual planning techniques enhance communication between project members and assist the project team in having a clearer picture of the project progress. The studies have shown that the visual lean planning tools enhance the relationship between planning and execution because they enable all stakeholders to have visibility of the workflow information (Witte et al., 2022).

Continuous Improvement in Lean Construction

Constant improvement is one of the principles of lean construction that is concentrated on improving the construction processes by continually assessing and refining them. The principle also promotes the learning of the past by the project teams and the continuous improvement of the project planning, execution, and management practices.

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In lean construction, it is implemented in a continuous manner with two factors: performance is noted constantly, feedback, and joint problem-solving. Construction teams also analyse data on project performance to determine areas where there are issues and put in place better ways of improvement to achieve better productivity. This will enhance learning within an organisation and foster innovation in construction practices.

Studies show lean construction practices enhance productivity since it allows the teams to uncover issues early and solve the problems before they become significant problems that could lead the project to delays. Project performance monitoring is one of the methods helping organisations ensure a steady workflow and attain improved project outcomes (Johansen et al., 2021).

Constant improvement also incorporates the use of alternative management styles to improve the performance of construction. As an example, a combination of lean construction and agile and takt planning proven to enhance production planning and coordination in construction projects has also been proved (Power and Sinnott, 2025).

Besides that, there is a growing use of digital technology to aid the process of continuous improvement in lean construction. Production control systems based on digital systems allow project managers to examine workflow trends, track the progress of the project, and see where it can be changed to enhance it. Research indicates that by combining the concepts of lean management and digital tools, the quality of collaboration, decision-making, and productivity in construction projects can be improved by a significant advantage (McHugh, 2025).

Organisational commitment and a cultural change in the construction organizations is also needed for continuous improvement. Lean construction allows developing a culture of transparency and accountability, as well as teamwork, in which project teams are urged to diagnose issues and cooperatively create problem solutions. Companies practising this culture have high chances of realising productivity and project performance growth in the long run.

Theoretical Framework

The Transformation -Flow- Value (TFV) theory of lean construction forms the basis of this study. TFV describes the production of constructions in three linked dimensions: transformation that consists of converting inputs into construction products: labor, materials, information, etc.; flow which is concerned with the flow of activities, resources, and information in the project; and value which is interested in delivering products that satisfy the requirements of clients and

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stakeholders (Garcés and Pena, 2023). This theory fits the current study as not all productivity of building projects is gauged by the completion of tasks, but by the efficiency of the working process, as well as making sure that those activities of the project add value.

In this context, lean construction is referred to as an approach of management in production that will enhance the performance of the project by enhancing the relationship between transformation, flow and value. The transformation dimension is connected with the way the construction tasks are performed based on the available inputs. The flow dimension incorporates delays, interruptions, wait time and integration issues that cause inefficiency. Value dimension exists to ensure that the project process and products are up to the expectations of the client and project goals are achieved. Current research establishes that TFV is also a pertinent basis when it comes to explaining the implementation of lean construction and project improvement in modern construction research (Habibi Rad et al., 2022).

Research Gap

Although a lot of research has focused on lean construction, there have been gaps in comprehending how lean construction has had an integrated influence on productivity in the construction of a building project. The majority of literature concentrates on the specific lean tools or particular case studies as opposed to emphasising the overall impact of the underlying principles, which include waste reduction, optimisation of a working process, and improvement, on productivity. Also, productivity improvement does not have standardised measures, and its comparability with studies is restricted (Asmone et al., 2025). Moreover, few studies use qualitative content analysis to summarise the existing evidence, which generates a necessity to have a more comprehensive perspective on the lean construction practices for enhancing project performance.

Methodology

Research Design, approach and philosophy

The research is based on the interpretivist research philosophy, which places special attention on the cognition of human experiences, perceptions, and social realities. In this study, interpretivism is suitable because it is aimed at investigating the perception and use of lean construction principles by the construction professionals in a real project setting. In contrast to positivist methods based on quantifiable data, interpretivism is able to provide a lot more information about such intricate phenomena as productivity enhancement and management

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practices in construction (Christofi et al., 2021). Moreover, the research takes an inductive research methodology, where inferences are made based on gathered information as opposed to testing set theories. This design is appropriate since the researcher seeks to examine the effects of lean construction principles on productivity through the actual experiences of industry scholars. The inductive reasoning enables the patterns, themes, and relationships to be identified in the data, which is why it is very applicable to the qualitative studies of construction management (Spearing et al., 2022).

This study uses a primary qualitative research design to explain how the lean principles of construction support the increase in productivity in building projects. The qualitative research is a common application in construction and management research to investigate elaborate processes and the situational factors that affect the outcomes of projects. It allows the researcher to take a closer look at the professional practice and the organisational behaviour in an actual environment (Spearing et al., 2022). Semi-structured interviews are used as the primary research approach in the study. It is a flexible approach to data collection that would cover the main areas of research. Semi-structured interviews, especially in construction research is a very effective method due to giving profound insight into the experiences of the members in the study and practical insight into the project management practices (Chand, 2025).

Data Collection Method

Primary data were used by applying semi-structured interviews to 6 respondents who were engaged in construction building works. The sample consisted of the project managers, site engineers, contractors and supervisors who have experience in construction project execution. The choice of respondents was able to make the data collected relatable and based on real-life working experience.

The semi-structured interviews were applied with the aim of giving the respondents a chance to express elaborate views while ensuring uniformity in the issues raised. The open-ended questions were structured to find out what lean construction practices are being applied, what problems arise during implementation and how this has led to the productivity of the project. Interviews have been accepted as a strong qualitative method of data collection to use in gathering in-depth and rich information in a real-life practice (Chand, 2025).

The article utilised a purposive sampling method to choose participants who have useful knowledge and experience in construction projects. Purposive sampling is popular among

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qualitative studies as it helps to ensure that the participants are certain specialists on the subject of a research study. The approach enables the gathering of meaningful data with details through the involvement of people studying the phenomenon of interest (Campbell et al., 2020).

The selection comprised 6 respondents, and this is said to be adequate when it comes to qualitative research because it provides depth in the research but also saturates the data. Research indicates that qualitative research can use smaller sample sizes in instances where the participants are within the area of relevant expertise (Sarfo et al., 2021).

Data Analysis Technique

Thematically, the collected data of interviews were analyzed the way that Braun and Clarke created, relying on the method of thematic analysis of data. Thematic analysis can allow the researcher to discover, examine, and interpret trends of qualitative data (Byrne, 2022). These themes enable systematic organisation of data into meaningful aspects, and this is why it is widely used in qualitative research.

The discussion was performed in several steps. First, responses obtained during the interviews have been thoroughly reviewed to find familiarity with the data. Afterwards, central concepts and common patterns were recognised and clustered into more general themes according to their similarities. Lastly, the themes were narrowed down after an iterative process to make sure that the themes properly reflect the views of the participants. It has been identified that thematic analysis is a successful approach to interpreting qualitative data and establishing connections between notions (Karimi and Khawaja, 2023).

Results

The thematic analysis of the interview responses showed that there were some common patterns that resonated on the issue of the pertinence of lean construction principles in enhancing productivity in the building projects. Results show that the production problems in the construction industry are closely connected with weaknesses in the planning, coordination, resource management, and the absence of constant striving for improvement. According to the analysis, four key themes have been identified, namely waste reduction, workflow optimisation, resource and materials management, and continuous improvement. All the themes indicate the way in which the lean construction principles can solve the existing inefficiencies and boost the performance of the project.

Theme 1: Waste Reduction as a Key Driver of Productivity Improvement

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Among the most notable themes in the analysis is the role of waste reduction in enhancing productivity in building projects. The construction projects are mostly plagued by inefficiencies brought about by wastes of different types, such as wastes of the material used, lapses in time waiting, unnecessary movement of workers or machines used, over-production, as well as rework due to mistakes in design or construction processes. These valueless processes decrease the efficiency of projects and also help to multiply time and cost overruns. The interviews also reveal that waste reduction is important in enhancing productivity. Participants have indicated waiting time, rework, and ineffective planning as the most frequent perspectives of inefficiencies in construction projects. One participant stated:

"A lot of time is wasted waiting for materials or approvals. Sometimes work stops completely because one team is delayed, and others cannot continue." (R1)

Another respondent noted:

"Rework is very common, especially when drawings are not clear. We end up doing the same work again." (R3)

Likewise, one of the participants stated:

"There is too much waste in terms of time and effort because tasks are not properly planned." (R4)

These responses imply waiting, ambiguous designs, and inadequate planning are major culprits of waste that have a direct influence on the productivity of the construction projects. Existing literature supports these observations. Studies show that Lean construction techniques and tools such as value stream mapping, process cycle analysis, and root cause analysis soffer a systematic means of identifying and dealing with such inefficiencies to allow workflow optimization and eliminate non-value-added processes by the teams. Value stream mapping, process cycle analysis, and root cause analysis are lean techniques that are often applied to identify inefficiencies in construction processes and come up with corrective action plans. In a case study reviewing the application of lean in the construction of building projects, the key factors of waste were identified, and it became evident that process efficiency improved much further (72% vs. 79% when lean techniques are applied), and the process cycle also became more efficient (Anggraini et al., 2022).

Theme 2: Workflow Optimisation and Improved Project Scheduling

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Workflow Optimisation and Improved Project Scheduling is the theme that shows the effectiveness of lean construction practices to the efficiency of project workflows and schedules. Construction projects entail numerous interdependent undertakings done by different teams and trades. The absence of coordination and proper scheduling tends to cause delays in the workflow, labor wastage, delays in material delivery and conflict of tasks.

According to the responses of the interviews, the primary cause of inefficiency in the workflow is the lack of effective coordination and communication between teams.

One respondent explained:

"Different teams are not well coordinated. One team finishes late, and the other has to wait, which slows everything down." (R2)

Another participant stated:

"There is a lack of communication between engineers and workers, which creates confusion on-site." (R5)

Another respondent pointed out:

"Sometimes work stops completely because one activity depends on another that is delayed." (R1)

These answers imply that time-lags, lack of coordination, and communication breaches are the major causes of workflow inefficiencies in construction projects. Lean construction focuses on them with the help of collaborative planning, the pull-based scheduling, and lean project management tools that assist the teams in organising the work more efficiently, ensuring the workflow is smooth during the entire project life cycle.

The observations are supported by existing literature. Research indicates that lean project management application approaches minimize waiting time, defects, and efficiency of workflow in construction projects. (Ho et al., 2022). The paper has shown that a combination of lean practices and project scheduling methods contributed to the optimisation of construction processes and the communication between the project members and the coordination of their activities.

In the construction work of infrastructures, lean construction and the use of collaborative planning tools had a great effect on improving the scheduling and management of the projects as well as the resources. Lean implementation reduced delays and enhanced the overall project performance through more coordination and communication within the project teams (Panchal, 2024).

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Theme 3: Improved Resource and Materials Management

Improved Resource and Materials Management is a theme that highlights the direct influence of efficient resource and material management concerning productivity of building projects. Wastage that is caused by misallocation of resources and handling of materials that are not effective can result into a lot of wastage, delays, and high costs of the project. These inefficiencies are to be solved through lean construction practices like the just-in-time delivery, standardisation of work processes, and improved coordination of the supply chain. The results of the interview also underline the fact that the problem of ineffective management of resources and materials has a major impact on construction productivity.

One participant stated:

"Delays usually happen due to material shortages, which affect the entire project timeline." (R3)

Another respondent highlighted:

"Workers are often idle because materials are not available or instructions are not clear." (R2)

Similarly, another participant explained:

"Sometimes materials arrive late, and it disrupts the whole workflow." (R5)

These responses indicate that the availability of materials and instructions on time is very important to sustain the efficiency and productivity of a project. These findings are validated by the supporting literature. Research indicates that effective material management and deliveries help to improve the performance of the project to a great extent. Poor material management and slow deliveries have been a common issue in most construction projects, resulting in the disruption of workflow and a high cost of the project. Reductions of these inefficiencies through lean measures, to include just-in-time delivery and better coordination of logistics, can be applied to enhance project performance (Albert et al., 2025).

Through the results, it is also shown that lean construction can enhance productivity in the form of increasing the maintenance of construction equipment. Machinery failure and ineffective maintenance procedures may propagate the construction activities and decrease the project productivity. The study investigating lean maintenance practices concluded that the use of lean tools in equipment maintenance decreased operational waste and enhanced the equipment reliability and consequently enhanced the efficiency of construction (Masoud et al., 2023).

Theme 4: Continuous Improvement and Organisational Learning

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The last theme that is established in the analysis is the significance of continuous improvement and organisational learning in lean construction implementation. The key concept in the lean philosophy is continuous improvement, which is provided on a weekly basis through process review, finding defects, and making changes to streamline performance in the project.

The answers provided by the respondents reveal that best practices of continuous improvements are present in construction projects, albeit they are not always formalised and formalised.

One respondent stated:

"We try to learn from mistakes in previous projects and avoid repeating them." (R6)

Another participant noted:

"Regular meetings help us identify problems and improve processes." (R6)

Similarly, another respondent explained:

"Improvement happens, but not in a structured way—it depends on the team." (R4)

These reactions suggest that lessons that arise after experiences and problem solving as a team are central in increasing efficiency of the operations over the time, though the processes may not necessarily be formalised.

These observations are validated by the literature. Research indicates that work process standardisation, delivery on-demand, and ongoing quality improvement schemes can make productivity and process efficiency sustainable in the long term (Alsakka et al., 2022). Moreover, performance control and periodic appraisal of project operations have been identified to decrease the delays and enhance the project outcomes in general (Atout, 2022).

Besides, the studies of lean implementation in sustainable construction projects emphasize that the continuous improvement assists organisations to improve collaboration with stakeholders, manage resources, and attain superior project results (Suseelan & Vadivel, 2024).

Altogether, evidence provided by interviews, as well as research, shows that continuous improvement and organisational learning is essential to develop efficient processes, ensure high productivity, and ensure the success of the long-term project.

Discussion

The results of this paper demonstrate the high importance of lean building principles that enhance productivity in building projects. The thematic analysis revealed four general patterns of how lean practices help in improving productivity, namely waste reduction, workflow

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optimisation, better resource management, and continuous improvement. These results correspond with the research literature on the topic of construction management that underlines the idea that lean construction involves the removal of non-value-added processes and the enhancement of the project processes to decrease the overall performance.

The findings show that waste minimisation is among the most essential elements that affect an increase in productivity in construction projects. It was found in the analysis that the waste can be identified and removed through reducing areas of: rework, waiting time and lack of efficient communication, which can greatly increase the efficiency of projects. These results align with the past studies that have indicated that lean construction methods can be used to minimise material waste and non-value-adding processes in building practices (Ikram et al., 2025). Likewise, lean waste management studies accentuate that due to the systematic defining and tracking of waste sources, the construction organisation is able to enhance operational effectiveness and productivity (Aisyah et al., 2023).

The other significant result of the study is the relevance of workflow optimisation to the productivity increase in the construction industry. Close cooperation of the construction activities will ensure that the work is not carried out with unnecessary disputes and delays. The lean construction tools that include collaborative planning and better scheduling systems can be used to sustain the continuous flow of work and enhance communication within project teams. As it has been noted in the literature of the past, the enhancement of workflow coordination is likely to provide considerable improvement to the efficiency of the project and reduce project delays by facilitating the more effective integration of the project activities (Kulkarni et al., 2023).

The findings also support the role of good resource and materials management to enhance the productivity of projects. The lean construction supports the strategies of just-in-time delivery of materials and supply chain coordination that contribute to the reduction of delays caused by the lack of materials or unproductive use of resources. This finding is backed by research, which suggests that lean production techniques enhance the practice of managing the materials to be used and reduce the number of disruptions in the construction processes (Albert et al., 2025).

Lastly, the concept of continuous improvement became a critical success factor in the maintenance of productivity gains of building projects. Lean construction prompts the organisations to review the performance of projects frequently and make improvements based on the lessons learned during the past projects. Research cited has demonstrated that organisations

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that embrace continuous improvement activities have a better chance of improving the efficiency of projects and attaining long-term productivity (Alsakka et al., 2022).

Conclusion

This study has reviewed the use of lean construction principles to enhance the productivity of building projects using a qualitative content analysis of the recent literature. The findings showed that lean construction is important in fostering efficiency of a project in that it deals with the main areas of productivity that are usually encountered in the construction industry. The thematic analysis revealed that there were four key areas in which the lean is involved in enhancing the performance, these included the reduction of waste, enhancement of the workflow, more efficient management of resources and materials, and continuous improvement. These results validate the fact that lean construction practices assist in the removal of non-value-adding activities, facilitate the project working process, and enhance coordination of project stakeholders.

The results are congruent with the past studies that reveal that the implementation of lean construction methods would be of great help to the productivity of construction through minimising delays, wastage, and improving efficiency in construction project scheduling. Besides that, it has been observed that lean construction also enhances project delivery because it promotes collaborative planning, enhances communication across stakeholders, and efficient use of resources by the project throughout the project lifecycle. These advancements culminate in an improvement in the performance of projects, lower cost of the project, and productivity in the construction projects.

A further development in this study may be as follows: future researchers may carry out empirical research, such as a survey or an interview of professionals in the construction business, to study the real-life application of lean construction of a construction project. The synthesis of lean building and new technologies like digital twins, artificial intelligence, and advanced project management systems to enhance construction productivity is a topic of other studies as well. Also, the researchers are expected to study the lean construction practices within other construction sectors and geographical areas to establish a deeper picture of their efficacy. By conducting such studies, there would be a deeper contribution to the creation of more effective frameworks to apply the principles of lean construction in the construction sector of the whole world (Yang et al., 2025).

Informed Consent

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Informed consent was obtained from human participants before distribution of survey and collection of data.

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Author Contribution

M.H.: Conceptualization, methodology, data collection, analysis, and manuscript writing.

B.D.: Literature review, data collection, analysis, and manuscript review.

M.T.A.C.: Data collection, analysis, and manuscript revision.

M.A.H.: Data analysis, statistical analysis, and manuscript review.

B.S.B.: Data collection, manuscript review, and final editing.

M.R.I.: Data collection, thematic analysis, and manuscript review.

Conflict of Interest

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Appendices

Appendix A: Questionnaire

1. **What is your role and experience in construction projects?**
2. **How would you describe your understanding of lean construction?**
3. **What are the major challenges affecting productivity in your projects?**
4. **What types of waste or inefficiencies do you commonly observe?**

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5. **How do these inefficiencies affect project performance (time/cost)?**
6. **How would you describe coordination between teams on-site?**
7. **What problems occur in workflow and scheduling?**
8. **What practices are currently used to improve project performance?**
9. **Do you think learning and improvement occur during projects? How?**
10. **What suggestions would you give to improve productivity in building projects?**