

Adoption of Lean Construction Techniques by SMEs in the Western Cape Province, South Africa to Enhance Project Delivery.

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Abstract

Small and Medium Enterprises (SMEs) in Western Cape construction industry face significant challenges in adopting Lean Construction Techniques (LCT). This work examined the challenges and benefits that come with the adoption of LCT to improve the delivery of projects of SMEs in the Western Cape Province of South Africa. The qualitative research methodology was employed, involving six semi-structured interviews with construction professionals from Construction Industry Development Board (cidb) registered SME constructors (grade1-6) operating within the Western Cape province. A thematic analysis was used to determine the existing practices, limitations and performance results. The results reveal that although LCTs are positively perceived among SMEs, its adoption is still informal and project-oriented because of financial limitations, lack of training, resistance to change, and weak commitment of management to embrace change. Despite these challenges, partial adoption of techniques like the Last Planner System (LPS), Just-in-time (JIT), 5S, and Value Stream Mapping (VSM) contributed to improved workflow coordination, time management, decrease in rework, better performance of safety, and client satisfaction. The findings indicate that LC techniques and management commitment may be institutionalised to boost the performance of SMEs. The study established that Lean Construction techniques are a promising solution to enhance project delivery among SMEs in Western Cape if awareness, systematic training, and policy-backed solutions are given priority.

Keywords: Lean construction; Lean construction adoption; Lean construction techniques; Project delivery; SMEs

1. Introduction

Construction is a fundamental economic development engine across the globe that drives infrastructure building and job creation as well as sustaining the economy in the country (Karimulla et al., 2024). The South African construction sector is a vital component for national economic development because it contributes about 3% to the country's GDP according to Ramabitsa (2022). It adds substantial economic value to the national GDP which amounted to 109.5 billion rand in 2023 (Statista, 2024).

However, with all these contributions, the construction industry is facing several challenges which are curbing its ability to successfully complete construction projects. The factors that cause delays in the completion of project, financial running over, low quality, etc, are common factors that results in the dissatisfaction of the client and loss of revenue opportunities (Al Balkhy *et al.*, 2021). It was suggested by Jacobs (2024) that the lack of financial resources on SMEs in South Africa, coupled with low operational capabilities, is the primary reasons for their poor performance. LCT are structured process improvement mechanisms designed to minimise waste, coordinate more effectively and generate more value in project environments (Salem et al., 2020). However, the adoption of LCT faces many issues for South African SMEs to manage. Poor

industry-academia collaboration, opposition to policy changes, cultural differences, and a lack of industry knowledge of LC are some of the obstacles that prevent the adoption of lean techniques by South African SMEs (Salem et al., 2020).

This study aimed to explore the adoption of LC techniques by SMEs in the Western Cape Province, South Africa, to enhance project delivery. A qualitative research design was used where data were collected as structured and in-depth interviews using purposely sampled cidb-registered general building contractors (Grades 1-6) and a thematic analysis. This method was suitable because it allowed the in-depth understanding of professionals' experiences that would have been more difficult if a quantitative approach had been used. The study, although restricted to the Western Cape province, provided context-specific results that should help SME managers, policymakers, and industry stakeholders to become more efficient, competitive, and sustainable in project performance.

2. Adoption of Lean Construction techniques in SMEs

Problems that South African construction SMEs face with project delivery include delays, cost escalation, rework, low productivity, and inconsistent quality deliveries (Sogaxa, 2020). These performance issues

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are usually caused by financial constraints, informal management systems, poor planning systems, lack of skills and disjointed communication among project stakeholders. These limitations lower the competitiveness and limit the long-term sustainability of the SMEs. Process improvement solutions for these inefficiencies are organised and are specific to the SME context (Xing *et al.*, 2021).

According to Akanbi *et al.*, (2019) Lean Construction (LC) is a construction management philosophy based on Lean Manufacturing, which is aimed at increasing the value while minimising waste throughout the construction process. It focuses on continuous improvement, teamwork, effective management of workflow, and doing away with non-value-added activities. The construction industry is in the state of constant advancement and industry players employ a more significant degree of activity towards operational effectiveness, waste elimination, and environmental responsibility (Liong *et al.*, 2024). LC is a disruptive approach that can be utilised to make construction projects more productive in terms of the reduction of their inefficiencies (Akanbi *et al.*, 2019). LC is the adaptation of Lean Manufacturing principles to the construction sector that suggests new delivery solutions to the implementation of a project taking into account its specifics (Xing *et al.*, 2021). Despite the proven effectiveness of lean construction techniques in large construction organisations, their uptake in SME remains unsatisfactory, particularly in developing countries such as South Africa (Makondo, 2021).

The financial ability, skills and informal management structure of SMEs tend to restrict their capacity to undertake formal improvement initiatives, as well as determine the resultant outcome of lean techniques adoption, when the latter is applied. It is therefore important to comprehend both the obstacles that would impede the adoption and the benefits that can be achieved by adopting LC to the project environment of SMEs to establish the practicability in the SME project setting. The current literature is examined on two important levels, namely the challenges hindering the adoption of lean construction techniques and the benefits linked to their use in improving the performance of project delivery.

2.1 Challenges hindering the adoption of lean construction techniques by SMEs to enhance project delivery.

The problems that the construction industry faces are issues of cost overruns, delays, re-work and low productivity, which makes lean construction a strategy that can help reduce waste and maximise value (Al Balkhy *et al.*, 2021). Although it has been found to work within large companies, its level of adoption remains low in SMEs, especially in developing economies. SMEs possess scarce resources and unstructured management frameworks constraining the

ability to perform structured improvement practices (Jacobs, 2024).

The first barrier has been recognised as resistance to change since managers and workers usually enjoy the routine and perceive LCTs as hard to implement or disrupting (Sarhan *et al.*, 2018). Lean initiatives are regarded as another administrative burden, not as a productivity tool, without effective leadership and change management (Al Balkhy *et al.*, 2021). Implementation also faces financial and time limitations, as the adoption of LCT involves initial investments in the form of training, planning, and redesigning processes that most SMEs cannot afford (Jacobs, 2024).

According to Huaman-Orosco *et al.*, (2022) the lack of knowledge and poor collaboration among industry, academia, and support institutions lead to decreased awareness and practical knowledge of lean construction techniques. A commitment of poor leadership also compromises long-term implementation as stated by Al Balkhy *et al.*, (2021). All these cultural and financial, as well as capability-related barriers, clarify the gradual adoption of LCT among SMEs despite the opportunities it may provide in terms of improving project performance.

Besides the cultural and financial barriers, technical capacity is also limiting as it restricts effective adoption of LCT in SMEs. The most popular are the Last Planner System, Just-In-Time (JIT) delivery, 5S organisation of the workspace, and Value Stream Mapping (VSM) that are expected to enhance the reliability of workflow, efficiency of materials, and coordination (Singh, 2025). The effective application of these techniques however involves disciplined planning, training as well as regular leadership guidance. These enabling conditions are not present in most SMEs, and informal, intermittent and project-specific application is in place as opposed to institutionalisation by the organisation (Singh, 2025).

2.2 Benefits of adopting lean construction techniques by SMEs to enhance project delivery.

Although SMEs have been facing substantial adoption challenges, empirical studies have proved that lean construction can bring substantial benefits to an organisation in terms of operational as well as strategic advantages, especially when it is implemented wisely. LCT can be used to improve project performance through reduction of the non-value-adding activities and maximisation of resources utilisation, which leads to an increase in productivity and competitiveness (Dara *et al.*, 2024). These benefits have a particular relevance to SMEs, because their survival in a variety of situations depends on effective cost control and timely delivery.

One of the main benefits that have been reported in the academic literature is the minimisation of waste of material and the cost implication thereof. Just-in-time (JIT) procurement and enhanced workflow planning are lean tools that ensure the reduction of unnecessary inventory, material damage, and over-ordering (Dara *et al.*, 2024). Belhadi *et al.* (2018) state that the material losses and storage cost are reduced considerably in organisations that use pull-based and JIT systems. In the case of SMEs, which are normally faced with limited financial resources, the cost savings would directly increase profitability, positive cash flow, and financial sustainability. Waste minimisation will help in environmental sustainability, making construction activities in line with the rising client demands and regulation standards (Belhadi *et al.*, 2018).

Lean construction techniques are linked to better time management and schedule reliability. Co-operative planning methods, like the Last Planner System, help in coordinating tasks, identifying constraints earlier and stabilising the workflows, thus producing fewer delays and less rework (Sibiya *et al.*, 2023). Belhadi *et al.*, (2018) states that companies using formal lean scheduling have a shortened project life and greater predictability of the completion time. Improved performance in schedules builds confidence in clients and allows SMEs to implement more projects during the same time, thereby increasing revenue opportunities.

Another relevant advantage is better collaboration among the stakeholders. LCT also promote frequent communication, joint problem-solving, and shared responsibility between the contractors, subcontractors, and suppliers (Belhadi *et al.*, (2018). The use of the LCT like daily huddles and visual management boards enhances the transparency and the speed of the decision-making process. Dara *et al.*, (2024) note, that it becomes easier to coordinate the work, and the number of disagreements and misunderstandings decreases, resulting in an improved flow of the work. In the case of SMEs, which often rely heavily on the working relationships, this collaboration will improve the efficiency of the operations and lead to long-term partnerships.

The value proposition of LCT adoption is further supported by improving of quality and customer satisfaction. The continuous improvement practices encourage the early identification of flaws, streamline operations, as well as learning about earlier undertakings (Belhadi *et al.*, 2018). This results in better quality of workmanship by minimising rework, reducing the cost of corrective work and more regular performance, also enhances the reputation of the organisation. According to Sibiya *et al.*, (2023), small and medium enterprises adopting lean strategies record better repeat business and referral rates, which can be attributed to the high-quality of service delivery. These

performance improvements are reflected in increased competitiveness in tendering as clients become more willing to hire contractors who have proven their efficiency, reliability, and cost-effectiveness (Sibiya *et al.*, 2023).

2.3 Synthesis

The existing evidence proves that although lean construction offers unique benefits to the execution of the SME projects, its adoption is hampered by resistance to change, limited resources, lack of competencies, and the lack of leadership support. There is however systematic evidence that demonstrates that SMEs that overcome these hindrances incur fewer costs, better schedule performances, increased teamwork, better quality, and increased competitiveness. The contrast of high potential benefits in the future with the long-term barriers to implementation, highlights the necessity of contextually focused empirical research on ways SMEs, including those in the Western Cape, can effectively apply lean methodology to streamline project results.

3. Research Methodology

A qualitative research design was used to investigate the adoption of Lean Construction Techniques among the Small and Medium Enterprises (SMEs) in the Western Cape Province. An interpretivist research philosophy was adopted since the study was concerned with trying to make sense of the experiences, perceptions, and practicality of LCT adoption by construction professionals. Six semi-structured interviews were conducted with a project manager, quantity surveyor, site supervisor, director, safety officer, and operations manager in different General Building contractors registered with the Construction Industry Development Board (cidb), i.e., SMEs in Grades 1 to 6. These participants were selected using purposely sampling method and are considered a small-scale representation of construction stakeholder with experience ranging between 6 and 18 years in the construction industry, ensuring a range of practical insights from mid-level to senior professionals.

Face-to-face and virtual interviews were scheduled for 30-45 minutes. The interviews were audio-recorded with participant consent to ensure accurate transcription and analysis. The data were analysed using thematic analysis; the data were coded and reclassified into key themes of lean adoption, challenges and benefits. Careful comparison of the results with the literature was used to strengthen the credibility of the study in interpreting the results. Ethical considerations were observed throughout the study. Participation was voluntary, and all participants were informed of the study's purpose before the interviews began. Respondents were anonymised and identified as P1 to P6 to preserve confidentiality.

4. Findings and Discussion

4.1 Challenges hindering the adoption of lean construction techniques by SMEs to enhance project delivery

The analysis established that the biggest issues include knowledge and training deficiencies, financial constraints, resistance to change, limited leadership support, with all of the themes supported by literature and participant responses.

4.1.1 Lack of knowledge and Training

Four participants (P1, P3, P5 and P6) emphasised the lack of awareness and available training opportunities as barriers to the understanding and adoption of lean construction techniques. P1 clearly stated: "Lack of awareness is the greatest challenge. Therefore, a lot of effort is required to train many workers who do not understand lean construction concepts." Similarly, P3 added: "Our artisans are competent but lack exposure to lean construction techniques." This is supported by Huaman-Orosco et al., (2022) who stated that the lack of specific lean education is one of the factors contributing to poor adoption.

4.1.2 Financial Constraints

Many of the participants also highlighted financial constraints as one of the key obstacles. P2 explained: "Financial pressure forces us to cut corners. LCT are regarded as something that is nice to have rather than necessary." P4 further stated: "With no finances we will not have the ability to employ qualified individuals to carry out lean construction in the proper manner." In addition, P3 noted: "We struggle to buy proper software or planning tools, so lean construction remains basic." These assertions prove that cost barriers do not only influence training but also acquisition of proper systems and tools needed to implement formal lean construction techniques. This is consistent with Jacobs (2024) who established that the financial capacity of SMEs is low, and as such, their choices are restricted to whether they invest in the training, technology, or seek consultancy services.

4.1.3 Resistance to Change

Another considerable barrier was identified as the resistance to change, and five of the six respondents cited difficulties with employee attitudes. P2 stated: "My greatest challenge is resistance of older staff. They are stuck to the traditional way of doing things." P5 similarly explained: "Most workers resist change because they want to do things the way they've always done." The findings indicated that not all employees are receptive to change especially employees who are used to doing things using traditional methods of construction and this is a major obstacle towards the successful adoption of lean construction techniques (Sarhan et al., 2018).

4.1.4 Lack of Management Commitment

Respondent P4 and P6 cited a lack of management commitment as a restraint. P4 stated: "The support of the management is unequal. There are those who desire LCT and there are those who believe that LCT is a distraction." P6 added: "The management regards lean construction primarily as compliance with safety, rather than as a company-wide strategy." These results imply that construction lean techniques have not yet been fully institutionalised in the SME governance system. In cases where leadership commitment is not steady, implementation activities are often informal and in a disjointed form. Jacobs (2024) has also indicated that inadequate managerial commitment has negative effects on the implementation of LCT. The results indicate that the problems faced by SMEs in Western Cape are similar to those found in international literature and is enhanced by the local contextual challenges of poor funding, inadequate training programmes, and the skills gap.

4.2 Benefits of adopting lean construction techniques by SMEs to enhance project delivery.

All the participants noted concrete gains of partial LC adoption as the process of work improvement, time management, teamwork, work reduction, and client satisfaction. These results are in line with Dara et al. (2024) who concluded that the adoption of LCT can help in the reduction of waste and shortening of the project duration. Quality and safety performance were improved as well, which is in line with Belhadi et al. (2018), who have associated collaborative lean construction techniques with better coordination and increased safety.

4.2.1 Better Workflow and Co-ordination

According to the participants, workflow stability and coordination were significantly better. P3 stated: "With Last Planner, the work is smoother and the subcontractors work together." P1 added: "It minimises the time wastage and enhances inter-team communication." Such responses show that LCT enhance the sequence, communication, and cooperation of project stakeholders. With improved coordination, the project will be executed with ease, and this will reduce the disruptions at the site.

4.2.2 Work Reduction and Time management

Participants also highlighted that LCT were used to eliminate rework and delay of projects. P3 explained: "I have come to know how to have better time management and how to skip unneeded overtime." Similarly, P5 confirmed: "If we eliminated rework and wastage, projects are completed faster and at reduced cost." These results show a higher level of reliability in planning and better prioritisation of tasks, which result in a reduced number of errors and decreased material waste. This is in line with Dara et al. (2024), who

associated the adoption of lean construction techniques to better time performance and reduction of wastage.

4.2.3 Client satisfaction

All six respondents attested that the adoption of LCT had a positive impact on client satisfaction. P4 stated: “Clients are more satisfied as a result of the fact that LCT minimises waste, which is converted into cost savings to them.”

4.2.4 Productivity and Profitability

Respondents cited moderate productivity and profitability. P1 stated: “The cost overruns are less, and this is more profitable.” P4 noted: “It improves the profitability, but not significantly.” P6 clarified: “There is an increase in productivity because of improved organisation and there is limited profitability as dictated by the outside market factors.”

The modest profitability improvements achieved by all respondents are in line with Makondo (2021), who reported financial benefits of introducing LCT only after long-term and systematic adoption. The overall evidence holds that partial LC implementation may produce both operational and relationship benefits, but more far-reaching financial benefits will be realised when the institutionalisation process and the commitment of the leadership are sustained. A summary of the challenges, findings and benefits of LCT adoption is presented in Table 1.

SMEs recognise the need and potential benefits of using LCT, their use is still low and informal. The primary obstacles mentioned are lack of awareness, training, financial constraints, resistance to change and management commitment.

Despite these challenges, the findings showed that even partial adoption of LCT contributes positively to project delivery. Some of the improvements that participants mentioned were better workflow coordination, communication, time management, decreased re-work, improved safety performance and client satisfaction. The study highlights that LCT can be effective in enhancing the operational performance and project outcomes of SMEs when they are supported by proper training, leadership commitment and organisational support.

The study contributes to the body of knowledge on LC adoption in the South Africa’s SME construction industry, by providing context specific evidence from the Western Cape Province. The results could help SME contractors, industry players and policy makers in formulating strategies that promote the broader use of LCT.

6. Suggestions for further research

Further research could replicate the study in other provinces of South Africa, and could also include interviews with clients and consultants to extend the

Table 1: Summary of challenges findings and benefits of LC adoption among SMEs

Challenges	Findings	Benefits
Lack of knowledge and training	Limited awareness of lean construction techniques among and insufficient formal training opportunities among SME employees and management	Improved understanding of lean construction techniques, better workflow coordination, and enhanced project planning.
Financial constraints	SMEs experience limited financial capacity to invest in training, software, tools and lean adoption processes.	Minimise material waste, improve cost control and enhance profitability overtime.
Resistance to change	Employees, especially long-serving workers, do not easily embrace new methods and prefer traditional construction methods.	Develop collaboration, streamline workflows and minimise project delays.
Lack of management commitment	Inconsistent leadership support and failure to institutionalise lean construction practices within organisations.	Better use of lean construction techniques, better organisation performance and better sustainable project delivery improvements.
Partial adoption of lean construction techniques (LPS, JIT, 5S, VSM)	SMEs adopt lean construction techniques on a limited scale due to operational and financial challenges.	Less rework, better time management, minimisation of waste and better project delivery results.

5. Conclusion and Further Research

The aim of this study was to explore the adoption of Lean Construction techniques by SMEs in the Western Cape Province, South Africa, specifically to improve project delivery. The results showed that although

range of viewpoints regarding the introduction of LC in the construction sector by SMEs. Furthermore, a mixed method or longitudinal method of research can be used to explore the long-term economic impact of LCT implementation of SMEs. Research on the application of digital technologies, such as Building Information

Modelling (BIM) for supporting and facilitating LCT among SMEs could also be pursued. Finally, further research is required to investigate the potential of policy instruments, such as tender requirements and government regulations, that would promote and facilitate the adoption of LCT by SMEs.

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