Advances In Multidisciplinary & Scientific Research
A Multidisciplinary & Interdisciplinary Journal

Vol. 12 No. 3, September , 2026

Assessment of Productivity and Operational Efficiency In Small-Scale Prefabricated Paving-Stone Production In Lagos State, Nigeria

Adejare, E.D. & Oladunmoye, O.M.
Department of Civil Engineering, University of Ibadan, Ibadan, Nigeria
Department of Architecture, University of Ibadan, Ibadan, Nigeria
E-mails; eniolaadejare@gmail.com
Phone; +2348114146940

ABSTRACT

Small-scale prefabricated paving-stone production meets construction-material supply needs but faces challenges related to inefficient production and resource use. This study evaluated the current level of productivity and operational efficiency of small-scale prefabricated paving-stone production in Lagos State. A quantitative descriptive survey design was used and a questionnaire was administered to participants. The study analysed 100 valid questionnaires using mean scores and ranked statements in descending order. Production targets being consistently achieved and efficient use of materials recorded the highest mean scores (3.91). Producing the required number of paving stones within the production period came next (3.67), followed by production coordination (3.49). Equipment utilisation and worker efficiency each scored 3.19, overall production efficiency 3.13, and general efficiency of the production process 3.01. Thus, while attaining targets and effective material use were positively perceived, equipment and worker efficiency as well as production organisation were viewed as weak. The study recommended monitoring of production performance, improvement of workstation organisation, and targeted enhancement of equipment and worker efficiency.

Keywords: Lean Project Management; Paving Stones; Small-Scale Manufacturing; Productivity; Operational Efficiency.

Aims Research Journal Reference Format:
Adejare, E.D. & Oladunmoye O.M. (2026): Assessment of Productivity and Operational Efficiency In Small-Scale Prefabricated Paving-Stone Production In Lagos State, Nigeria. Advances in Multidisciplinary Research Journal. Vol. 12 No. 3. Pp 89-100. www.isteams.net/aimsjournal. dx.doi.org/10.22624/AIMS/V12N3P8

1. INTRODUCTION

Small-scale construction-material manufacturers produce prefabricated elements used in house construction, commercial buildings, and civil engineering works. Productivity in such manufacturers is determined by the production volume and the ability of the production process to utilise labour, equipment, time and raw materials efficiently. Lean research has shown that the use of resources in construction and manufacturing can be hindered by organisational inefficiency (Bajjou and Chafi, 2019; Dauda et al., 2024). Studies on Nigerian small and medium enterprises have also revealed the importance of process management, organisational readiness, and production efficiency for such manufacturers (Inuwa, 2024a; Inuwa, 2024b; Ajibade and Ekott, 2026).

Small-scale manufacturers occupy an intermediate position between the production of construction materials and their use in building construction and civil engineering works. Paving stones are used in pedestrian sidewalks, house compounds, parking lots, and landscaping works. Users of such materials expect specific performance from prefabricated paving stones, which implies the necessity to design and plan the production process rationally.

The amount of materials needed for paving-stone production depends not only on the projected number of stones but also on the production site organisation, available equipment, and worker efficiency (Atoyebi et al., 2023; Gana et al., 2020). Therefore, production targets, material use, equipment utilisation, production coordination and worker efficiency should be evaluated to determine the level of productivity in a small-scale paving-stone manufacturer.Lean Project Management concepts are concerned with eliminating sources of production inefficiency. From this perspective, a thorough analysis of production process organisation can help identify causes of operational weaknesses in small-scale paving-stone manufacturers. The production of prefabricated paving stones involves several interconnected activities, including material batching, mixing, moulding, compacting, demoulding, curing, handling and storage. Each stage of the production process is connected with the others, and organisational weaknesses at one stage can lead to production delays, quality defects and material losses (Dara et al., 2024). Therefore, paving-stone production should be viewed as an integrated system in which the efficiency of each stage affects the performance of the others.

Researchers have examined different aspects of prefabricated construction-product manufacturing, ranging from capacity utilisation (Chen and Tiong, 2024) to improving production efficiency through process management (Becerra-Flores et al., 2024) and the application of lean construction principles (Meilani and Ab Samat, 2024; Ramasu and Kanakana-Katumba, 2025). In the Nigerian context, research on manufacturing processes has revealed the critical role of organisational issues in production inefficiency (Akinmoye, 2024). Similarly, Alumbugu et al. (2022) highlighted operational challenges associated with the handling of construction materials in Nigerian manufacturing firms, particularly their implications for material costs and delivery delays. Other studies have emphasised the importance of organisational readiness for lean construction and manufacturing innovations (Inuwa, 2024b; Ajibade and Ekott, 2026). Nonetheless, empirical information on the baseline productivity and operational efficiency of small-scale prefabricated paving-stone manufacturers remains limited, particularly in Lagos State. This gap provides the basis for examining the existing production conditions of these manufacturers.

The present study forms part of a broader dissertation on the application of Lean Project Management principles to small-scale prefabricated paving-stone production. However, this article specifically addresses the first objective of the dissertation: to determine the level of productivity and operational efficiency of small-scale prefabricated paving-stone production in Lagos State. The focus is on establishing the existing state of production rather than evaluating the implementation or effectiveness of lean improvement techniques. The topic was selected because of the contribution of small-scale paving-stone manufacturers to the supply of construction materials and the potential operational challenges associated with their production activities. Understanding their existing production performance is necessary before identifying appropriate strategies for improving efficiency.

Productivity in manufacturing is traditionally associated with production volume and is measured by the relationship between output and the inputs used in production. However, production volume alone does not provide a complete picture of manufacturing productivity. Other important considerations include the achievement of production targets, material utilisation, equipment utilisation, production coordination and worker efficiency (Owalla et al., 2022; Chen and Tiong, 2024). Research on material efficiency has also demonstrated the importance of assessing how materials are utilised during manufacturing operations to identify opportunities for reducing resource consumption and production waste (Shahbazi et al., 2017). Consequently, a comprehensive assessment of production productivity requires the consideration of multiple operational performance indicators.

The central problem addressed by this study is the limited empirical understanding of the productivity levels and operational efficiency of small-scale prefabricated paving-stone manufacturers in Lagos State. Although these manufacturers are expected to meet production demands while maintaining product quality and controlling production costs, their operations may be affected by inefficient material utilisation, inadequate equipment use, poor production coordination, low worker efficiency, and difficulties in achieving production targets. Without an assessment of these operational indicators, it becomes difficult to establish the extent of existing production inefficiencies and identify the areas requiring improvement. The study therefore seeks to provide an evidence-based assessment of the current production conditions of these manufacturers.

Addressing this problem is important because the productivity and operational efficiency of paving-stone manufacturers have implications for construction-material availability, production costs, product quality and the timely supply of materials for construction activities. Inefficient utilisation of labour, equipment, time and raw materials can increase production costs, reduce output and affect the ability of manufacturers to meet market demand. Conversely, understanding existing operational performance can provide a basis for improving resource utilisation, reducing avoidable production losses and strengthening the competitiveness of small-scale manufacturers. The findings will also provide baseline information that can guide future research and the application of Lean Project Management principles and other production-improvement strategies within the small-scale construction-material manufacturing sector.

A proper choice of indicators for productivity assessment is therefore essential for identifying the strengths and weaknesses of the production process. Based on the review of related studies on lean construction, lean manufacturing and production performance measurement, this study assesses productivity and operational efficiency using selected indicators, namely production target achievement, material utilisation, equipment utilisation, production coordination and worker efficiency. These indicators provide a basis for examining the existing performance of small-scale prefabricated paving-stone manufacturers in Lagos State and addressing the first objective of the dissertation.

1.1 Statement of the Research Problem

Small-scale prefabricated paving-stone manufacturers are key suppliers of construction materials in Lagos State. Nonetheless, the ability of such manufacturers to meet production targets does not necessarily imply the efficient use of production resources. Production of prefabricated paving stones can be characterised by machine downtime, varying worker performance, workstation inefficiency, and material losses. These inefficiency factors can complicate the achievement of production targets and the provision of consistent product quality. Researchers have demonstrated the importance of resource use analysis for lean construction and lean production process improvement (Bajjou and Chafi, 2019; Dauda et al., 2024; Ramasu and Kanakana-Katumba, 2025). Despite the critical importance of paving-stone production for residential, commercial, and infrastructure construction, few studies have analysed the level of productivity and operational efficiency of small-scale manufacturers.

Without such assessments, it is challenging to determine the strengths and weaknesses of the production process in paver stone manufacturers. Thus, the current study used a questionnaire to evaluate respondents ’perceptions of twelve productivity and operational efficiency indicators. The study aimed to identify the current level of productivity and operational efficiency and determine improvement priorities. For paving-stone manufacturers, inefficiency factors in production can be masked by the achievement of production targets. A workshop can report high production volumes while experiencing significant material losses, worker downtime, and organisational issues.

Such weaknesses can affect the ability of a small-scale manufacturer to meet delivery commitments and maintain stable production volumes. In addition, the absence of a systematic approach to production performance assessment can impede the identification of recurring process flaws (Chen and Tiong, 2024; Dara et al., 2024). Although lean research has explored various aspects of manufacturing and construction production, the current study focused on the analysis of a small-scale paving-stone manufacturer. Thus, while the lean literature serves as a valuable source of information on production process optimisation, the current study was limited to the analysis of one production site.

1.2 Aim and Objectives

This article aims to assess the current level of productivity and operational efficiency of small-scale prefabricated paving-stone production in Lagos State, Nigeria.

Specifically, the objective of the study is:
To determine the level of productivity and operational efficiency of small-scale prefabricated paving-stone production in Lagos State, Nigeria.

1.3 Research Question

The study seeks to answer the following research question:
What is the current level of productivity and operational efficiency of small-scale prefabricated paving-stone production in Lagos State, Nigeria?

1.4 Scope of the Study

The study focuses on the productivity and operational efficiency of small-scale prefabricated paving-stone manufacturers in Lagos State, Nigeria. It examines the existing production process using selected indicators, including production output, achievement of production targets, material utilisation, equipment utilisation, production coordination, and worker efficiency. The study is limited to assessing the current state of production operations and does not extend to implementing lean production techniques or evaluating the effectiveness of specific lean improvement strategies. The geographical scope is Lagos State, while the subject scope covers small-scale manufacturers involved in the production of prefabricated concrete paving stones. The findings are intended to establish a baseline understanding of their production performance and identify operational areas requiring improvement.

2. LITERATURE REVIEW

2.1 Overview

Productivity and efficiency play a key role in manufacturing. In small-scale manufacturing for construction materials such as paving stones, factors such as material availability, labour, equipment, production time and organisational structure will influence productivity and efficiency.
This section of the literature looks at what productivity and efficiency are and what indicators can be used to measure production performance. The impact Lean Thinking has had on operation performance, challenges and opportunities faced by small-scale manufacturers and previous studies.

2.2 Productivity And Efficiency In Small-Scale Manufacturing Of Paving Stones

Productivity in manufacturing typically refers to the amount of output per input. Within paving stone manufacturing, output could be measured by how many paving stones have been created to the required standard. Input would then be looking at how the manufacturer is using its labour, equipment, materials, energy, and space. Productivity can only be increased if production targets are achieved by efficiently using the available resources (Owalla et al., 2022).

Productivity should be looked at holistically by considering how much of a target has been achieved, material usage, equipment usage, production organisation and labour efficiency. Efficiency relates to how effectively resources can be used to achieve production targets with minimal losses and disruptions. This looks at how well the manufacturer is organising their production, performing consistently and using their available resources. Efficiency and productivity are closely related; however, they are not the same. A manufacturer may be achieving their production targets but may be inefficient due to excessive material usage, equipment downtime, and extra overtime (Chen and Tiong, 2024).

Production targets are an important indicator to look at when measuring production performance. This allows the manufacturer to understand how much they are achieving within their production. It helps them monitor their performance internally and understand how much of their available production capacity they are using. However, just looking at how much has been produced does not give an accurate indication of productivity. If production targets are being achieved but too many resources are being used then this can indicate inefficiency (Owalla et al., 2022; Dauda et al., 2024).

Material usage is an important factor in paving stone manufacturing. The main materials used in concrete paving stone manufacturing are Cement, Sand, aggregates, and Water. Using these materials efficiently can help to keep production costs as low as possible. If materials are not batched correctly, are wasted during mixing and moulding, and paving stones are rejected due to defects, this can increase production costs and reduce productivity. Previous studies have shown the importance of material choice, batching and usage (Atoyebi et al., 2023; Gana et al., 2020).

2.3 Material Usage, Equipment Usage and Labour Efficiency

Equipment usage looks at how effectively resources are being used to achieve production targets. Equipment used within paving stone manufacturing includes concrete mixers, moulds, compacting equipment, and other equipment. This will be influenced by production capacity, availability of equipment, maintenance, and organisation. Poor management of equipment can cause disruptions to the workflow and reduce production output. Studies have shown the importance of equipment capacity and usage within precast construction (Chen and Tiong, 2024). Labour efficiency looks at how effectively labour is being used. This will be influenced by organisation, availability of materials and equipment, clarity of instructions, and technical skill of workers. Poor organisation can cause workers to wait unnecessarily, repeat tasks, and cause delays due to lack of materials or equipment. This can reduce the amount of productive work that can be completed (Dara et al., 2024). Material usage, equipment usage, and labour efficiency all relate to each other. If materials are not prepared properly, this can cause equipment downtime and increase waiting times for workers. If production is poorly organised this can cause equipment and labour to not be used to the best of their ability. By looking at these factors holistically a better understanding can be gained of how efficient operations are.

2.4 Lean Thinking and Operation Performance

Lean Thinking encourages identifying and removing non-value-adding activities. The principle behind Lean Thinking is to create maximum value by making sure resources are being used efficiently, processes are streamlined and there is less wastage. This has been implemented within construction and manufacturing to improve production planning, resource management, organisation and performance (Bajjou and Chafi, 2019; Dauda et al., 2024). Researchers have looked at various factors that can cause inefficiencies within production. Equipment usage within precast production (Chen and Tiong, 2024), and material management within paving stone manufacturing (Atoyebi et al., 2023; Gana et al., 2020).

However, implementing lean principles within small-scale manufacturing can be difficult due to a lack of finances, technical ability, and production management differences. Due to the size and limitations of small-scale organisations, implementing formal production monitoring systems and improvement techniques could be challenging (Inuwa, 2024a; Inuwa, 2024b). Previous studies have looked at lean manufacturing practices within small-scale manufacturing (Meilani and Ab Samat, 2024) and lean manufacturing principles within small manufacturing companies (Ramasu and Kanakana-Katumba, 2025). There is a lack of research on lean construction and lean manufacturing within Nigeria. However, studies have looked at manufacturing and construction production processes and shown how organisation and management can impact operational performance (Akinmoye, 2024; Ajibade and Ekott, 2026). Lean Thinking provides a good foundation to understand productivity and efficiency within small-Scale Paving stone manufacturing. However, this study does not look at how effective lean techniques are being implemented. Instead, the principles behind Lean Thinking were used to guide the selection of indicators to measure current production performance. This includes efficiently using resources and reducing wastage.

2.5 Monitoring Operations Within Small-Scale Enterprises

Selecting the right indicators to measure production performance is important within small-scale enterprises. Larger manufacturers may have automated production monitoring systems whereas small-scale enterprises may have manual systems. Production performance indicators should be relevant to the scale of operations. Previous studies have shown the importance of organisation and management in selecting suitable improvement techniques (Inuwa, 2024a; Dauda et al., 2024).
Multiple indicators should be considered when monitoring operations. If a manufacturer is producing a large quantity of paving stones but using excessive amounts of material, experiencing equipment downtime, and extra hours of work this could indicate that quantity is not a good indicator of efficiency. Multiple factors should be considered such as production targets, material usage, equipment usage, production organisation, and labour efficiency (Owalla et al., 2022; Chen and Tiong, 2024).

2.6 Challenges Aad Opportunities to Improve Productivity Within Small-Scale Paving Stone Manufacturing

Small-Scale Paving stone manufacturers can encounter various challenges that can impact productivity. These include poor production planning, lack of equipment capacity, material wastage, equipment failure, lack of skilled labour, and poor production organisation. Availability and affordability of key materials such as cement and aggregates can impact production costs. Small-scale manufacturers will have limited capacity to implement formal production monitoring and improvement systems. This may be due to financial restraints causing issues with equipment maintenance, lack of training for labour, and investment into improving production. Without having a system in place to monitor production it can be difficult to compare planned outputs with actual outputs and identify regular inefficiencies.

Opportunities to improve productivity include having good production planning, managing materials efficiently, maintaining equipment correctly, and having good production organisation. Monitoring production targets regularly can help identify any variation in performance. Having correct batching of materials will help reduce wastage. Giving workers clear roles and having good production organisation can help avoid any disruptions. These opportunities align with lean principles as they encourage efficient resource usage and reduce wastage (Bajjou and Chafi, 2019; Dauda et al., 2024). However, it is important to understand the current level of productivity and efficiency within small-Scale Paving stone manufacturers to recommend suitable improvement strategies.

2.7 Review Of Previous Studies and Gap In Research

Various studies have been conducted looking at productivity, resource usage, and efficiency within construction and manufacturing. Owalla et al. (2022) provided a foundation to understand productivity within manufacturing. This helped identify that multiple indicators should be considered. Atoyebi et al. (2023) and Gana et al. (2020) looked at issues surrounding materials within paving stone production. This highlighted the importance of material choice and usage. Chen and Tiong (2024) looked at capacity usage and production performance within the precast construction industry.

Dauda et al. (2024) looked at lean-related production efficiency. Dara et al. (2024) provided insight into how production organisation affects operation performance. Meilani and Ab Samat (2024) and Ramasu and Kanakana-Katumba (2025) looked at lean manufacturing practices within small-scale manufacturing. These studies provided useful theoretical foundations to understand the importance of production organisation. Although these studies provide useful insights, they highlight different factors. Some focused on material usage, some on equipment capacity and some on lean manufacturing. This means they do not provide a holistic view of the selected productivity indicators within the specific context of small-scale prefabricated paving stone manufacturers.

The gap in research was identified by comparing previous studies. These studies were compared based on their research context, what they focused on, what indicators they looked at, and where they were conducted. From reviewing the literature it can be seen that there has been research conducted on productivity, material management, equipment usage, and lean production. However, there is not enough information to determine the overall level of productivity and efficiency within small-scale prefabricated manufacturers in Lagos State. There is not much empirical evidence to show how production targets, material usage, equipment usage, production organisation, and labour efficiency are being achieved within this category of manufacturers. This gap exists as most of the research focuses on a larger context such as construction, manufacturing, or lean production. It also exists because there has not been enough information gathered on the selected indicators of productivity and efficiency.

This study will address this gap by looking at the current level of productivity and efficiency within small-scale prefabricated paving Stone Production In Lagos State, Nigeria. Unlike other studies that focused on one particular factor or lean techniques, this study will provide a baseline to understand how much production is currently being achieved. This will help to understand the conditions of production within small-Scale Paving stone manufacturing and provide an empirical foundation to identify areas for improvement.

3. METHODOLOGY

This study used a quantitative descriptive survey to identify the current level of productivity and efficiency within the small-scale manufacture of precast paving stones in Lagos State Nigeria. This method was appropriate due to the systematic collection of information and the lack of manipulation to the production process. The study was conducted in Lagos State Nigeria with small-scale paving stone manufacturers. The target population was the owners/managers, production supervisors, machine operators, production staff, and quality control staff of the companies. 100 valid responses were analysed. The data were collected using targeted and convenience sampling techniques to obtain individuals who had the relevant experience. Targeted sampling ensured that individuals had knowledge about the production process whilst the convenience sampling provided individuals who were available and willing.

The data were obtained via a systematic questionnaire. The questions were created based on the purpose of the research and relevant literature. There were 12 statements about how efficient the production process was. This was relevant to the research purpose. The data were analysed using descriptive statistics. This entailed calculating the mean score and ranking. The mean score was calculated for the 12 statements; they were then ranked in descending order. Statements with the same mean score received the same rank. The higher the mean score the more positively the individual perceived the statement. Conversely, the lower the mean score the less positively they perceived the statement.

It was assumed that individuals gave an accurate assessment of their production based on their experience. It was also assumed that the answers given could be treated as roughly evenly distributed. The results should be seen as an indication of how individuals perceive their production. However, due to the non-probability sampling technique used, the results may not be representative of all small-scale paving stone manufacturers in Lagos State. The methodology could be improved in future research by using probability sampling techniques, piloting the questionnaire, and measuring production. This would provide a comparison of how individuals perceived their production against actual production data.

4. RESULTS AND DISCUSSION

4.1 Solution: Lean Production Principles

Definition and Background

Lean production is an improvement method that focuses on reducing waste to increase value. It was developed using the Toyota Production System, which focused on efficient production planning, workflow processes, reducing waste, and maintaining quality in production. By eliminating non-value-added activities, lean production can help increase efficiency in production. Lean production can be applied to improve the efficiency of material handling, production planning, and efficient equipment and labour use in manufacturing construction materials (Bajjou and Chafi, 2019).

Effectiveness of Solution

Using lean production principles can greatly improve productivity in small-scale paving stone manufacturing. Efficient production planning and standardised methods will reduce delays. Correct batching and handling techniques will reduce loss of material. Regular maintenance of equipment will reduce breakdowns and correct coordination of workers will reduce waiting times. This will increase overall production outputs, reduce costs, and produce more consistent quality (Dauda et al., 2024). (Meilani and Ab Samat, 2024)

Case Studies

There have been previous case studies into the potential of lean production to improve manufacturing and construction. A study by Meilani and Ab Samat (2024) looked at implementing lean production in small and medium-sized enterprises. This shows the relevance of lean production in small manufacturing companies. Another case study by Ramasu and Kanakana-Katumba (2025) looked at implementing lean manufacturing in a small manufacturing company. Both studies show evidence of how lean production can be used to improve operations in manufacturing companies.

Challenges of Implementing Lean Production Principles

Despite its potential benefits, implementing lean production principles in small-scale manufacturing may involve several challenges.

Social Challenges

Social challenges include workers' resistance to changes in established production practices, inadequate technical knowledge, limited training opportunities, and difficulties in adapting to new working procedures. These factors may affect workers' willingness and ability to adopt lean production practices effectively.

Economic Challenges

Economic challenges involve the initial costs associated with equipment maintenance, worker training, production monitoring, and investments in improved production facilities. Such financial requirements may restrict implementation, particularly among small-scale manufacturers operating with limited capital and financial resources.

Environmental Challenges

Environmental challenges include the management of cement and aggregate waste, dust generation during material handling and mixing, water consumption, and the disposal of rejected paving stones. Inefficient production processes may increase resource consumption and contribute to environmental pollution. Consequently, effective waste management and responsible resource utilisation are important considerations when implementing lean production principles. Addressing these challenges requires gradual implementation of improvement measures that reflect the operational and financial capacities of individual manufacturers. Practical interventions such as improved production planning, worker training, proper material handling, preventive equipment maintenance, and regular monitoring of production activities can provide an achievable starting point for adopting lean production principles in small-scale paving-stone manufacturing.

4.2. Current Level of Productivity and Operational Efficiency

The results presented in Table 1 showed differences in respondents 'assessments of the twelve indicators of productivity and operational efficiency. The mean scores ranged from 3.01 to 3.91, suggesting that some production activities were perceived to perform more favourably than others. The indicators were therefore examined individually and in related groups to identify the strongest and weakest aspects of the existing production process.

Table 1: Mean Scores and Rankings of Productivity and Operational Efficiency Indicators

S/N	Statement	Mean	Ranking
1	The paving stone production process operates efficiently.	3.01	12th
2	Production targets are consistently achieved.	3.91	1st
3	Available production equipment is effectively utilised.	3.19	9th
4	Raw materials are efficiently utilised during production.	3.91	1st
5	Workers perform their production tasks efficiently.	3.19	9th
6	Production downtime is kept to a minimum.	3.43	5th
7	Workstations are properly organised to support efficient production.	3.25	8th
8	Production activities are properly coordinated.	3.49	4th
9	Production schedules are generally achieved as planned.	3.34	7th
10	The current production system makes effective use of available resources.	3.43	5th
11	The required quantity of paving stones is produced within the expected production period.	3.67	3rd
12	Overall production efficiency is satisfactory.	3.13	11th

Source: Field Survey, 2026.

Consistent achievement of production targets and efficient utilisation of raw materials were jointly ranked first, each recording a mean score of 3.91. This suggested that respondents generally viewed output achievement and material handling as comparatively strong aspects of paving-stone production. However, meeting targets did not necessarily indicate that all operations were efficient, since production goals could also be achieved through additional labour, longer working hours or other resource inputs. The ability to produce the required quantity of paving stones within the expected production period ranked third, with a mean of 3.67. This finding indicated a relatively favourable perception of output delivery within planned timeframes. It complemented the high rating for production-target achievement, although the survey did not directly measure production cycle times or the number of paving stones produced per labour-hour.

Coordination of production activities ranked fourth, with a mean score of 3.49. This result suggested that the organisation of successive production tasks was moderately effective. Coordination remains important in prefabricated production because delays between batching, moulding, curing, and handling can affect the continuity of work. The finding was consistent with the emphasis on orderly workflow in the lean production literature (Bajjou and Chafi, 2019; Dauda et al., 2024).Minimisation of production downtime and effective use of available resources were jointly ranked fifth, each with a mean score of 3.43. These ratings suggested that respondents recognised some degree of operational control but did not perceive downtime management or resource utilisation as particularly strong. Unplanned equipment stoppages, material shortages and interruptions between activities may constrain productivity; however, the questionnaire findings did not establish the frequency or causes of such interruptions.

Achievement of production schedules recorded a mean of 3.34 and ranked seventh, while workstation organisation ranked eighth with a mean of 3.25. These results pointed to opportunities for improving production planning and the physical arrangement of work areas. Better sequencing of tasks and clearer placement of materials and tools could help reduce avoidable movement and waiting, as discussed in studies of lean manufacturing and process improvement (Balaji et al., 2023; Meilani and Ab Samat, 2024). Effective equipment utilisation and worker efficiency were jointly ranked ninth, each with a mean score of 3.19. Their comparatively lower ratings suggested that the performance of machines and labour warranted closer managerial attention. This pattern was relevant to Chen and Tiong (2024), who discussed capacity-utilisation challenges in precast production, and to Ramasu and Kanakana-Katumba (2025), who examined productivity improvement in small manufacturing enterprises. Nevertheless, the present findings reflected respondents ’perceptions rather than measured machine utilisation or individual labour productivity.

Overall production efficiency was rated at 3.13 and ranked eleventh, while the general statement that the paving-stone production process operated efficiently ranked twelfth, with the lowest mean of 3.01. These two assessments contrasted with the stronger ratings for production targets and material use. The contrast suggested that respondents distinguished the ability to deliver output from the broader efficiency of the process used to achieve it. Overall, the findings indicated that small-scale paving-stone manufacturers in Lagos State were perceived to perform relatively better in meeting output targets and using raw materials than in equipment utilisation, labour efficiency and general process performance. The results supported the need for routine monitoring of production output, downtime, labour input, and machine use. Since the analysis was descriptive and based on questionnaire responses, it did not demonstrate causal relationships or quantify actual productivity improvements.

5. CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion

The study assessed the existing level of productivity and operational efficiency in small-scale prefabricated paving-stone production in Lagos State using responses from 100 production personnel. Achievement of production targets and efficient raw-material utilisation recorded the highest mean scores (3.91 each). The findings indicated areas of operational strength, while other indicators suggested opportunities to improve the consistency of equipment use, labour coordination and production scheduling. The results suggested that output performance depended on the combined management of materials, equipment, and labour and production activities. The findings were consistent with the emphasis on process visibility and resource efficiency in Lean literature. However, the descriptive survey captured respondents 'assessments and did not establish measured before-and-after improvements or causal effects.

5.2 Recommendations

1. Production managers should maintain daily records of the number of paving stones produced, accepted, and rejected, alongside the labour hours and materials used, to establish a consistent productivity baseline.
2. Manufacturers should establish clear weekly production targets and compare actual output with planned output to identify recurring shortfalls and improve scheduling reliability.
3. Owners should monitor equipment availability, breakdown frequency and idle time, and introduce basic preventive-maintenance routines to improve machine utilisation.
4. Supervisors should standardise raw-material batching, mould preparation and curing checks to support consistent production quality and minimise avoidable variation.

REFERENCES

Alumbugu, P. O., Shakantu, W. M., Tsado, A. J., & Ola-awo, W. A. (2022). Efficient utilisation of automation in construction materials-handling processes. Acta Structilia, 29(2), 33–57. https://doi.org/10.18820/24150487/as29i2.2

Atoyebi, O. D., Odeyemi, S. O., Chiadighikaobi, P. C., Gana, A. J., & Onyia, S. C. (2023). Mix ratio design assessment of interlocking paving stone using both destructive and non-destructive methods. Research on Engineering Structures and Materials, 9(1), 229–242. https://doi.org/10.17515/resm2022.430st0420

Bajjou, M. S., & Chafi, A. (2019). Identifying and managing critical waste factors for lean construction projects. Engineering Management Journal, 32(1), 2–13. https://doi.org/10.1080/10429247.2019.1656479

Bajjou, M. S., & Chafi, A. (2019). Improving construction productivity by integrating the lean concept and the Clancey heuristic model. Sustainability, 11(17), 4535.

Bajjou, M. S., & Chafi, A. (2021). Lean construction and simulation for performance improvement: A case study of reinforcement process. International Journal of Productivity and Performance Management, 70(2), 459–487. https://doi.org/10.1108/IJPPM-06-2019-0309

Balaji, V., Venkumar, P., Sabitha, M. S., & Amuthaguka, D. (2023). Towards smart sustainable development through Value Stream Mapping: A systematic literature review. Heliyon, 9, e15852. https://doi.org/10.1016/j.heliyon.2023.e15852

Chen, C., & Tiong, R. (2024). Solutions to address the low-capacity utilization issue in Singapore's precast industry. Information, 15(8), 458. https://doi.org/10.3390/info15080458

Dauda, J., 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.

Dara, H. M., Raut, A., Adamu, M., Ibrahim, Y. E., & Ingle, P. V. (2024). Reducing non-value-added activities through lean tools for the precast industry. Heliyon, 10(7), e29148. https://doi.org/10.1016/j.heliyon.2024.e29148

Gana, A. J., Amodu, M., Orogbade, B., & Ashinetiang, U. J. (2020). Strength evaluation of different cement brands in the production of interlocking paving stones. IOP Conference Series: Earth and Environmental Science, 445, 012035. https://doi.org/10.1088/1755-1315/445/1/012035

Garcés, G., & Peña, C. (2023). A review on Lean Construction for construction project management. Revista Ingeniería de Construcción, 38(1), 43–60.

Inuwa, M. (2024b). Laying the foundation for Lean manufacturing implementation within small and medium-sized enterprises in Nigeria: An analysis of change readiness. International Journal of Economics and Business Management, 10(1), 88–116. https://doi.org/10.56201/ijebm.v10.no1.2024.pg88.116

Meilani, D., & Ab Samat, H. (2024). Lean implementation in Indonesian small and medium enterprises: A systematic literature review. Jurnal Optimasi Sistem Industri, 23(1), 29–45. https://doi.org/10.25077/josi.v23.n1.p29-45.2024

Owalla, B., Gherhes, C., Vorley, T., & Brooks, C. (2022). Mapping SME productivity research: A systematic review of empirical evidence and future research agenda. Small Business Economics, 58(3), 1285–1307. https://doi.org/10.1007/s11187-021-00450-3

Ramasu, T. K., & Kanakana-Katumba, M. G. (2025). Implementation of a lean manufacturing approach to improving productivity in SMEs: A case study in a cloth manufacturing company. The South African Journal of Industrial Engineering, 36(4), 73–87. https://doi.org/10.7166/36-4-3238

Shahbazi, S., Salloum, M., Kurdve, M., & Wiktorsson, M. (2017). Material efficiency measurement: Empirical investigation of manufacturing industry. Procedia Manufacturing, 8, 112–120. https://doi.org/10.1016/j.promfg.2017.02.014