

The Role of Lean Manufacturing in Enhancing Productivity in Nigerian Small and Medium Enterprises (SMEs)

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ABSTRACT

Lean manufacturing (LM) is a strategic approach aimed at reducing waste, optimizing efficiency, and improving productivity in production processes. The successful implementation of LM throughout various industries across the globe fails to translate into adequate adoption by Nigerian SMEs because of financial limitations, inadequate infrastructure, and organizational obstacles. This research explores how Nigerian SMEs can improve their productivity through LM by studying both benefits and implementation difficulties together with adoption approaches. Researchers used a systematic review method to examine peer-reviewed sources and reports and Nigerian case studies from international and domestic perspectives. The research establishes that LMS produces substantial improvements in operational efficiency while offering cost-reduction features and delivering quality product outcomes for SMEs. Its adoption remains restricted because Nigerian SMEs face obstacles stemming from low awareness, resistance to change, financial limitations, and insufficient infrastructure. This paper reviews successful LM implementations in developing economies, which demonstrates functional patterns for Nigerian SME sectors. Research findings indicate Nigerian SMEs need specific government backing and training initiatives plus progressive implementation approaches to receive complete benefits from LM. The study enhances the current knowledge base through its systematic analysis of LMs in Nigerian SME productivity and proposes evidence-based solutions for implementing LMs effectively among small businesses.

Keywords: Lean Manufacturing, Productivity, Nigerian SMEs, Operational Efficiency, Waste Reduction

INTRODUCTION

Lean Manufacturing (LM) provides fabrication organisations with an organised method that minimises wasteful activities and achieves optimal process productivity and effectiveness. LM emerged from the Toyota Production System to become a leading modern industrial management philosophy which prioritises continuous development together with value stream analysis, Just-In-Time (JIT) manufacturing, and total productive maintenance (Dutta, 2024). The fundamental goal of LMs consists of optimising workflow operations and minimising unnecessary expenses alongside quality improvement achieved by removing activities which lack value. Since Toyota first established lean principles in the mid-20th century, they have spread across the global business sector to serve multiple sectors, starting from automotive manufacturing up to healthcare and construction, together with service-based industries (Martins et al., 2021). Businesses conducting operations in resource-deprived environments will benefit tremendously from the combination of adaptation and efficiency which lean management provides.

The Nigerian economy depends mainly on SMEs, which act as fundamental creators of employment, industrial development, and economic expansion. The Nigerian Gross Domestic Product (GDP) receives approximately

50% of its total output, while SMEs employ more than 80% of the workforce (Ojimaajo et al., 2020). The provision of employment possibilities from SMEs helps decrease poverty levels for urban and semi-urban populations. Numerous challenges obstruct the competitive position along with the sustainability of Nigerian SMEs despite their demonstrated potential. The productivity of Nigerian SMEs faces key impediments from restricted funding options, a lack of infrastructure, supply chain limitations, and insufficient technological progress (Mohammed et al., 2019). The severe operational expenses, along with governmental red tape and inadequate policy structure, make it harder for SMEs to expand their business activities. The resolution of these problems requires operational efficiency enhancements through strategic approaches, which LM has proven to be an effective method to boost SME productivity in Nigeria.

The research investigates this topic because Nigerian SMEs require urgent enhancement of their operational efficiency and market competitiveness. Many operational problems facing small businesses find practical solutions through LM, especially among production and manufacturing businesses (Inuwa & Usman, 2022). Nigerian SMEs that implement lean principles can enhance profitability while creating better market competitiveness by eliminating waste and improving resources as well as product quality. LM enables cost reduction and simultaneously creates a continuous improvement atmosphere that promotes customer value creation. Lean practice adoption among Nigerian SMEs remains restricted because of insufficient awareness of funding limitations and employee reluctance toward change (Inuwa & Male, 2024). Knowledge about how LM applies to Nigerian SMEs, coupled with its advantages and implementation challenges, will create better policies for advancing industrial growth.

This review examines the function that LM plays in boosting productivity within Nigerian SMEs. This research investigates the financial advantages of lean adoption, the obstacles preventing its deployment in SME operations, and potential techniques to implement lean principles effectively. The review evaluates the effects of LMs on business performance through research on existing literature and case studies, along with empirical evidence. The analysis explores successful LM implementation practices among other developing economies, which provide Nigeria with essential knowledge for adoption.

This review methodology incorporates the systematic study of scholarly articles, industry reports, and government publications on LM and SME productivity. This review incorporates peer-reviewed publications along with international and Nigerian case studies as well as policy materials obtained from NASME, MAN and other relevant organisations. The research examines articles that describe LM structures alongside adoption obstacles and financial results from implementing lean practices across SMEs. The research includes comparative empirical studies of emerging economies whose economic systems share areas in common with Nigeria to show how lean principles have been implemented with success in similar contexts. The research review merges sources spanning various viewpoints to generate an equitable evaluation of LM potential for Nigerian SMEs.

The research intends to connect missing information about lean production within Nigerian SMEs to generate precise business optimisation solutions for state officials together with business managers and owners. This research establishes through systematic evaluations of LM effects on productivity that SMEs must take a strategic path to adopt lean principles for driving economic success and employment creation as well as global competitiveness enhancement.

Conceptual Framework of LM

LM enables organisations to develop systematic methods that direct process efficiency improvements while decreasing waste in manufacturing workflows. The mid-20th-century foundation of the Toyota Production System (TPS) developed LM as a concept which combines customer value creation with reduced resource usage (Sumi, 2024). The essential principles of LM consist of eradicating secondary activities, streamlining workflows, and developing an enduring commitment to perpetual enhancement. The concept has spread through different sectors of business operations worldwide, including SMEs that face resource limitations and operational inefficiencies (Alkhoraif et al., 2018).

Organisations use the key principles of LM as a fundamental component to guide the implementation of their lean strategies. The fundamental principle of Value Stream Mapping (VSM) helps organisations picture and evaluate the movement of materials together with information through production flow operations. VSM helps businesses detect operational inefficiencies along with bottlenecks, thus enabling them to make steps that genuinely support end products, according to Wang et al. (2019). SMEs benefit from this method because it helps them find and remove wasteful processes at a low cost while needing minimal funds.

The fundamental aspect of LM depends on JIT production techniques to minimise inventory possession and create goods during times of actual necessity. By applying this method, businesses achieve better cash flow alongside operational efficiency enhancements with reduced storage requirements and decreased costs of inventory and materials (Milewski, 2022). The principles of lean are supported by JIT production, which maximises resource use while avoiding overproduction and shortens manufacturing lead times between stages. The successful deployment needs strong supply chain oversight combined with excellent supplier and manufacturer coordination systems.

LM relies on the 5S methodology to organise workplaces through standardised methods. The five-step procedure, which consists of sorting, setting in order, shining, standardising, and sustaining, enables businesses to create an organised, functional work area that enhances safety and boosts efficiency. Through this methodology, SMEs can develop focused production protocols in which errors are minimised and employee work performance improves (Obulam & Rybkowski, 2021). Implementing 5S practice allows businesses to develop workplace order, which enables employees to reach tools and materials more efficiently, resulting in better workflow and reduced operational interruptions.

Through Kaizen, organisations can integrate Japanese for continuous improvement in their processes, leading to more efficient operations while creating innovative solutions. All business employees through Kaizen participate in the search for improvement opportunities to build a shared accountability system for productivity development (De Sousa et al., 2021). The regular optimisation of production processes enables SMEs to handle altering market environments while delivering better products and satisfying customers. Kaizen achieves results through complete support between management representatives and employee team members.

The key component of LM, total Productive Maintenance (TPM), concentrates on achieving optimum equipment efficiency and reliability. Proactive maintenance techniques enable machines to achieve maximum operational capability, thus preventing equipment downtime and manufacturing stoppages. Total Productive Maintenance uses preventive maintenance and operator involvement together with continuously tracked status to stop unwanted equipment breakdowns (Saenagri et al., 2023). The adoption of TPM by SMEs results in reduced operational expenses because it both extends machine life expectancy and reduces operational interruptions.

Production workflow and inventory control function through visual management by utilising the Kanban system as a technique. Companies use visual signalling techniques through cards or electronic boards under the Kanban system to reach accurate inventory amounts while stopping excess production runs. The system allows SMEs to adapt quickly to customer needs without interrupting their product manufacturing process (Yuniar et al., 2023). Work progress becomes easily traceable through Kanban implementation, and this system improves both supplier relations and departmental communication.

LM is superior to traditional manufacturing methods because it focuses on operational effectiveness combined with adaptability. Operations that use conventional manufacturing systems manufacture bulk goods because they believe demand levels will match production volumes. When manufacturers adopt this method, the benefits in terms of efficiency, storage costs, and obsolescence risk decrease (Shi & Liu, 2020). When traditional manufacturing approaches work independently between departments, diverse inefficiencies are produced, along with delayed product delivery. LM approaches production through customer-driven methods, ensuring that resource distribution happens according to market demand fluctuation. This strategy minimises waste and optimises resources, enhancing organisational operational speed. SMEs that adopt lean principles become more efficient and deliver swift reactions to market changes, leading to better competitive advantage (Koloszar, 2018).

Under LM principles, the workplace develops into a process where workers spearhead the ongoing optimisation of operational procedures and generate new ideas. This customer-driven approach can make SME owners and managers feel more customer-centric and market-responsive.

Business productivity in SMEs rises substantially when LM principles are implemented. This is because lean principles optimise operations through streamlined functions and waste reduction. The primary waste elimination strategy of lean focuses on eliminating non-productive processes, including both overproduction and non-trivial waiting durations, unneeded transport, and defective outputs (Aka et al., 2019). Businesses that identify wasted resources during operations can redirect these assets to achieve better results with reduced costs. This emphasis on waste reduction can reassure SME owners and managers about the cost savings and resource optimisation that LMs can bring. Efficiency-based productivity boosts arise from LM through its improved workflow patterns. JIT and Kanban methods are two key strategies in LM. JIT ensures that materials and products move through the production line without delays, while Kanban reduces congestion points. The controlled method produces shorter delivery times, which allows SMEs to serve clients better and build operational adaptability.

The essence of LMSs lies in their dedication to staff participation and the development of their practical skills. The lean approach strengthens employee accountability through workplace inclusion, enabling staff to both solve problems and improve processes. The organisation empowers staff to submit proposals, join company decisions, and take actions for operational improvement (Hąbek et al., 2023). This empowerment creates a workforce that is more driven to work, leading to decreased employee departures and superior productivity results. This sense of empowerment can inspire SME owners and managers to implement lean principles in their operations. The implementation of LM creates better quality guidelines that minimise damaged products while guaranteeing product reliability throughout its entire lifecycle. The combination of standardised operations with continuous monitoring and root cause analysis enables businesses to deliver high-quality products by reducing existing waste streams (Bubber et al., 2022). The dedication to quality delivers stronger customer satisfaction that builds up respective brand reputations within competitive business markets.

More profit margin results from adopting lean principles because these principles create cost savings through waste elimination and better inventory control and resource optimisation. Due to their restricted financial resources, small businesses find lean methodology to be an economical method they can deploy to enhance productivity. Small enterprises can build operational excellence together with long-term sustainability through implementing lean systems. LM provides Nigerian SMEs with a powerful means to advance productivity through waste elimination process refinement and sustained improvement programs. Specific concepts inside lean include value stream mapping and JIT together with 5S and Kaizen, and TPM, as well as Kanban that create an organised approach to retrieve operational efficiency and competitive advantages. The principles of LM deliver flexibility, customer-oriented production, and employee empowerment, which provide valuable tools for SMEs to enhance operational success. Nigerian SMEs that adopt LM methods will face operational obstacles more easily while boosting their marketplace success and supporting sustainable economic expansion.

The State of LM Adoption in Nigerian SMEs

The economic expansion of Nigeria heavily depends on SMEs, which create job opportunities while generating industrial output for national development. The manufacturing sector of this category struggles with multiple obstacles that damage operational efficiency and effectiveness, as well as local and international market competitiveness. LM functions as a systematic method to reduce production waste while maximising productivity, which experts identify as beneficial for addressing current inefficiencies. The implementation of LM as a solution within Nigerian SMEs encounters limited adoption because of various elements, such as existing manufacturing structures and barriers to widespread adoption and the extent of lean implementation (Okolocha & Anugwu, 2022).

The production approaches of Nigerian SMEs in manufacturing rely on traditional manual work and use limited technology integration along with labour-intensive operations. The outdated machinery, along with inconsistent

supply chains and ineffective inventory management systems, result in excessive production waste along with poor resource use among many SMEs (Ogah et al., 2022). The informal operational models in many businesses create difficulties for efficiency because they use experience-driven decision-making instead of data-based approaches. Fruitful quality control systems remain insufficient, which results in increased product defects and unhappy customers. The implementation of process improvement by certain companies remains insufficient since most organisations struggle with organisational workflow issues, unnecessary stockpiling and deficient work resource optimisation. However, LM offers solutions to these problems (Keke et al., 2023).

Although implementing LM principles in Nigerian industries is slow, some sectors are now integrating these approaches into their production systems. Companies that undertake local vehicle manufacturing and assembling within the automotive assembly industry have started implementing LM methods successfully. The manufacturing facility of Innoson Vehicle implements lean principles to increase assembly line effectiveness as well as decrease production flaws (Orji & U-Dominic, 2022). Several agro-processing firms within the food processing industry show interest in LM through their implementation of JIT inventory management and continuous process improvement, which enhances production and minimises waste. Pharmaceutical sectors working with lean methodologies now use these approaches to optimise production timelines while reducing manufacturing batch problems and maintaining regulatory standards.

The specific instances demonstrate lean adoption methods, while broader case research reveals that organisations have implemented lean principles in diversified approaches. Business strategies that implement lean tools are implemented in individual processes rather than being used as whole-business holistic strategies by numerous organisations. Some large packaging companies that use 5S workspace organisation principles in their FMCG activities do not link their lean culture with procurement operations and distribution methods. Several furniture manufacturers have implemented kaizen-based production efficiency methods, yet they have failed to achieve full value stream mapping integration throughout their supply networks (Chen et al., 2008). Limited inclusion of lean principles demonstrates that local owners understand the concepts, but there remains no organised national system for lean adoption within Nigerian SMEs. The adoption rate of LM remains slow within Nigeria because of various difficulties that managers face. The main obstacle stands in the insufficient knowledge and training on lean principles possessed by SME owners and their management staff. Nigerian business operators demonstrate limited understanding of lean methodologies and their capabilities to enhance enterprise performance. SMEs located in Nigeria struggle to adopt LM because they lack awareness about lean principles and how these concepts better production methods. The lack of appropriate knowledge about lean methodologies extends from business owners and managers down to their workforce because employees lack both the training and expertise needed to implement lean strategies successfully. The absence of formal training programs, together with institutional backing, keeps lean adoption rates at a low level.

Lean implementation faces a significant obstacle because of the opposition companies express toward change. Operating SMEs in Nigeria usually choose to preserve traditional business methods because they consider process modifications as disruptive instead of beneficial to their operations. Most workers and business owners encounter substantial difficulties when trying to accept the cultural changes needed to implement lean techniques. SMEs repeatedly resist changing their well-established practices; therefore, they perform hasty implementations by adopting lean tools while neglecting core improvements focused on waste elimination (John, 2024). Workers commonly resist lean implementation because they falsely believe it could result in staff reduction, mainly in industries that depend significantly on human workers. Financial limitations reduce the potential of SMEs to implement LM practices. SME businesses face challenges in adopting lean principles because they must allocate funds to acquire new technology, restructure their processes, and train their staff. However, they lack sufficient budgetary capacity to do so. Small businesses encounter difficulties justifying lean transformation expenses because they have constrained budgetary resources from both credit facilities and government industrial support programs (Liu et al., 2023). SME businesses maintain narrow financial resources, which forces them to choose daily survival until they can maintain their current resources despite potential future production changes. Lean adoption becomes difficult to sustain for interested businesses because specialised financial support structures for lean implementation are not currently available.

The limited infrastructure adds to supply chain problems that create significant obstacles to lean adoption by Nigerian SMEs. The manufacturing sector in Nigeria encounters ongoing difficulties with its infrastructure system because the power supply remains unreliable, transportation networks function poorly, and raw material sources are inconsistent. The supply chain efficiency plays a crucial role in LM because JIT production requires it to reduce inventory costs. Organisations should avoid JIT implementations when their supply chains face regular delays and disruptions in their delivery times. Uncertain delays in acquiring raw material supply force small and medium-sized enterprises to maintain extra inventory holdings, thus working against their waste reduction efforts (Choi et al., 2023). The poor state of roads and port congestion create implementation barriers that hinder the success of lean implementation.

Nigerian SMEs resist the implementation of LM principles because of cultural barriers that create challenges to their adoption process. Lean principles endorse collaboration, efficiency, and continual improvement, but numerous businesses operate with hierarchical structures that hold central decision-making authority in their core operations. The inability of Nigerian SME employees to participate in process enhancement initiatives through kaizen practices and other collaborative approaches makes lean methods less effective for their organisations. Companies in Nigeria prioritise short-term revenue growth over process streamlining since delays in profit generation discourage businesses from treating lean management as a vital investment (Egbuta, 2022).

LM holds promise to enhance Nigerian SME productivity through the elimination of its present barriers. When businesses receive lean principle education while having access to financial funding and better facilities, they can implement lean practices throughout their operations (Bagshaw, 2018). By encouraging persistent process development and motivating employees to lead their efficient work activities, LM practices demonstrate better sustainability for the manufacturing industry.

LM achieves worldwide results that boost productivity and efficiency, but Nigerian SMEs have only recently started implementing these practices. The majority of manufacturing processes today depend on conventional methods, as only the automotive assembly industry and food processing and pharmaceutical production sectors have achieved substantial LM implementation. For lean adoption to succeed industry-wide, individuals must overcome multiple obstacles which stem from inadequate awareness paired with financial difficulties and resistance to change, as well as insufficient infrastructure and cultural resistance. The Nigerian SME sector will achieve industrial expansion coupled with enhanced global competitiveness by establishing targeted initiatives to educate on lean principles and offer financing support while improving infrastructure systems.

Benefits of LM for Nigerian SMEs

The implementation of LM provides various benefits for Nigerian SMEs. LM solutions help resolve problems that SMEs encounter through operational inefficiency, high costs, poor product consistency, workforce underutilisation, and environmental issues. The application of lean principles produces better production efficiency and reduces costs, leading to environmental sustainability in manufacturing.

The primary benefit of an LM for Nigerian SMEs consists of better operational efficiency. Businesses should implement lean principles to locate unproductive operations within production systems and remove them to achieve higher quality service. Through the use of JIT production and TPM principles, Nigerian firms maximise material efficiency and minimise production waste to reduce their accumulated inventory and production levels (Amos et al., 2020). All products reaching the market will have better quality because defects, rework, and material waste will be considerably reduced. Production velocity increases through Lean methodologies by streamlining workflows as they establish better inter-operation connections within manufacturing stages. The identification of bottlenecks within manufacturing processes becomes possible through value stream mapping and Kanban systems, which allow business organisations to find solutions that speed up production cycles. By implementing lean methodologies, Nigerian SMEs can deliver orders at a faster pace and meet customer needs more quickly, all while doubling their production volume at minimal new investment costs.

The application of LM practices enables Nigerian SMEs to reduce costs, which results in better profitability and extended business sustainability. The primary way LM creates cost-effectiveness involves reducing material expenses and inventory control costs. Manufacturing procedures of the past frequently resulted in a practice of stockpiling raw materials and finished products, which consumes substantial capital through excess inventory. SMEs practising LM need to implement pull-based production systems that keep inventory at appropriate levels, matching customer demand, thus cutting storage expenses while stopping the waste of unused materials (Palange & Dhattrak, 2021). Through its application, SMEs can achieve efficient resource utilisation by minimising production downtime and maintaining optimal machine activity levels and labour productivity. SMEs reduce expenses significantly by avoiding unfounded movements and optimising layouts together with practical automation deployment to maintain production stability.

The quality enhancement process holds essential value for Nigerian SMEs, which operate under product standard requirements. Through LM, quality control measures are integrated across all production stages to achieve better product uniformity. Through Six Sigma and Kaizen methodologies, Nigerian businesses detect product defects early while performing rapid corrective actions. Through preventive actions, the company maintains minimal customer complaints and product recalls, which protect its reputation while enhancing brand worth (Marodin et al., 2018). Mainly due to better product quality, customers become more satisfied and show higher loyalty. Nigerian small-to-medium enterprises improve their market position through LM since their products exceed industry standards, thus appealing to consumers who are focused on product durability and reliability. Strong delivery of high-quality goods creates trusted relations with customers, which allows SMEs to build international markets and establish long-term business partnerships.

The success of LM primarily depends on how well employees work together productively. Organizations that use LM systems provide employees with decision-making power and productivity enhancement opportunities by removing established management structures. Production processes benefit from worker creativity through business-supported problem-solving activities which enable workers to solve problems at work. The purposeful allocation of worker capabilities creates better work-related effects that boost operational efficiency and reduce time loss from employee absence. The implementation of lean principles constructs an operational structure that enhances staff motivation and improves work satisfaction. Employee cross-training, together with multi-skilling, allows workers to occupy various positions, thus enabling continuous operation independent of specific roles and providing flexibility (Okenabirhie, 2021). The feeling of ownership employees have in company growth through participation motivates them to be more productive while preserving high morale. Organisational value perceived by workers combined with their participation in decision-making leads to higher acceptance of lean initiatives which produces continued operational performance enhancement.

The LM approach enhances environmental sustainability goals and implements worldwide standards related to sustainable production procedures. The main contribution of Lean to sustainability through environmental preservation comes from reducing energy and material waste. The reduction of both carbon emission levels and wasteful energy costs becomes possible when companies minimize their resource waste and optimize their operational consumption. The combination of JIT inventory systems with procedure optimization standards allows organizations to lower their raw materials used by maximizing the utility of production inputs. Environmental degradation remains a significant problem in Nigeria, according to Udemba (2020); therefore, natural resource reduction and industrial pollution controls have become necessary measures. Through the combination of Lean and green manufacturing principles, businesses acquire advanced opportunities to implement environmentally sustainable business methods. The principles that govern environmental conservation maintain direct parallelism with lean philosophy through both waste minimization and operational efficiency establishment. Nigerian SMEs should develop sustainable manufacturing systems by bringing together lean and environmentally friendly practices to achieve economic and environmental improvements. The integration of sustainable operations by businesses helps them satisfy regulatory needs and welcome customers and investors whose priorities include environmental sensitivity, which leads to increased market strength in the modern eco-conscious international economy.

The adoption of LM principles by Nigerian SMEs will transform the manufacturing sector through improved efficiency and cost reduction, better quality outcomes, workforce engagement, and sustainability promotion. The economic and competitive environment of Nigerian SMEs makes LM an effective method for establishing sustainable operational excellence and long-term growth. Through implementation of lean methodologies Nigerian SMEs will become competitive local and international market participants that enhance both industrial development and economic sustainability.

Barriers to LM Implementation in Nigerian SMEs

The adoption of LM within Nigerian SMEs remains challenging because of multiple significant obstacles that have blocked its successful implementation. A variety of obstacles block the implementation of LM in Nigerian SMEs, including insufficient worker understanding and more fundamental limitations that include financial problems and cultural opposition to change, deficient infrastructure, insufficient government backing, and research and development shortfalls. Knowledge regarding these obstacles serves as the foundation for designing effective measures to promote successful lean implementation and attain maximum rewards in Nigeria's manufacturing industry.

Lack of awareness and training stands as the main obstacle for Nigerian SMEs in implementing LM principles. Most business owners together with management teams demonstrate restricted understanding about lean methodology along with its tools and profit potential. Several Nigerian SME operators do not understand LM principles that focus on optimizing efficiency, waste reduction, and continuous improvement (Saka & Chan, 2020). Businesses that lack a proper understanding of lean methodology become unable to detect both the advantages offered by lean implementation and its worth to their operations. Training programs which teach proper lean practice implementation skills are lacking; thus, employees and managers do not acquire sufficient expertise to carry out lean initiatives effectively. The majority of Nigerian SMEs face monetary limitations in their training budgets while lacking access to professional development programs which better multinational corporations can afford. The lack of proficient lean knowledge prevents SMEs from adopting lean approaches; therefore, they must operate with outdated or inefficient manufacturing systems.

The financial limitations of Nigerian SMEs increase the barriers to implementing LM methods. SMEs must spend money on new tool acquisitions and project modifications as well as staff skill development when they introduce LM procedures. Nigerian SMEs face financial setbacks which limit their ability to obtain budgetary resources for lean transformation due to the scarcity of affordable funding solutions. Sustaining high initial expenditures on JIT systems together with TPM and automation tools creates substantial difficulty for organizations wanting to implement these lean tools. The continued financial investment needed for lean implementation makes SMEs with limited profit margins view process monitoring systems together with employee training and process enhancement as financially challenging (Onwuzulike et al., 2024). Small business owners exhibit fear regarding the immediate benefits of LM investments because of their risk-averse mindset. SMEs' reluctance to think beyond their financial performance of the present quarter makes them unable to make choices that could build productivity and profitability in the long term.

The process of implementing LM faces significant difficulties because of organizational resistance to change along with cultural barriers. Most Nigerian SMEs function in a business environment that promotes hierarchical authority and does not welcome change through new methods or flexible work systems. Workers who practised traditional manufacturing before could doubt that lean practices serve any valuable purpose. Workers show resistance to these principles because they worry about employment termination following LM efforts that focus on process optimization. The perception of lean as a danger to job stability causes workers to avoid implementing continuous improvement and flexibility (Enoch, 2013). Small businesses that have avoided structured process management for multiple years struggle to adopt lean methodologies because they need constant observation, performance evaluation, and modification. An established organizational culture that values innovation and change acts as a barrier to lean implementation because leaders need full support for successful execution; when managers fail to engage staff properly and maintain their dedication, lean principle implementation struggles to succeed in operational transformation because workers resist change, which leads to project cancellation.

The widespread infrastructural problems and complicated supply chains throughout Nigeria create more difficulties for organizations in implementing LM principles. To adopt JIT production, the supply chain needs reliable components and efficient distribution networks with quick raw material delivery. The limited quality of transportation infrastructure together with unreliable power distribution and limited storage capabilities prevents smooth material movement throughout Nigeria. Procurement issues for SMEs stem from patchy roads combined with congested ports along with complex customs procedures at ports. Logistical inefficiencies prevent the elimination of inventory wastes while maintaining uninterrupted production, according to Nurudeen et al. (2024). Local suppliers who fail to use lean management methods create supply chain problems through unstable material quality, unanticipated delivery delays, and missing deliveries. Foreign raw material dependence, together with currency rate changes, create additional difficulties for SMEs in supply chain management. The application of LM faces difficulties in these circumstances because operations fail to match the lean requirements.

LM experiences operational challenges because the current government lacks supporting policies and incentives needed to promote its adoption. Governments of developed nations must create policies containing financial backing to enhance business lean knowledge while simultaneously training employees for lean practices and boosting investments in such practices. The Nigerian government does not offer any structured programs to assist SMEs in their lean transformation process. The government has not implemented supportive policies which provide tax credits or financing options with low-cost rates for operational improvement initiatives. According to Pulka et al. (2021) most government agencies together with industrial associations maintain support for SME development through generic financial help instead of purpose-specific operational excellence programs like LM. Nigerian SMEs require government-funded lean training facilities, certification programs, and consultancy support to acquire proper lean expertise, but these services do not exist presently. A deficiency in government support, together with institutional weaknesses, prevents the widespread adoption of LM practices in Nigeria's SME sector.

The shortage of research and development spending stands as the final main obstacle preventing Nigerian SMEs from implementing lean initiatives. Sustainable development under LM depends on organizations that aim to improve their data-driven choices while developing new operational systems. Nigerian SMEs face difficulties in performing effective research and development (R&D) work for implementing customized lean strategies because they lack the required resources and facilities (Kolawole et al., 2021). The weak standing of research in Nigeria impedes knowledge sharing by negatively affecting academic-industry relationships, which slows innovation of lean system applications. Limited interactions between Nigerian SMEs and academic researchers and technology incubators prevent them from obtaining appropriate lean solutions managed by either academic institutions or research organizations. Local LM success stories prove ineffective in encouraging SMEs to begin lean transformations since those firms lack practical organizational success examples from their own country. Academic institutions along with industrial businesses and state institutions need to create partnerships through research and development operations to decrease information gaps that will enhance lean implementation conditions.

Various obstacles stand in the way of implementing LM systems within Nigerian SMEs due to absent knowledge about lean approaches, financial restrictions, cultural resistance against change, inadequate infrastructure, inadequate policies, and lack of innovation in research. The implementation of LM in Nigerian SMEs demands a comprehensive solution that includes enhanced training initiatives and financial support together with continuous improvement initiatives and supply chain optimization, government policy backing, and research-based innovation development. Through effective solutions for these challenges Nigerian SMEs will be able to maximize LM benefits which will in turn produce higher productivity with lower costs and superior global market competitiveness.

Strategies for Effective Implementation of LM in Nigerian SMEs

Nigerian SMEs need a unique method to implement LM which addresses their special business situations. The adoption of lean practices enables significant productivity enhancements and efficiency while improving core

business competitiveness. For successful LM integration within Nigerian SMEs, the government and industry stakeholders must work together with business organizations (Okolocha & Anugwu, 2022). The adoption of lean principles becomes more streamlined by implementing four key strategies which combine support from government policies along with employee training programs and technological implementation under leadership that upholds a positive organizational culture.

The government's support of Nigerian SMEs through policy implementation and incentive programs stands as the vital factor that enables LM success. Schemes funded by governments help SMEs afford the implementation expenses of LM methods. The lack of available funds among SMEs creates obstacles to their investment in lean training programs and new equipment, together with process optimization solutions. The government should establish grant programs and low-interest financing and tax benefits for SMEs who want to implement lean methodologies. Financial support alongside infrastructure development serves as essential factors for creating an environment suitable for lean adoption (Agbim, 2020). A manufacturing facility needs dependable power sources together with efficient transportation systems and industrial zone access to function at maximum efficiency. The benefits of LM diminish when proper infrastructure does not exist because business operations encounter too many logistical and operational risks. National programs that establish industrial clusters and technology parks enable SMEs to access shared resources, thus decreasing manufacturing expenses and building collaborative operations.

Nigerian SMEs should focus on staff education and facility development as essential methods to establish LM practices. The implementation of lean methods faces major obstacles because business owners along with their workers have insufficient knowledge regarding this approach. The gap between university learning environments and industry needs can be closed through agreements between technical institutes, universities, and SMEs in joint ventures. Academic institutions should provide specialized courses together with workshops as well as research collaborations which enable SMEs to receive training for lean implementation (Queiroz et al., 2022). Employees gain better grasp of lean principles through structured learning programs which guide them toward implementing lean methods in actual business scenarios. Three types of entities conduct certification programs: professional organizations, industry associations, and government agencies that establish standardized training methods and best practices for businesses. SMEs will develop lean expertise among their workforce when they implement standardized training about lean methodologies.

The adoption of LM requires a systematic plan to implement it with Nigerian SMEs. Nigerian SMEs avoid lean adoption because they believe that their implementation process requires advanced complexity and costs too much at the start. The first step of lean implementation starts with implementing 5S principles among companies for building sustainable and organized working environments through sorting and setting in order, shining, standardizing and sustaining practices. The business can proceed with value stream mapping and JIT production and additional complex lean approaches following the foundation of essential lean fundamentals. Pilot projects provide businesses with an efficient method to introduce gradual organizational changes, according to Rossini et al. (2021). Feedback effectiveness can be established for lean implementation through initial testing of defined production areas. SMEs gain numerous benefits from pilot projects because they learn valuable approaches and solve problems, which generates favourable circumstances for employees to adopt lean principles. The process of implementing lean methodologies across the entire organization is organized through defined sequential implementation phases that enable smooth institutional change.

The successful implementation of lean requires technology integration to be an essential aspect for Nigerian SMEs. Digital lean tools enhance business operations by producing higher efficiency levels and process reduction and by generating superior decision-quality outcomes. Nigerian SMEs can reach maximum production efficiency through enterprise resource planning (ERP) systems, real-time production monitoring, and data analytics platforms, which enable them to manage their key performance indicators effectively. Businesses which adopt these tools acquire essential knowledge about inventory control and workflow optimization together with quality management to reveal new optimization possibilities (Egwuonwu et al., 2024). Infrastructure performance gets improved by adding automation capabilities and Industrial 4.0 solutions to LM systems. Automating recurring operations helps reduce human errors because workers can focus on critical tasks.

Networked organizations, through modern production systems relying on AI and IoT along with smart sensors, make it possible to adjust their setups according to changing consumer demands (Pagliosa et al., 2019). Even though total automation remains inaccessible to certain businesses because of their financial constraints, SMEs should use their affordable digital solution funds to enhance lean implementation advancement.

Business leadership combined with organizational culture creates the foundation to maintain LM performance in Nigerian SME businesses. Organizations need to use proper change management systems to defeat employee reluctance toward lean implementation. Staff members who work with traditional production methods tend to view lean implementation as disruptive. Leaders of businesses should describe lean advantages to workforce colleagues while using employee involvement in decisions and giving continuous assistance across the implementation period (Babalola et al., 2024). Organizations must establish continuous improvement through a fundamental change of organizational perception that promotes staff involvement in problem-solving together with innovation development. Employee involvement represents a fundamental requirement for lean success because workers possess the best understanding of production processes, which allows them to detect operational problems effectively. The practice of employee responsibility building inspires better detection and elimination of waste through proactive involvement. Continuous improvement objectives are consolidated through standard training programs together with feedback systems along with appreciation rewards.

A successful LM implementation in Nigerian SMEs demands multiple steps which merge state backing with staff education and staged rollout of innovative technologies under clear leadership structures. SMEs will achieve full LM benefits by establishing financial support through government policies alongside lean knowledge training for workers while implementing lean steps by step along with digital technology utilization and continuous improvement focus (Kolawole et al., 2021). Nigerian SMEs need proper implementation strategies to handle lean practice conversion which will boost productivity and operational efficiency thus securing their manufacturing market dominance.

Case Studies and Best Practices in LM Adoption in SMEs

Different developing countries achieved success through the implementation of LM, which resulted in enhanced productivity, waste reduction, and better operations efficiency. Many Indian, Brazilian, and South African small and medium-sized enterprises provide vital knowledge about lean implementation techniques to help businesses operate beyond financial constraints, infrastructure challenges, and cultural barriers. A study of these case examples enables Nigerian SMEs to learn how lean practices work in real business situations while tailoring those methods to Nigerian market requirements.

The automotive textile and engineering domains, together with automotive components, represent strategic areas where Indian businesses successfully implement lean management approaches. The LM Competitiveness Scheme (LMCS) enables the Indian government to provide funding to SMEs while conducting lean training courses and arranging expert guidance for lean practice deployment. The Indian automotive component manufacturing sector reaches lean operation success through the integration of JIT and value stream mapping, and Kaizen principles (Dave & Sohani, 2019). Production enhancements became possible because companies implemented LM, which simultaneously reduced operational costs during shorter delivery periods. The implementation of government policy-supported structured, systematic programs in India allowed SMEs to obtain necessary resources along with technical guidance that assisted their journey toward lean implementation.

Brazil applies Lean Management principles to all businesses creating food goods, metalworking organizations, and textile manufacturing facilities. Understanding how lean transformation works can be achieved by assessing a textile factory in São Paulo. The organization deployed 5S methodology and TPM and cellular manufacturing to handle production expenses and material inefficiencies (Tsukada et al., 2024). The company cut production waste by 40% as employees started participating in continuous improvement activities and achieved enhanced inventory control because of these new systems. Brazilian small and medium enterprises achieve success in lean implementation by establishing training programs devoted to employee participation. Training programs at the Brazilian company taught employees lean principles along with permitting self-directed problem identification

for operational solutions development (Tsukada et al., 2024). The success of Brazilian businesses proves the necessity for organizations to create a culture that embraces change and lifelong learning activities so Nigerian SMEs can adopt them as their top priority.

The manufacturing and service industries in South Africa demonstrate successful lean implementation among SMEs. An engineering firm based in Johannesburg managed a successful lean transformation to resolve its problems with inefficient workflow processes while improving its order fulfilment system. The company used Kanban systems for inventory management and standardized work processes to improve production flow, according to Elemure et al. (2023). The company achieved a 30% rise in production efficiency alongside lower manufacturing defects and better customer satisfaction after its first year of operations. The implementation of lean principles in South Africa achieved success because executives were fully committed to changing management practices. SMEs that achieved lean implementation success did so because they received robust leadership backing, which transformed lean practices into permanent organizational norms beyond single-time adjustments.

Indian, Brazilian, and South African manufacturing experiences present beneficial learning opportunities for Nigerian SMEs who want to implement LM. Extensive external support is necessary for all businesses, including the government sector, industrial organizations, and international aid institutions. Indian structured initiatives fulfilled a vital function by eliminating both financial and knowledge obstacles that block SMEs from adopting lean practices. The implementation of supportive programs for SMEs through technical guidance and financing support with lean expertise accessibility would benefit the Nigerian economy.

Employees should have a key role in company operations, and training must be implemented at all levels of organizational development. Brazil achieved its best lean implementation results by letting workers take an active part in the process and fostering their sense of ownership over change improvements. Small—to medium-sized Nigerian businesses should establish organizational structures that combine lean educational programs while encouraging workforce-based improvement detection.

Lean transformation programs require leadership dedication as their primary factor for achieving success. South African SMEs achieved lean practice integration through leadership support, which made lean principles operational norms that went beyond project-focused implementations. Nigerian SMEs need their leaders to actively endorse lean initiatives because owners, along with managers, must lead sustainable improvement efforts during lean adoption.

Successes in implementing LM do not eliminate all the business hurdles faced by Nigerian SMEs in successfully implementing this system. At present, Nigeria lacks an established lean support system supported by the government. The combination of limited electricity distribution and poor financing routes together with poor road systems prevents Nigerian SMEs from implementing Lean Management practices. Nigerian SMEs maintain a change-resistant culture that makes lean practice maintenance difficult, while South African organizations succeed due to strong leadership backing lean implementation. To develop their production performance, Nigerian SMEs need to adopt specific lean strategies that they have learned from other developing countries. The successful transformation of lean principles during implementation occurs first through basic foundational methods such as 5S and Kaizen before moving onto advanced lean strategies in Nigerian businesses when they demonstrate their willingness to advance. Nigerian SMEs need to develop cooperative relationships with local educational institutions as well as private sector organizations and research institutions in order to receive lean implementation training and necessary technical support.

Nigerian SMEs continue to prove that well-suited lean implementation methods lead to improved business outcomes, rational efficiency, and lower expenses despite facing structural and operational obstacles. Competitive markets will support sustainable development for Nigerian SMEs when they create favourable conditions, gain management endorsements and launch employee training initiatives.

Future Research Directions

Ethnographic analysis of Lean Management implementation practices, along with identification of performance results, needs extensive examination in Nigerian SMEs. Little empirical evidence exists about Nigerian SMEs' actual lean practice use as well as its effects on productivity and, operational efficiency and cost reduction performance (Memari et al., 2022). Multiple case assessments, together with historical monitoring projects and industry-wide database collection, provide detailed information about local adaptation of LM requirements and necessary performance enhancements. Research needs to analyze lean adoption results regarding business finances while studying the behavioural changes enabling successful implementation. Future research establishing links between empirical research will generate evidence-based guidance to support the Nigerian manufacturing sector in applying lean principles for business leaders, policymakers, and researchers.

The research domain needs to examine how digitalization transformation will affect Lean Management practices in Nigerian SMEs in the coming years. The modern manufacturing sector transforms the global process due to digital developments, which create innovative production systems by integrating lean principles with digital technology. Supply chain management optimization and workflow optimization alongside improved decision-making processes result from the combination of artificial intelligence with the Internet of Things and cloud computing that utilizes real-time data analytics. Research presently fails to show the extent to which Nigerian SMEs apply digital Lean management techniques. Current research should investigate the digital readiness of Nigerian SMEs, analyze both transformation costs, and describe precisely how digital lean tools benefit constrained resource settings. The evaluation of digital lean solution implementation challenges faced by Nigerian SMEs must cover insufficient technical abilities together with expensive system implementation costs and poor infrastructure (Bagshaw, 2018). Research studies into these knowledge gaps will lead academics to create specific digitalization methods which fit Nigerian SMEs effectively.

Scientific investigations regarding lean adaptation need to prioritize particular industrial production systems. Manufacturers attain varied success in implementing LM since different industries generate separate products that require individual supply chain approaches as well as unique customer needs. The broad implementation of lean principles takes place in automotive manufacturing and electronics. However, there exists limited knowledge about how these approaches would support the Nigerian agro-processing industry, textile industry and pharmaceutical production. Research must examine individual sector challenges to enable the implementation of LM and develop lean strategies applicable to various production settings. Research groups should use comparison methods to examine various manufacturing subsectors to develop specialized lean frameworks that match each production industry framework. The evaluation of suitable lean strategies for individual business conditions stands essential for SMEs so they can avoid deploying universal lean implementations.

The research world must overcome significant obstacles when linking LM principles to sustainable manufacturing practices. Lean and sustainability share common objectives, such as waste reduction, resource efficiency, and continuous improvement. Beyond operational efficiency, sustainability involves environmental and social aspects that mandate energy conservation, pollutant reductions, and fair treatment for workers. Additional research must identify suitable ways for Nigerian SMEs to implement lean along with green production methodologies to achieve improved dual financial and ecological results. Studies on the implementation of lean-sustainable methods encompassing circular business approaches together with eco-friendly manufacturing methods and renewable power solutions will present practical solutions for sustainable business management with economic preservation. Research should examine public policies that enable lean and sustainable production by studying their enforceable guidelines, which define industrial approaches.

New research regarding LM utilization in Nigerian SMEs should examine these areas to promote scholarly and industry practitioner knowledge of lean effects. LM continues advancing within the Nigerian industry by using information-based research to build digital models that drive industry adaptations and sustainable manufacturing solutions.

CONCLUSION

Implementation of LM standards creates potential for Nigerian SMEs to revolutionize their operational efficiency and productivity levels. The investigation of Nigerian SMEs covers LM principles together with its advantages and obstacles for implementing LM in Nigerian SMEs while demonstrating its waste reduction impact on operational efficiency gains and its ability to enhance both product quality and resource management. Several factors have restricted the broader adoption of LM in Nigeria, including poor awareness levels, financial constraints, resistance to change, infrastructure quality, and ineffective supply chains. The solution demands systematic government backing along with educational programs aimed at the industry, as well as gradual implementation approaches and sectoral partnership programs. The main discovery from this study confirms that LM represents both an operational toolkit and a comprehensive cultural transformation which promotes perpetual enhancements and enhanced performance. To implement lean effectively in Nigerian SMEs, there must be strong leadership backing and employee engagement coupled with open methodology from the organizational teams. Other developing economies like India, Brazil, and South Africa prove that appropriate government policies with industry support enable SMEs to adopt lean principles successfully. These countries have taught valuable lessons about financial rewards combined with focused training and institutional research partnerships that create more efficient adoption methods—the implementation of lean-consuming digital transformation as one of its fundamental factors. Lean processes can become more efficient through the implementation of digital tools such as real-time production monitoring, supply chain automation, and artificial intelligence systems. Future research investigating cost-effective digital lean solutions must focus on finding options that match the current business environment challenges of Nigerian SMEs. Research should focus on exploring how LM can be integrated with sustainable business practices to achieve maximum synergies. Nigerian SMEs need to embrace lean principles which respect both environmental sustainability and operation costs during their transition to environmentally conscious global production norms. The combination of green manufacturing practices with lean principles provides SMEs with an avenue to increase productivity and fulfil global sustainability requirements, which might increase their market expansion potential. The success of LM as an improvement method for SME productivity in Nigeria depends on the degree of joint action between business policymakers and industry stakeholders to tackle existing hurdles. Nigerian SMEs can benefit from lean principles when strategic awareness development, financial assistance, and phased deployment models work together effectively for long-term business sustainability. The establishment of continuous improvement and efficiency practices by SMEs will significantly advance Nigeria's economic development and industrial progress.

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