Lean Manufacturing Strategy and Corporate Performance of Selected Pharmaceutical Firms in Southwest Nigeria

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ABSTRACT

This study was conducted to examine the influence of lean manufacturing strategy on the corporate performance of selected pharmaceutical firms in Southwest Nigeria. Before now, the pharmaceutical subsector has been ravaged by challenges of poor inventory management, frequent machine breakdowns that stifled production, and technical know-how that led to waste of resources in the system. Lean manufacturing techniques such as inventory leanness, total productive maintenance, and automation were evaluated to ascertain their effect on the corporate performance of the selected firms. The survey research design was used to carry out this study. The study population was 1,146 employees of four lean-oriented pharmaceutical firms in Southwest Nigeria. Primary data were collected from a sample size of 285 respondents as determined by Krafcik and Morgan's sampling size technique. Data collected were analysed using Multinomial Logistic Regression (MLR). Findings showed the parameter estimates Wald tests of .891, .883, and .987, indicating the effect of inventory leanness on the corporate performance of the selected firms at significant values of .019, .02 and .004. The results also revealed that total productive maintenance influences corporate performance (operational and market performance) at a p-value of .021, and .0001 accordingly. Moreover, the estimated coefficient Wald tests of .933, .893, and 268 showed a strong positive influence of manufacturing automation on corporate performance at a p-value of .007, .018, and .0001 for operational, financial, and market performance, respectively. The results also indicated significant influence of waste elimination on corporate performance at a p-value of .014, .012, and .0001, respectively. Based on the findings, it was concluded that the lean manufacturing strategy has a positive influence on the corporate performance of the selected pharmaceutical firms in Southwest Nigeria. It was recommended, amongst others, that corporate managers should work tirelessly to minimise every form of non-value addition to the production system.

Keywords: Automation, Lean Strategy, Inventory, Manufacturing, Corporate Performance

INTRODUCTION

The modern practices for productivity enhancement began to make waves during the third Industrial Revolution as a blend of productivity-boosting techniques that combined new and modified conventional processes. In the fourth industrial revolution, where manufacturers began to innovate and digitalise operations, there was a need for managers to initiate alternative strategies that would lead to cost reduction and waste minimisation. Lean manufacturing, a Japanese production technique designed to tackle high production costs from a system-wide perspective, became the major alternative strategy in the manufacturing sector. This is similar to the automated assembly lines, which modify the scientific management concept. The lean system is aided by computerised manufacturing machines that are applied by adaptable production methods, including cell-based production layouts and automated technology (Kofana *et al.,* 2021).

Lean manufacturing encourages eradicating bottlenecks and strives for continual enhancement to attain greater levels of effectiveness (Kumar *et al.,* 2022). This manufacturing strategy, derived from the Japanese industry, was created by John Krafcik in 1988 in his thesis, "Triumph of the Lean Production System" at the Sloan School of Management. The study was completed by International Motor Vehicle at the Massachusetts

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Institute of Technology, which created the greatest international-selling book contributed to by Jim Womack and Daniel Jones, named "The Machine that Changes the World" (Womack *et al*., 2013).

Toyota Motor Corporation in Japan created this technology, which was implemented in the US to reduce waste during the 1973 oil embargo. The major goal of Toyotaism, then, was to increase production and decrease costs by emulating Henry Ford's mass manufacturing line and Taylor's classical management system. The introduction of this innovation led to a radical transformation in the way the Japanese manufacturing sector organised operations.

One of the most critical issues this strategy sought to solve was the industry competitiveness in cost, quality, and product offerings (Logu *et al.*, 2021). Lean management strategy is more important as a tool used to reduce production cost, and inventory management, minimise delivery time (lead time), reduce wastage, and enhance quality. Businesses that ignore these parts will not be able to thrive in the current marketplace. Lean is one of the most promising strategies to continuously improve company efficiency by determining the value stream of the organisation and then methodically eliminating waste that exists (SMU, 2022).

The fourth industrial revolution, known as Industry 4.0, with promising lean tools, helped businesses to achieve increased profitability, quality enhancement, reinvigorated innovation, and increased market share**,** among others. Many pharmaceutical industries in developed economies began to review and develop robotic lean systems in the 21st Century. Companies that adopted lean strategies, such as manufacturing automation, inventory leanness, Total Productive Maintenance (TPM), knowledge management, and robotic organisation, gained competitive advantages (Karmal, 2022). And were able to outsmart their rivalries. This expanded lean is viewed as a corporate performance driver, having first dealt with customer centricity (Kanitorn *et al.*, 2021).

According to Lean scholars, sustainable performance outcomes require more than just optimising operational efficiency. Researchers suggested that critical enablers, such as visual stream mapping, quality improvement, expertise participation, among others, that should simplify lean transition and competition based on adaptability, avoiding inventory, and introducing value stream mapping to remove steps within an organization that add no value are necessary (Muhammad and Oduoza, 2019). Working in very small units and eliminating bottlenecks are encouraged by lean production to provide customers with value at a faster rate. Lean management techniques can, therefore, be applied to the pharmaceutical industry to ensure compliance with current Good Manufacturing Practices (cGMP). Also, to improve productivity, lower task expenses, and increase revenue. Due to the current strain on product margins, lean industrial concepts provide a viable structure for cutting costs out of production. The essence of this study was to examine the effect of lean manufacturing strategy on pharmaceutical manufacturing firms in Southwest Nigeria.

Statement of the Problem

In Nigeria, one of the main issues facing many institutions managing public health systems is ensuring the populace has access to necessary medicines of high quality at reasonable costs. Fake medications, Poor infrastructure, brain drain of medical personnel, and insufficient modern production devices have posed the most significant challenges to Nigeria's pharmaceutical business in the past decades**.** Presently, Nigeria is ranked 11th among the 12 countries with the worst health system by Legatum, a London-based firm that specialises in measuring healthcare globally (Legatum, 2024). A few pharmaceutical companies in Nigeria supplied anti-malaria, anti-TB, anti-retroviral, and other necessary medications. The low grade of the industry was caused by a lack of standard equipment for pharmaceutical production and poor storage facilities, bogus inventory management, lack of standardised procedures, and inadequate automated systems to aid quality production. These problems resulted in a vast waste of resources, poor revenue, bogus inventory, and low returns on assets. The advancement of lean strategy that minimises costs of production, reduces waste, reduces lead time, maintains inventory leanness, and improves product quality and profitability was initiated to meet current goods manufacturing practices in the pharmaceutical sector.

Objectives of the Study

The main objective of this study was to examine the effect of lean manufacturing strategy on the pharmaceutical industry's performance. The precise intentions of this research are to:

1. Determine the influence of inventory leanness on the corporate performance of the select pharmaceutical firms in Southwest Nigeria;
2. Examine how Total Productive Maintenance (TPM) influences the corporate performance of the select pharmaceutical firms in Southwest Nigeria;
3. Assess the influence of manufacturing automation on the corporate performance of the select pharmaceutical firms in Southwest Nigeria;
4. Evaluate the influence of waste elimination on the corporate performance of the select pharmaceutical firms in Southwest Nigeria; and
5. Analyse the combined influence of inventory leanness, total productive maintenance (TPM), manufacturing automation, and cost minimisation on the corporate performance of select pharmaceutical firms in Southwest Nigeria

Research Hypotheses

Ho_1: There is no significant influence of inventory leanness on the corporate performance of selected pharmaceutical firms in Southwest, Nigeria.

Ho_2: Total productive maintenance does not significantly influence the corporate performance of selected pharmaceutical firms in Southwest Nigeria.

Ho_3: There is no substantial influence of manufacturing automation on the corporate outcome of selected pharmaceutical firms in Southwest Nigeria.

Ho_4: There is no substantial influence of waste elimination on the corporate performance of select pharmaceutical firms in Southwest Nigeria.

Ho_5: There is no substantial combined influence of the predictors on the corporate outcome of the selected pharmaceutical firms in Southwest Nigeria.

Scope and Limitations of the Study

This study highlighted the impact of lean manufacturing strategy on the corporate performance of selected pharmaceutical firms in Southwest Nigeria. Contextually, this work is domiciled in Production Management (PM). Geographically, this study covered selected pharmaceutical firms in Southwest Nigeria. The zone is made up of Ondo, Osun, Oyo, Ekiti, Ogun, and Lagos State. The selected companies, Fidson Healthcare Plc, May & Baker Plc, Emzor Pharmaceuticals, and Neimeth Pharmaceutical, were chosen because these companies have integrated lean management methods into their production systems. These firms are among the top 100 innovative companies in Nigeria, as quoted in the Nigerian Exchange Group Limited (NGX Factbook, 2022). The content scope of this study covered all the explanatory variables (inventory leanness, waste elimination, total preventive maintenance, manufacturing automation) and the outcome variables (corporate performance proxies).

REVIEW OF RELATED LITERATURE

Lean Manufacturing Notion

Lean manufacturing concepts offer a great basis for cutting business budgets, especially in light of the present pressure on product margins. Lean strategy is one of the well-known alternative strategies for improving business quality by organising a company's manufacturing process in a way that eliminates all waste. In the automotive industry, lean management approaches can reduce project costs, increase productivity, and decrease revenue. Lean system can be described as a set of tools and practices to consistently remove and

discard unproductive substance in the manufacturing process, ensure the production of quality goods and accessibility of quality services, and boost worker productivity (Landau, 2024 and Fullerton *et al.,* 2014) in Riffken (2024). Lean manufacturing is an all-inclusive production philosophy in which every employee in an organisation consistently increases outputs (Yadav and Lenka 2020). Lean industrial strategy is a unified coordinated approach made up of many different management techniques, such as work groups, Just-in-Time (JIT), quality management, and cellular trade, as well as highly interconnected elements (Sinha and Matharu, 2019).

Most people see lean as a collection of instruments that help find trash and gradually remove it (muda). Based on the Toyota Manufacturing Scheme, lean manufacturing is a philosophy that reduces the amount of time that passes when a client's request for a particular product and when the completed product is delivered (Logu *et al.,* 2021). In essence, Womack and his associates coined the term "lean" to describe the approach that requires fewer inputs to make desired outputs that are comparable to those of the conventional systems of mass production, all the while providing the customer with more options. Lean production is a set of management practices to consistently eradicate wastes in the manufacturing system, ensure the production of quality goods, accessibility of the same and boost worker productivity (Michail and Yannis, 2021). When it comes to meeting customer expectations, lean production is a business approach that prioritises providing exceptional products with achievable expense and space when needed. Lean innovation is an evolving, knowledge-based, customer-driven strategy that all staff of a firm should utilise to relentlessly minimise inefficiency while adding value (Growing Science, 2022).

Lean Manufacturing Success Factors

The lean manufacturing strategy employs methods for lowering expenses to enhance company efficiency and demonstrate an astounding ability to adjust to shifting customer needs. The tools and techniques to achieve these include inventory leanness, Total Productive Maintenance (TPM), 5S (Sort, Strengthen, Shine, Standardise and Sustain), Continuous improvement model, value stream mapping (Venkat *et al.,* 2020). Others include pull system, time batching, automation, rank-order clustering, and Poka-yoke (error-proofing), among others (Xiang and Nor, 2021).

Inventory Leanness:

Inventory leanness is an improvement on "just-in-time," which stresses that the production unit should keep the least volume of stock necessary to attain the manufacturing process (Alam *et al.,* 2022). The first lean inventory theory, which was predicated on the idea of keeping fewer stocks within the company, was developed by Womack in 1990. A lean inventory system improves the financial performance of the business by lowering the cost of carrying inventory (Abdullah *et al.,* 2023). The objective of lean inventory is to reduce expenditures in enterprise inventory systems by focusing decision-making on overall supply chains, production, and warehouses (Egbunike, 2017).

Total Productive Maintenance (TPM):

According to the literature published by the JIPM, Productive Maintenance is referred to as maintenance for revenue and consists of four components: equipment improvement, preventive maintenance, corrective maintenance, and maintenance prevention. The unique aspects of TPM are the preservation of the department's agility and operators' confidence that injection is not being followed (Venkat *et al.,* 2020).

Automated Production System:

The transfer of human intelligence to automated machinery to enable automatic loading, unloading, stopping, and starting is known as Jidoka. Often, machines can also be programmed to recognise when a defective part is being produced, halt, and signal for assistance. The operators can complete the additional value-added tasks thanks to this system. The term "automation with a human touch" refers to a lean instrument which was designed in the early 1900s by Sakichi Toyoda. His automatic loom would immediately stop if a thread broke. This method and mistake-proofing, or poka-yoke, are closely related (Junewick, 2023).

Waste Elimination:

In a manufacturing system, waste is defined as Non-Value-Added (NVA) activities, which include faults, excessive output, improper processing, needless stock, needless motion, delivery, and waiting (Asana, 2023). According to Abdul (2021), the goal of lean manufacturing, also known as lean management, is to continuously reduce waste in the production system through a collection of methods and instruments, reducing production costs. To be more precise, lean manufacturing aims to reduce errors and needless physical trash

Vorn (2023) separated the lean management strategy into six parts: machines, processes, forecasting and switching, personnel, invention scheme, dealer relationships, and customer relationships. The effectiveness of implementing Lean is contingent upon four essential elements, according to Achanga *et al.* (2016): leaders and managers, funding, knowledge and abilities, and a positive company ethos.

Corporate Performance

Performance is a gauge of the extent to which managers use the assets at their disposal to meet the corporate purposes or gratify customers (Owonte and Uduak, 2022). The term "corporate performance" denotes Fundamental yearly fiscal and operational excellence metrics as well as particular goals set by the company's top management and authorised by the committee. The accolades will be given out based on the achievement of certain performance goals. Revenue, Operating Income, Bookings, and EPS, each weighted at 25%, can be used alone or in combination to measure corporate performance (Law, 2024).

According to Nnamseh and Ayandele (2016), corporate actors should develop a variety of approaches aimed at expanding and acquiring a competitive edge in their diverse commercial dealings, considering the variety and volatility of modern enterprises. The way corporate decisions are implemented, together with how well they are received by all stakeholders of the company, has a major role in achieving corporate goals. Key corporate performance indices reviewed in this study were financial, operational, and market performance constructs.

Theoretical Background

In the course of this study, dynamic capabilities theory was carefully reviewed as one of the lean-related theories. Dynamic capabilities theory was put forward by David Teece, Gary Pisano, and Amy Shuen in 1997 in their work, “Dynamic Capabilities and Strategic Management” (Teece *et al.*, 1997). The dynamic capabilities theory (DCT) states that for businesses to thrive and reach their full capacity in volatile market environments, they must implement strategies that are incredibly flexible and adaptive to quickly reorganize their operations and activities to accommodate externally generated constraints and seize new opportunities as they present themselves (Teece *et al.*, 1997). The objectives of Dynamic Capabilities (DC) are to restructure, leverage, learn and create knowledge, collaborate, sense, and seize (Teece, 2017).

Review of Empirical Studies

Observed studies related to this work are reviewed here:

Antonio (2024) examined lean manufacturing and its impact on production efficiency in Sweden's health sector using an exploratory research approach. Research indicates that lean promotes a constant enhancement mentality.and workers involvement in policymaking processes.

Liu *et al. (*2024) considered the connection between SMEs' lean strategy and financial performance in China. A survey design was adopted to choose a sample of 4019 companies randomly. Data were analyzed using a fixed-effect regression model. The result showed a positive link between empirical inventory leanness and returns on assets.

Amahi (2023) examined the lean accounting adoption and the financial results of Nigerian industrial companies that are quoted. Data were taken from the monetary records of the sampled companies for the years 2018 through 2022. The evaluation indicated a robust and favourable link with financial achievement and lean

accounting. The study concludes that the financial performance of Nigerian limited consumer enterprises and the implementation of lean accounting are significantly correlated.

Hashmi *et al.* (2023) investigated the role of lean leadership on an organisation's operation in India. The study explored the association between an organisation's operational performance and its operational characteristics and to reach a consensus among different approaches for operational improvement. Their findings illustrated that repeat production, flow-oriented design, daily schedule adherence, and operational success are positively correlated.

Hasan *et al.* (2023), Kaban (2023) investigated the connection between sustainability and Lean Manufacturing Performance (LMP) in Malaysian manufacturing companies using different research designs In particular, Hasan *et al.* (2023) looked at how Factory Productivity influences the connection between sustainability and LMP. 2368 businesses made up the study's population. The survey questionnaires were dispersed at random to 335 businesses, yielding a reaction rate of 30.4%. PLS-SEM was used to analyze the data, and the findings showed that there was a positive correlation between LMP and sustainability, manufacturing performance. Kaban (2023) concluded that combining sustainability and lean methods results in a production process that is more efficient and responsive to buyer needs, signifying a comprehensive strategy to transform the way value is generated and waste is reduced.

LMP offers a more comprehensive understanding of Malaysia's manufacturing organizations. The study suggested examining production efficiency and its effect on sustainable manufacturing to determine how lean can address business sustainable progress.

In their study, De l.Vega *et al.* (2023) examined the crucial elements of a lean strategy's performance in the manufacturing sector. The study was organised and carried out using a descriptive survey design. A total of 1580 copies of the feedback form was circulated to 75 different firms in Mexico, out of which 240 copies were validly retrieved. The results demonstrated an undeviating correlation between senior management's participation and dedication to project leadership.

Willian *et al.* (2023) investigated the connection between company efficiency and the application of lean in a subset of Akwa Ibom businesses using Ordinal Logistic Regression analysis (OLR). The analysis revealed a significant relationship between the lean management dimensions of waste elimination and value stream mapping and organisational performance in manufacturing firms. The study concluded that these relational dimensions impacted organisational performance.

To evaluate the complementary impact of digitizing on operational performance in Norway, Buer et al. (2021) carried out an online survey with 76 respondents from a sample of 212 businesses in Norway. A partial least squares (PLS) equation model was adopted for the analysis of data. The results indicated that lean production is still relevant for manufacturing organizations to fully benefit from new technologies and transform them into improved operational performance. However, because survey fraud is common when undertaking online surveys, the study used an internet poll, which is vulnerable to bias due to no responses. Because the response margin was so tiny with the sample population, it might be impossible to generalise the results.

Schwantz *et al.* (2023) investigated how lean practices and organisational performance are related. The study's primary premise could be confirmed based on the results, which led to the conclusion that lean approaches improve organizational performance by reducing waste, fostering continuous improvement, and offering leadership and support.

Saettaa and Caldarelli (2020) examined lean techniques for green manufacturing using the Green Foundary Life Project of Italy. The research design applied while carrying out this work was experimental. The study was designed to evaluate the minimum gas formation requirement to energise quality at the source to diminish the risk factors while making moulds. The result showed that movement toward a more sustainable environment was done by modifying the current production system in the Foundary factory. The researchers recommended a result-oriented approach to eliminating defects.

In a study by Budianto *et al.* (2020) on the impact of manufacturing proficiencies on lean manufacturing in increasing performance in 244 food companies in Indonesia, a survey research design was used to conduct the study244. 157 copies of questionnaire were distributed manually and electronically to these food companies. The discoveries revealed that lean manufacturing has a positive effect on operational performance with manufacturing agility competencies at a t-statistic of 5.121, a P-value of 0.001. It was also revealed that manufacturing agility as a predictive adaptable data has an encouraging effect on operational performance at a t-statistic of 2.95 with a p-value of 0.001. They concluded that the quality control system should be positioned independently, and lean system practices should gradually follow the will of the quality control system.

METHODOLOGY

This study embraced the descriptive investigation design to organise and collect data.

The population of the study was one thousand one hundred and forty-six (1,146) management and supervisory members of the Fidsons Healthcare Plc, Emzor Pharmaceutical Industries, Neimeth International Pharmaceutical Plc, May & Baker Nigeria Pls. These pharmaceutical companies were considered because they are known as lean-focused firms. Hence, our choice of the study area was not out of place. The judgmental sampling procedure was used to select four (4) pharmaceutical companies from the population of the study. The resolution of an achievable sample size for this study was guided by the lean practices of the pharmaceutical industry in Nigeria. Krafcik and Morgan's (1970) sampling technique was used to achieve a sample size of 285 from the 1,146 population of the study. The Multinomial Logistic Regression (MLR) was used to analyse the research data. This model is suitable when there is more than one response proxy with more than two independent variables in categories (sorted or unordered) and nominal nature.

RESULTS AND DISCUSSION OF FINDINGS

Table 1: A simple percentage frequency table of respondents from the selected companies

Companies' Name	Respondents	Percentage (%)
Fidson Healthcare Plc.	80	39.2
May $ Baker	39	19.1
Emzor Pharmaceuticals Plc	38	18.6
Neimeth Int'l Plc.	47	23.1
Total	204	100.00

Source: Field Survey (2024).

Table 1 indicates the number of respondents according to their companies. Fidson Healthcare Plc recorded the highest number of respondents, 80(39.2%), who participated in the study. This number was possible because the company's Chief Executive Officers (CEO) and other key management staff participated in the exercise and also encouraged other staff to participate. 39 respondents from May & Baker, representing 19.1% of the total participants, responded. 38(18.6%) evaluators were staff members of Emzor Pharmaceuticals Plc. While respondents from Neimeth International Plc were 47, that is, 23.1% of the total respondents.

Table 2: Analysis of Lean techniques implemented by the selected companies

Lean techniques	Responses	Percentage (%)
Automation	187	92.1
Continuous improvement	171	84.2
Inventory leanness	143	70.4
Total productive maintenance	108	53.2

Value stream mapping	73	36.0
Waste elimination	161	79.3
Zero defects	30	14.8
5s – Sort, Straighten, Shine, Standardise, Sustain	94	46.3

Source: Researcher's Computation (2024).

Table 2 shows different lean techniques implemented by some pharmaceutical companies in Nigeria. 187 respondents, representing 92.1% of the total respondents, adopted automation, and 171 respondents (84.2%) implemented the continuous improvement method. In the aspect of inventory leanness and total productive maintenance, 143 and 108 respondents, representing 70.4% and 53.2% of the total respondents, respectively, indicated that the firms adopted the lean strategies. 73(36%) respondents said Value Stream mapping was one of the lean techniques used by the company. 161(79.3%) of the total respondents agreed that their firms adopted waste elimination. Also, 30 and 94 of the total respondents, representing 14.8% and 46.3%, respectively, agreed that their companies implemented zero defects and 5S, respectively. We listed the different lean manufacturing strategies in this study to know the degree of leanness of the selected pharmaceutical firms.

Summary of the Test of Hypothesis

Ho_1: There is no significant influence of inventory leanness on the corporate performance of selected pharmaceutical firms in Southwest, Nigeria.

Ho_2: Total productive maintenance does not significantly influence the corporate performance of selected pharmaceutical firms in Southwest Nigeria.

Ho_3: There is no substantial influence of manufacturing automation on the corporate outcome of selected pharmaceutical firms in Southwest Nigeria.

Ho_4: There is no substantial influence of waste elimination on the corporate performance of select pharmaceutical firms in Southwest, Nigeria.

Ho_5: There is no substantial combined influence of the predictors on the corporate outcome of the selected pharmaceutical firms in Southwest Nigeria.

Ho_1: There is no significant influence of inventory leanness on the corporate performance of selected pharmaceutical firms in Southwest, Nigeria.

Table 3: Summary of nominal regression of the influence of inventory leanness on corporate performance of selected pharmaceutical firms in Southwest, Nigeria.

		Likelihood Ratio Test		
Effect	**-2long likelihood reduced model**	**Chi-square**	**Df**	**Sig.**
Intercept	**872.238**	**56.438**		**.000**
LOGIVL	**855.150[a]**	**39.350**	**17**	**.002**

SPSS Result (2024) **P<0.05** **Df = 17**

Source: Researcher's Computation (2024).

The result of the data analysis in Table 3 shows -2log likelihood of a reduced null model related to the intercept at 17 degrees of freedom (872.238 – 855.150). The result indicates that the predictor variable,

inventory leanness, is statistically significant at .002, less than the probability threshold of 0.05. Hence, the first hypothesis was rejected, which states that there is no significant influence of inventory leanness on the corporate performance of selected pharmaceutical firms in Southwest Nigeria. The result of the findings is in tandem with the discoveries by Liu *et al.* (2024) and Marodin *et al.* (2017), which observed that there is a connection between inventory leanness and the financial results of the firms. The finding is also in consonance with the findings by Iranmaneh *et al.* (2019), which observed that only the correct inventory level improves a company's performance.

Test of the combined influence of lean manufacturing tools on the corporate performance of selected pharmaceutical firms in Southwest Nigeria

Ho_5: There is no substantial combined influence of the predictors on the corporate outcome of the select pharmaceutical firms in Southwest Nigeria.

Table 4: Summary of nominal regression of the combined influence of the predictor variables on corporate performance of selected pharmaceutical firms in Southwest Nigeria.

		Likelihood Ratio Test		
Effect	-2long likelihood reduced model	Chi-square	Df	Sig.
Intercept	872.238	56.438		.000
LOGIVL * LOGTPM * LOGMA * LOGWE	854.650[a]	39.930	17	.001

P<0.05 df 17

Source: Researcher's Computation (2024).

The likelihood ratio test in Table 4 shows the combined likelihood test of the predictor variables {inventory leanness (IVL), total productive maintenance (TPM), Manufacturing automation, and Waste elimination (WE)} on the corporate performance at a significant p-value of 0.001. This proves that the independent variables of this study contributed significantly to the final effect. Therefore, the null hypothesis that there is no substantial influence of the combined lean factors variables used in this study on the corporate performance of the selected firms was rejected. The results align with the views of the vast majority of authors, including Frank *et al.* (2025), Joseph *et al*. (2023), El-Khali and Nader (2021), Saettaa and Caldarella (2020), Valente *et al.* (2019)**.** These findings contradict the conclusions made by Iqbal *et al.* (2020), who found no discernible effect of Lean methods on the performance of businesses.

SUMMARY OF DATA ANALYSIS RESULTS

The multinomial logistic regression model was used to test the hypotheses and the summarized results are presented here:

Table 5:	**Model Fitting Information**			
Model	Model Fitting Criteria	Likelihood Ratio Tests		
	-2 Log Likelihood	Chi-Square	Df	Sig.
Intercept Only	957.598			
Final	815.800	141.799	68	.0001

Source: Researcher's Computation (2024)

The model fitting information in Table 5 shows the 2log likelihood ratio chi-square tested to know the substantial improvement in the fit of the final model relative to the intercept only. In this case, we see a considerable improvement in the fit of the model over the null model {x2(68) =141.799, at a probability value less than 0.05 (P<0.05). Hence, the model displays a good fit at a significance level of 0.0001.

Table 6: Pseudo R-Square

Cox and Snell	.501
Nagelkerke	.504
McFadden	.136

Source: Researcher's Computation (2024).

Table 6 shows the Pseudo R-squared used in multinomial regression to explain the rate of change in the model. The Nagelkerke test of .504 indicates that 50.4 per cent of the change in the model is attributed to the independent variables. It shows that the outcome prediction has improved by 50.4 per cent using the predictors.

Table 7: Parameter Estimate

LOGCORP[a]		**B**	**Std. Error**	**Wald**	**Df**	**Sig.**	**Exp(B)**	**95% Confidence Interval for Exp(B)**	
								Lower Bound	**Upper Bound**
.56	Intercept	1317.761	15692.836	.933	1	.007			
	LOGWE	-1247.930	10581.866	.906	1	.014	.000	.000	.[b]
	LOGTPM	-1071.121	7321.380	.884	1	.021	.000	.000	.[b]
	LOGIVL	-2088.981	15204.750	.891	1	.019	.000	.000	.[b]
	LOGMA	1992.460	23735.095	.933	1	.007	.[b]	.000	.[b]
.57	Intercept	1680.160	12726.914	.895	1	.017			
	LOGWE	-629.500	5652.368	.911	1	.012	1.000E-013	.000	.[b]
	LOGTPM	-887.182	3429.416	.796	1	.067	.000	.000	.[b]
	LOGIVL	-2077.218	14109.799	.883	1	.022	.000	.000	.[b]
	LOGMA	584.2	4337.188	.893	1	.018	5.502E+2	.000	.[b]

		59					53		
.58	Intercept	-1001.755	6487.371	.877	1	.024			
	LOGWE	486.032	28.664	287.506	1	.000	1.205E+211	4.807E+186	3.020E+235
	LOGTPM	-192.605	26.189	54.086	1	.000	1.000E-013	1.000E-013	1.000E-013
	LOGIVL	198.281	11756.298	.987	1	.004	1.295E+086	.000	.[b]
	LOGMA	1433.003	27.643	2687.308	1	.000	.[b]	.[b]	.[b]

The reference category is .56. b. Floating point: overflow occurred while computing this statistic. Its value is therefore set to system missing. Alpha: 0.05.

Source: Researcher's Computation (2024).

The result of data analysis in Table 7 shows the parameter estimates, otherwise known as the coefficients of the model. B is the Beta or logistic coefficient for the models that treat the log of corporate performance as the referent group. In the first column, .56, .57 and .58 represent operational, financial, and market performance accordingly. This parameter estimate shows a logarithm model for inventory leanness (LOGIVL), Total Productive Maintenance (LOGTPM), Manufacturing Automation (LOGMA), and Waste Elimination (LOGWE) relative to Corporate Performance (LOGCORP). The intercept is the multinomial logit estimate linking corporate performance to other variables (predictors) at -1317.761, 1680.160 and -1001.755. The Wald statistic tests the null hypothesis coefficient of the independent variables to determine whether they are significant or not. When the Wald test indicates the constraints for explanatory variables equal to zero, such proxies must be eliminated from the model. In Table 6, the Wald statistics of all the explanatory proxies are approximately one and above. Hence, the estimate significantly improves the model fit, and the variables are statistically relevant. This finding explains that lean manufacturing strategy, inventory leanness, total productive maintenance, automation, and waste elimination substantially influence the corporate performance of the selected pharmaceutical firms in Southwest Nigeria.

CONCLUSION

For the past decades in Nigeria, every sector of the economy has faced a harsh business environment occasioned by unfriendly fiscal and monetary policies, high costs of energy, and raw materials and unhealthy rivalry. The need for organisations to rethink ways forward and how to mitigate these investment risks gave rise to several business approaches that were deemed fit to recover from the economic quagmire and make a profit. Some of the strategies adopted were the lean manufacturing strategy, total quality management, virtual organisation, knowledge-based manufacturing and robotic production. Business organizations had to pull resources together and marshal them to meet customers' requirements and make profits. The method presented in this study, known as LMP (Lean Manufacturing Practices) seeks to revolutionise the way manufacturing resources are being utilised by encouraging the creation of modern tools and techniques designed to deliver modern work needs and fulfil requirements, as well as design work structure, equipment repairs, and training.

This study specifically examined the influence of lean manufacturing strategy on the corporate performance of selected pharmaceutical companies in Southwest Nigeria. This study has empirically established that lean manufacturing influences business performance as measured by operational, financial, and market performance. Our findings show that lean manufacturing practices play significant roles in the performance of the selected pharmaceutical firms. The results showed a positive influence of inventory leanness on corporate performance at a p-value of 0.012. TPM at a p-value of 0.013. The analysis also shows a significant effect of

Manufacturing Automation (MA) on corporate performance at a p-value of .015, less than the 0.05 threshold. This indicated why the studied firms are among Nigeria's few cGMP-compliant pharmaceutical firms. cGMP compliance covers manageable inventory levels and automation compliance, such as installing automatic blister machines, high-speed tabletting equipment, analytical equipment, and a digital laboratory.

Lean constructs (inventory leanness, total productive maintenance, manufacturing automation, and waste minimisation) influence corporate performance at an interactive likelihood probability value of 0.001. This implies that an increase in corporate performance resulted from the firms' strategy in executing their tasks. In this case, lean manufacturing strategy. This study concludes that lean manufacturing is the right strategy for a firm to increase productivity, minimize waste, and gain competitive advantages.

Business Implications of Findings

This research presented theoretical and empirical evidence focusing on how implementing a lean manufacturing strategy influenced business performance (operational, financial, and market performance) across many economies. From this study, we discovered that economic benefits were the primary reasons for adopting a lean strategy. This paper provides some findings that could aid in improving managerial decisions in the business. Many organisations would make lean manufacturing an essential philosophy across every unit, length, and breadth. Lean culture is a philosophy that, if properly implemented, will enhance production efficiency and improve product quality and returns on investment. In the pharmaceutical sector, lean manufacturing compliance, known as current Good Manufacturing Practices (cGMP), has become the condition for businesses in the industry to be certified as World Health Organization's (WHO) approved manufacturing firms. New and existing firms in the manufacturing and health sectors can adopt these findings when implementing a lean manufacturing strategy.

Contribution to Knowledge

This study's conclusion is consistent with its findings and recommendations. Undoubtedly, the study has significantly contributed to the knowledge already available on lean manufacturing and organisational performance. It encourages other sectors of Nigeria's economy to consider using lean manufacturing to increase productivity, gain a global competitive edge, and influence customer perception and loyalty. This work is immensely beneficial to Nigeria's manufacturing sector and, by extension, Africa. It will give a sense of fulfilment to the management of the studied pharmaceutical firms as the referenced lean manufacturing firms in Nigeria.

The economic benefits of this study are enormous. It educates managers and business stakeholders on how to lower production operating costs. It enables companies to utilise available resources efficiently. Producing more with fewer resources (lean) increases a firm's sales revenue and profit.

Gap in Knowledge Reviewed

This study has identified and filled the following lacuna which the previous studies left out.

Previous studies failed to review and document the management strategies which the lean model rested upon. This study reviews lean manufacturing as an extension of cellular and flexible manufacturing systems which is similar to the process layout-based production system. The pharmaceutical sector of Nigeria applied models such as Philip Crosby's zero-defects philosophy, cellular manufacturing system, and computer-based flexible manufacturing for increased productivity. Adoption of zero defects is the philosophy that seeks to ensure the absence of any detectable quality flaw in a product or service. Several reviewed literature on lean have not heightened this key context. Little literature is available on the measurement of inventory leanness as a key lean success factor. Many empirical studies on lean show operational performance as an outcome variable, which is a subset of corporate performance. This limited their work to a subsystem in the organization instead of evaluating the whole organization.

RECOMMENDATIONS

The following recommendations were made based on the findings and conclusion of the study:

1. We recommended that managers of pharmaceutical companies use a flexible, knowledgeable work environment with team collaboration and adequate control measures to reduce the number of days of inventory and accounts receivable cycle. They should work with lean specialists to track and eliminate unnecessary inventory.
2. One vital objective of this study is the role of Total Productive Maintenance (TPM) on firms' performance. This study recommends that companies, management, staff, and shop floor should get involved in planning and executing maintenance-related activities. No firm wanting to remain dynamic in a globally competitive environment would ignore planned, autonomous, and preventive maintenance. In a sense, TPM should be applied to general management.
3. We also recommend that business managers work tirelessly to minimise every form of None Value Addition (NVA) to the production system, such as waste of raw materials, finances, waste of space, unnecessary motion, inappropriate processing, inappropriate lead time and cycle time.
4. The automation of the pharmaceutical sector should be the responsibility of both the government and the industry's actors. Reducing technological tariffs and other import duties will enable these companies to meet the automation demands in line with the cGMP requirements. This is because the lower the automation cost, the higher the manufacturing companies' automation rate.

Conflict Of Interest

This study, entitled "Lean Manufacturing Strategy and Corporate Performance of Selected Pharmaceutical Firms in Southwest Nigeria", is a research article carried out by Johnson Okokon Odohoedi with the help and support of his supervisors, Prof Isaac Ayandele and Dr Victoria Umana. These authors and scholars are seasoned researchers in the Department of Business Management, University of Uyo, Nigeria. Hence, there is no conflict of interest from anyone about the authorship of this thesis.

REFERENCES

1. Abdullah, B., Duranmany, E., and Foday, D. (2023). Empirical evidence of the impact of inventory management on the profitability of a manufacturing company. Journal of Banking and Finance, 13(6): 207 - 228. Doi:10.47260.jofb/136.10
2. Abdul, L. (2021). Lean innovation and Research and Development. Abdul Latif James and Company. 18 – 23.
3. Achanga, P., Shehab, E., Roy, R., and Nelder, G. (2016)."Critical success factors for lean implementation within SMEs," Journal of Manufacturing Technology Management, 17(1): 67 -70.
4. Alam, M. K., Thakur, O. A., and Islam, F. T. (2022). Inventory management systems of small and medium enterprises in Bangladesh, Rajagiri Management Journal, 18(1): 8-19p. https://doi.org/10.1108/RAMJ-09-2022-0145
5. Amahi, F. (2023). Lean accounting adoption and financial performance of quoted manufacturing firms in Nigeria, Journal of Xidian University, 17(7): 349 – 258. DOI:10.37896/jxu17.7/031
6. Antonio, A. (2024). Lean Manufacturing and Its Impact on Production Efficiency. Journal of Research in International Business and Management, 11(3): 01-02. DOI: http:/dx.doi.org/10.14303//jribm.2024.025
7. Asana, T. (2023). What is value mapping (VSM)? 2-3. https://asana.com/resources/value-stream-mapping.
8. Budianto, Surachman, Djumilah, H., and Rofiaty (2020). The effect of manufacturing agility competencies on lean manufacturing in increasing operational performance. Uncertain Supply Chain Management, 195 -204. www.growingScience.com/uscm.
9. Buer, S., Semini, M., Strandhagen, J. O., and Sgarbossa, F. (2021). The complementary effect of lean manufacturing and digitalisation on operational performance. International Journal of Production Research, 59(7): 1976–1992. https://doi.org/10.1080/ 00207 543.2020.1790684

10. De la Vega, M., Macias-Velasquez, S., Baez-Lopez, Y., Limon-Romero, J., Tlapa, D., and Chávez-Moreno, E. A. (2023). Modeling Critical Success Factors of Lean Strategy in the Manufacturing Industry. Systems, 11(10), 490. https://doi.org/10.3390/systems11100490
11. Egbunike, D., (2017). Report on Small and Medium Enterprises, S. l.: Ethiopia Central Statistical Agency. 4-6.
12. El-Khalil and Nader (2021). The role of lean in enhancing operational performance through sustainability and supply chain practices: a case study on the Automotive industry. 2nd South American International Conference on Industrial Engineering and Operations Management, Semantic Scholars, 567p https://doi.org/10.46254/SA02.2021
13. Frank, A. G., Sturgeon, T. J., Benitez, G. B., Marodin, G. A., and Cunha, S. F. (2025). How Lean and Industry 4.0 affect worker outcomes and operational performance: A quantitative assessment of competing models. International Journal of Production Economics, (279): 109 -212.
14. Growing Science (2022). The effect of digital supply chain on lean manufacturing: A structural equation modelling approach. 5 -18p. https://growingscience.com/effect-of-digital-supply-chain-on-lean.
15. Hasan, M. Z., Yaacob, T. Z., Hashim, H. I. C., Asaad, M. N. M., and Iteng, R. (2023). Sustainability and Lean Manufacturing Practices: The Mediating Role of Manufacturing Performance. International Journal of Academic Research in Business and Social Sciences, 13(3): 715 – 740.
16. Hashmi, H.A., Khan, N.R., and Haq, M.A. (2023). The impact of lean management implementation on organizational operational performance. Logrum Forum, 14(4): 375
17. Inside law (2023). Corporate performance, 3 – 4. ref=https://www.lawinsider.com/ dictionary/corporate-performance >Corporate Performance Definition | Law Insider
18. Iqbal, T., Sadiq, M., Bhutta, M., and Qureshi, S. M. (2020). Lean and Agility manufacturing: Complementary or competing capabilities? Journal of manufacturing Technology Management. Ahead-of-print. 10.1108/IJMTM-04-2019-0165.
19. Jones, D. T. and Womack, J. P. (2016). Lean thinking: Banish waste and create wealth in your corporation. Revised edition, Simon and Schuster Pub. 232p. Doi.10.17877/D529002-5997.
20. Joseph, K., Aliata, V., and Tambo, A. (2023). The effect of lean manufacturing on the operational performance of sugar firms in Kenya. International Journal of Business and Management Invention, 12(9): 23 -34. ISSN (online): 2319-8028.
21. Junewick, M. (2023). Lean Speaks: The Productivity Business Improvement Dictionary, 568p
22. Kamal Zaraba (2022). Automotive Industry: What the future holds. Infomeno, 43p. https://infomineo.com/technology-telecommunication/automotive-industry-what-the-future-holds/
23. Kaban, L. M. (2023). Unveiling the Sustainability of Lean Production. Asian Journal of Economics, Business, and Accounting: 23(22): 435-40. https://doi.org/10.9734/ajeba/2023/v23i221163
24. Kumar, N., Shahzeb H. S., Srivastava, K., Akhtar, R., Kumar Yadav, R., and Choubey, V. K. (2022). Lean manufacturing techniques and its implementation: A Review Materials Today: Proceedings, 64: 1188–1192. https://doi.org/10.1016/j.matpr.2022.03.481
25. Aniston, T., Amporn, P., and Ussanee, M. (2021). Effect of Lean on the Operational Performance of medium-sized Thai manufacturing companies. Uncertain Supply Chain Management, 9: 647 – 658. www.growingsupply-chain.com/uscm.
26. Landau, P. (2024). What Is Lean Manufacturing? Definitions, Principles & Techniques. Manufacturing Resource Management online. https://www.projectmanager.com/what-is-lean-manufacturing(Retrieved on 16th January 2025)
27. Law Insider (2024). Corporate Performance definition. https://www. 2p. lawinsider.com/dictionary/corporate-performance (Retrieved on 20th January 2025).
28. Legatum Institute (2024). Countries in Africa with worst healthcare systems. https://li.com/countries_in_Africa_with_worse_healthcare/ (Oct. 30, 2024)
29. Liu, F. Yanling Y., Fang Y., Zhu, M., Shie, Y. Shufeng (2024). Lean strategy in SMEs: Inventory leanness, operational leanness, and financial performance. The Asian Journal of Shipping and Logistics: 1 -11. https://doi.org/10.1016/j.ajsl.2024.02.003.
30. Logu, P., Arun B., M., Aravinth, R., Ganesh, K. (2021). Implementation of Lean Manufacturing in Automotive Industries. International Journal of Operations Research, 234-246.

31. Marodin G. A, Frank, A. G, Tortorella G., and Fetterman, D. C. (2017). Lean production and operational performance in the Brazilian automotive supply chain. Total Quality and Business Excellence, 30(4):370-385 https:// doi.org/1 0.1080/ 14783363.2017.1308221
32. Michail, A. and Yannis, P. (2021). Change Management via Data Analytics for a Success Lean Transformation of Public Companies. Archives of Business Research 9(12): 47 -64. https//doi.org/10.14738/abr.912.11351.
33. Mohammad, I. S. and Oduoza, C. F. (2019). Interaction of Lean Enablers in Manufacturing SMEs using Interpretive Structural Modelling Approach. 29th International Conference on Flexible Automation and Intelligent Manufacturing held at Limerick, Ireland from 24 to 28th June 2019, 901p.
34. National Agency for Food and Drug Administration and Control (NAFDAC, 2022). List of Inspected Local Manufacturing Facilities in Nigeria. Annexure – 2A.: 1 – 18 www.nafdac.gov.ng/cop/content/files/
35. NGX Facebook (2019). List of quoted firms on the floor of the Nigerian Stock Exchange. 2p. https//ngxgroup.com.
36. Nnamseh, M. and Ayandele, I. (2016). "Effect of Employee Participation in Decision Making On Corporate Performance: A Case of Selected Banks in South-South Nigeria," International Journal of Management Sciences, Research Academy of Social Sciences, 7(7): 350-358.
37. Owonte, L. H. and Uduak, J. (2022). Customer Service Strategies and Marketing Performance of Automobile Firms in South-South Nigeria, African Journal of Management and Business Research, 3(1): 29-40.
38. Saettaa, S. and Caldarellia, V. (2020). Lean production as a tool for green production: the Green Foundry case study. International Conference on Industry 4.0 and Smart Manufacturing (ISM 2019), Procedia Manufacturing 48: 498-502
39. Schwantz, S. T. Shun, F. and Xu, U. (2023), The Toyota Way in Services: The case of lean product development. Academic Journal of Management Perspective, 20(1): 5-20
40. Sinha, N. and Matharu, M. (2019). A comprehensive insight into lean management: Literature review and trends. Journal of Industrial Engineering and Management, 12(2); 302- 317. Doi.org/10.3926/jiem.2885
41. Southern Methodist University (SMU) (2022). Lean Continuous Improvement: Origins Principles, and Goals. 5p. http://smu.blog.com (Retrieved on January 2025)
42. Teece, D. J. (2017). Managing Intellectual Capital: Organizational, Strategic, and Policy Dimensions. Oxford: Oxford University Press Teece. (2017). Explicating Dynamic Capabilities: the nature and micro-foundations of sustainable enterprise performance. Strategic Management Journal, 28(13): 1319-1350.
43. United Nations Industrial Development Organisation (UNIDO) (2020). Nigeria Pharmaceutical Sector Profile. Vienna, 1–11. Available at: unido.org/default/file/Nigeria/pharm/Ebook_O.pdf.
44. Valente, C., Sousa, P., and Moreira, M. (2019). The lean effect on business performance: The case of small and medium scale enterprises (SMEs). Journal of Manufacturing and Management, 16(2): 320-335. DOI:10.1108/jmtm-04-2019-0137.
45. Venkat, B., Prathap, P., Sivaraman, P., Yogesh, S., and Madhu, S. (2020). Implementation of lean manufacturing in the electronics industry, Materials Today Proceedings, 14p. https:// doi.org/10.1016/j.matpr.2020.02.718
46. Vorne, I. (2023). Lean Production Tools. USA, 2p. info@leanproduction.com//vorne
47. Womack, J. P. and Jones, D. T. (2013). Lean Thinking: Banish the waste and create wealth in your organisation. Revised edition, Sinnon and Schuster publication. 400p.
48. Willian I.C., Uwa K.L. and Okurebia S. (2023) Lean Management and Organizational Performance in Selected Manufacturing Firms in Akwa Ibom State, International Journal of Business and Management Review, 11(11): 50-71.
49. Xiang, T. and Nor, N. (2021). Lean manufacturing practices and their influence on sustainability performance in the Selangor manufacturing industry. 11th Annual International Conference on Industrial Engineering and Operations Management Singapore, March 7-11:24-32.
50. Yadav, S., and Lenka, U. (2020). Diversity Management: A Systematic Review. Equality, Diversity, and Inclusion: An International Journal Op, 39: 901 -929. https://doi.org/10.1108/EDI-07-2019-0197