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JUST-IN-TIME INVENTORY MANAGEMENT PRACTICES AND SUPPLY CHAIN PERFORMANCE OF FOAM MANUFACTURING COMPANIES IN NASARAWA AND PLATEAU STATES NIGERIA.

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ABSTRACT
The just-in-time is the way to efficiency because it helps in cost reduction and time efficiency in production. This study explores just-in-time inventory management practices and supply chain performance of foam manufacturing companies in Nasarawa and Plateau states, Nigeria. The specific objectives are to; assess the effect of technology on the supply chain performance of foam manufacturing companies in Nasarawa and Plateau states, Nigeria and investigate the effect of warehouse system on supply chain performance of foam manufacturing companies in Nasarawa and Plateau states, Nigeria. From the manufacturers association of Nigeria (MAN) there is one foam manufacturing firm in each of Nasarawa and Plateau state, 497 employees that form the population of the study. The study used the Taro Yamane formula to determine a sample size of 244 for the study. A closed-ended questionnaire was used for data collection. The statistical tool used for analysis was descriptive statistics that is (mean, and standard deviation) and SPSS software version 25 was used for regression. The results show a positive and significant relationship between technology and supply chain performance and negative and insignificant relationship between warehouse system and supply chain performance. The study recommended that both United and Vita foam should integrate digital application such as (AI, Blockchain, IoT, and Cloud based solution) in their operation, also Identify inefficiencies by evaluating the warehouse system and try to integrate the warehouse system with other supply chain system.
Key words: Just-in-Time Inventory Management Practices, Technology, Warehouse System, Supply Chain Performance, Cost Efficiency.

1. INTRODUCTION

In the rapidly evolving global industrial landscape, manufacturing firms are under immense pressure to innovate continuously while simultaneously minimizing production costs. The growing demand for efficiency, responsiveness to market fluctuations, and resource optimization has driven many firms to adopt the Just-in-Time (JIT) inventory management system. Rooted in lean production philosophy, JIT focuses on reducing waste, streamlining production processes, and enhancing operational flexibility. By minimizing excess inventory, shortening setup times, improving material flow control, and prioritizing preventative maintenance, JIT enables firms to reduce cost and enhance productivity (Shivaani et al., 2021).

The evolution of JIT has been significantly influenced by advancements in digital technology. The integration of modern technologies such as real-time data analytics, artificial intelligence (AI), the Internet of Things (IoT), and automation has transformed traditional inventory management. Manufacturing firms now utilize sophisticated software solutions to track inventory levels, predict demand with improved accuracy, and manage supplier relationships more effectively (Nunez-Meriono et al., 2020). IoT-enabled sensors alert operators when stock is low or equipment requires maintenance, ensuring uninterrupted production. Automation, including the use of robotics, facilitates faster production processes by minimizing human error and handling repetitive tasks, while AI and machine learning models use real-time and historical data to optimize inventory levels and forecast demand more precisely (Yasaman et al., 2020).

The role of warehouses within the JIT framework has similarly shifted from static storage units to agile facilitators of demand-driven supply chains. Under JIT, materials are ordered based on actual customer demand rather than speculative forecasts, necessitating tight coordination between suppliers and production schedules. This operational model reduces inventory holding requirements, allowing for smaller and strategically located warehouses that support high material turnover. To function effectively, these

warehouses require optimized receiving processes, advanced tracking systems, and seamless accessibility of materials, all of which contribute to the responsiveness and efficiency of JIT operations (Andiyappillai, 2020).

Despite the widespread global adoption of JIT and its associated technological advancements, many manufacturing firms in Nigeria—particularly those in the foam manufacturing sector—continue to face substantial challenges. Several studies have reported that these firms struggle with inaccurate forecasting, largely due to the absence of real-time inventory and demand data. This has led to inconsistent deliveries, stockouts, and customer dissatisfaction (Jelena et al., 2022). The performance of foam manufacturing companies in Nigeria has therefore remained suboptimal, with inefficiencies arising from investments in non-essential stock items, poor responsiveness to customer orders, and general operational delays (Hassein & Zayed, 2020). Nevertheless, the adoption of JIT-aligned technologies and optimized warehouse systems offers an opportunity for such firms to improve performance, enhance customer satisfaction, and gain a competitive edge through better market positioning and superior product delivery (Hoffman, 2024).

In light of these dynamics, this study seeks to explore the influence of technology and warehouse systems on the supply chain performance of foam manufacturing companies operating in Nasarawa and Plateau States, Nigeria. Specifically, the study investigates whether technological adoption—through tools such as AI, IoT, and inventory management software—has a measurable impact on supply chain efficiency. It also examines the role of modern warehouse practices in facilitating timely, demand-driven operations. The research is guided by two hypotheses: first, that there is no significant relationship between the use of technology and supply chain performance in the foam manufacturing sector; and second, that there is no significant relationship between warehouse systems and supply chain performance. By addressing these hypotheses, the study aims to provide empirical insights into how strategic investments in JIT-related infrastructure can enhance the performance and competitiveness of local manufacturing firms.

2. LITERATURE REVIEW

i. Conceptual Review

The philosophy of just-in-time (JIT) inventory management is mostly related to the manufacturing industry which has the plans to dispose of waste, waste results from any action which adds cost to the process of production or giving out services without essentially increasing the value of the item being produced or service been giving, example can been seen in the transportation inventories from one distribution center to the next or the basic demonstration of putting them into storage (Madanhire & Mbohwa, 2016). Sustaining the advantage, the organization has over its competition is the main objective of just-in-time inventory management. Just-in-time inventory management is well accomplishes by focusing on the customers and delivering a performance that is exceptionally superior while keeping the cost of production of goods and services at a minimum level, and continuously improving quality (Chen, 2023). One of the main reasons why just-in-time is one of the tools mostly used for inventory management systems and why it has been successful over the years. However, the financial implications of just-in-time inventory management, are very critical. Juárez*et al.*, (2017).

For years now, just-in-time inventory management application has been effective and efficient within the manufacturing sectors globally. This has led to the philosophy being adopted and implemented within the service industries not only in the manufacturing industries (Hay, 2018). The successful implementation and execution of just-in-time inventory management allows manufacturing companies to counter the vulnerability that they face due to the regularly changing financial climate. Based on research of Khourshed and Youssef (2024) that measured the relationship between inventory level and organizational effectiveness through JIT, the technique has played major roles and drastic impact for agencies that had to manage their finances (costs specifically), but for the context of this research, the question is, whether foam manufacturers are among those organizations that have adopted the philosophy and benefited

Technology

A digital just-in-time practice is an approach that employs state-of-the-art technology and greater insights into the responsibilities of each stakeholder along the inventory to improve decision-making about material sources, product demand, and all linkages between participants (Saberi, *et al.*, 2019). Integrating current demand forecasting, asset management, warehouse management, transportation, logistics management, purchasing, and order fulfillment systems is an important first step in achieving this goal. However, to successfully digitalize (technology) a supply chain, it is also important to data from these processes and instrument the gear that generates the data. Monitoring logistics or production processes is a common use of technology such as Internet of Things (IoT), a network of sensors and monitors, is used to instrument the supply chain. (Saberi, *et al.*, 2019). Gateways may transmit this data to various participants in the supply

chain. Once the data has been collected, stakeholders may use it to learn whether they can trust the information to predict when they will get the needed products. Compared to previous methods, users can get much more timely insight into the supply chain's operations because of the near-instantaneous nature of the data collection and analysis technology (Nunez-Merinon, *et al.,* 2020). However, complex analytics must examine all that data and foresee its outcomes. When there are more people involved and more parts, complexity rises. One technology that might help make this possible is a digital twin, a digital copy of a physical product or process. In this case, one vendor's green shirts may be 16% more expensive than another's, but to meet consumer demand, it will be necessary for both suppliers to provide the product (Nunez-Merinon, *et al.,* 2020). Machine learning techniques can do predictive modeling and provide advice on how to respond to various scenarios. Blockchain promises to facilitate worldwide openness and provide precise, real-time asset monitoring. Because it is public and immutable, Blockchain can accurately store transaction details.

The world is becoming an artificial intelligence (AI) village and this too affect the just-in-time system to provide solutions that have the potential to revolutionize stock management due to their capacity to handle massive amounts of data. These intelligent systems can rapidly analyze and interpret huge datasets, delivering real-time actionable insights for demand and supply planning that will put just-in-time in the right place (Ben-Daya, *et al.,* 2019).

Warehouse System

According to Masae, *et al.,* (2021), warehouse management system (WMS) is more of a software application designed for efficiently and effectiveness control and oversee a firm warehousing processes, which will result in improving the cost-effectiveness of the industry the firms found itself. The Warehouse Management System is more of a software system that always facilitates the effective administration of the general warehouse operations. with a comprehensive warehouse management system (WMS) implemented, a software customized in designed to meet a specific or general operational that is required for firms to assumes it responsibility for the strategic organization, regulation, and overall functions of the warehouse operations. One of the major objective of warehouse management system (WMS) is to optimize their customer happiness by effectively lowering the overall time it will required from order processing in real-time, resulting in decreased queue lengths and expedited response times. With a dynamic warehouse management system (WMS) will lead to efficient manages essential warehouse operations by directing instructions or commands to the relevant personnel with the help of an internet platform or a computer-based application.

Supply Chain Performance

The supply chain investigates the need and desired of the consumers, behavioral and change of interest, cost effective approaches and different other services that are related to consumers. Supply chain performances create the profitable business margins for industries and provide best outcomes in services to the customers (Alshurideh, *et al.,* 2022). It is also creating the customer experiences and attitude towards the products and hold their interests for a longer period of time. The performance -based structure of the supply chain helps to maintain the criteria in which the accuracy of the time management is considering for deliver the products to its customers (AlBatyneh, *et al.,* 2022). Currently, business industries become efficient to meet the market requirements in terms of customer demand and they are also taking initiative to perform supply chain strategies to fulfill the customer needs at their door step (Farouk, 2022). The supply chain performance measurement is a task of the supply chain management of the business industries that defines the operational activities of the business (Shamout, *et al.,* 2022). The supply chain performance starts from the manufacturing of the raw material to deliver the items in consumers' hands (Eli, &Lalla 2022). It is only depending on the efficient supply chain management that hold the entire business industry and its operations through different strategic networks (Al Kurdi, *et al.,* 2020).

Cost Efficiency

Kinyugo (2021) argued that cost efficiency deals with cost reduction as well as continuous improvement product with the least waste while also having the best resources and change instead of cost containment. The term cost reduction could be used in place of cost efficiency. Cost efficiency consists of those actions that are taken by managers to reduce costs, some of which are prioritized on the basis of information extracted from the accounting system. Kinyugo (2021) noted that while traditional cost control systems have been applied on a continuous basis in organizations, cost efficiency tends to be applied on an ad hoc basis anytime opportunity for cost reduction is identified. Similarly, majority of the approaches that are incorporated within the area of cost efficiency do not necessarily involve the use of accounting techniques. In contrast, cost control relies heavily on accounting techniques. Cost reduction is measured by evaluating whether the manufacturers' cost is higher, equal, or lower than their industrial competitors.

ii. Empirical Review

Huselin, *et al.,* (2024) conducted an empirical study that identified articles between 2017 and 2022 focused on technology in agricultural supply chains. Using Scopus database to utilized and gather pertinent data regarding "technology, agriculture, and supply chain. Finding reveal, the following after accessing 680 articles by perusing their titles, abstracts, and entire articles. 83 articles were eliminated due to duplication, and 213 abstracts were discarded due to screening. In addition, 307 articles were rejected after screening the complete text, and 67 articles were rejected after screening the eligibility of the full text. Hence, only 10 documents were considered appropriate for further analysis. The study found that the technology has transformed the agricultural supply chain operations by using advanced technology such as data analytics, blockchain, IoT and other technological aspects. Additionally, this has significantly contributed to the overall operation of agricultural supply chain tasks and as well as enhanced the capability of stakeholders of agriculture supply chain. Research, Practical & Social implications. Recommendation was for many stakeholders involved in agriculture to benefit from ideas, including agricultural institutions, farmers, landowners, agribusiness managers, producers, suppliers, distributors, customers, and consumers because they will help agricultural supply chain performance.

Christian, *et al.,* (2024) study an empirically investigated the role of warehousing in the logistics supply chain performance of shipping companies in Nigeria. Data were obtained from registered shipping enterprises and warehouse operators in Nigeria to test the hypotheses. Descriptive and inferential statistics were tools for data analysis. The study concluded that warehousing impacts shipping Companies' logistics supply chain performance significantly. From the findings it was established that if warehousing activities are successfully implemented in shipping companies, their logistics supply chain performance will be improved rapidly. Recommendation was that logistics managers and warehousing operators should devise strategies for improving their warehousing activities to achieve effective and efficient logistics supply chain performance. Mwizerwa and Akumumtu (2024) evaluated how inventory management, warehouse capacity building, and material handling affects supply chain performance in Inyange Industries Ltd. The population of the study was 105 staff members of Inyange Industries Ltd. Using census was conducted because the population size is affordable. Questionnaires were used to gather primary data, which was then analyzed. Data analysis with Statistical Package for the Social Sciences (SPSS), and descriptive and inferential statistics were used to show the study's results that reveal supply chain performance is positively and significantly affected by both automated and manual material handling. Mechanical material handling, on the other hand, improves supply chain performance, but not much. Inyange Industries'. Supply chain performance is positively and significantly affected by inventory counts, warehouse management systems, and inventory organization. Supply chain effectiveness is positively and significantly impacted by warehouse demand planning, design, and management. Recommendation was for smooth and Swift warehouse system through capacity building and material handling for better supply chain performance.

Baha (2023) looked at the digital supply chain strategy aims to maximize choices concerning supply and demand, as well as the interdependencies among them, via cutting-edge technology and a deeper knowledge of the responsibilities performed by all stakeholders along the supply chain. Looking at how mobile Internet has contributed to the always-online mentality and the hyper connectivity of people, businesses, and machines in the global digital economy. Social networks amass a mountain of information on their users. Artificial intelligence provides decision-making algorithms and process management automation. Big data technologies allow for the analysis of massive volumes of organized and unstructured data and predictive analytics. The cloud facilitates the sharing of complex data and knowledge across all actors in an ecosystem. When it comes to some tasks, intelligent robots can do away with the need for human workers altogether. Utilizing Augmented Reality (AR) provides a more all-encompassing and in-depth understanding of business processes. The Internet of Things allows for the remote administration of systems and processes, and the blockchain ensures the legitimacy of all involved parties and transactions.

iii. Theoretical Framework

Lean Theory

The lean theory was propounded by James P. Womack, Daniel T. Jones, and Daniel Roos in their book title “the machine that change the world” in the year 1991. The theory is a management philosophy derived from the Toyota production system that focuses on creating value for customers with the use of fewer resources and less waste. The theory emphasizes on eight (8) core principles which include; Customer value: the theory always starts with what customer need that is underrating what the customer values and therefore aim at solving their problems more efficiently. Continuous experimentation: there should be ongoing experimentation in other to achieve a close to perfect value with zero waste, leading to better quality, flow, reduction in time and effort, and lowing cost Respect for people: respect for all stakeholders of customers, employees, suppliers, inventors, and communities, with the believe that all can benefit from the lean practice. Adaptability: with lean practices in place organization

will be highly adaptive to change due to the continuous learning and innovation in work processes. Value-driven purpose: by focus on defining the problem to solve and aligning their work towards value delivering to customers effectively. Management system: any lean organization should require a specific management system that supports operational efficiency and leadership behaviors conductive to lean practices. Continuous improvement: one of the key tenet of the lean theory is the commitment to ongoing improvement in the processes in other to eliminate waste and enhance value delivery. Problem solving: with a culture of problem solving in the lean practices encourage organizations at all level to be driven by innovation and efficiency. Lean theory aims to eliminate waste, which aligns with JIT's goal of minimizing inventory levels and reducing waste with emphasis on continuous improvement (Kaizen) which is also a key principle of JIT. Lean theory's pull-based production approach, where production is driven by customer demand, the lean theory focus on reducing lead time and improving responsiveness aligns with supply chain performance goals too. Lean theory's emphasis on improving quality reduces defects and variability, leading to improved supply chain performance. Lean theory's focus on flexibility and adaptability enables supply chains to respond quickly to changing demand and market conditions.

3. METHODOLOGY

This study employed a descriptive survey research method, which involves the systematic collection of data in a standardized format from a clearly defined population. This method was particularly suitable for exploring the relationship between just-in-time (JIT) inventory practices and supply chain performance in the foam manufacturing sector. The study population consisted of employees from the two foam manufacturing companies operating in Nasarawa and Plateau States, Nigeria, namely Hara Foam and Chemical in Karu, Nasarawa (259 employees), and Vita Foam Nigeria PLC in Jos, Plateau (238 employees), resulting in a total population of 497 employees, as reported by the Manufacturers Association of Nigeria (MAN, 2024). To determine a manageable and statistically significant sample size, the Taro Yamane (1967) formula was applied, considering a 5% margin of error, which yielded a sample size of 222. To account for potential non-response or data loss, a 10% buffer was added, resulting in a final sample size of 244. Proportional allocation using Burnley's formula distributed the sample between the two companies, assigning 127 respondents to Hara Foam and Chemical and 117 to Vita Foam Nigeria PLC. Primary data were collected using a structured questionnaire designed on a five-point Likert scale, which allowed respondents to express their level of agreement or disagreement with various statements. Data were analyzed using multiple regression analysis through the Statistical Package for Social Sciences (SPSS) Version 25, with inferential tests such as the t-test and f-test conducted at a 5% significance level to evaluate the hypotheses and determine the impact of technology and warehouse systems on supply chain performance.

Multiple Regression Model specification

$$\mathbf{SCP = \beta_0 + \beta_1 T + \beta_2 WS + E}$$

Where:

SCP	=	Supply Chain Performance
T	=	Technology
WS	=	Warehouse System
β_0	=	is the intercept of the regression model of performance
E	=	Error term associated with the model

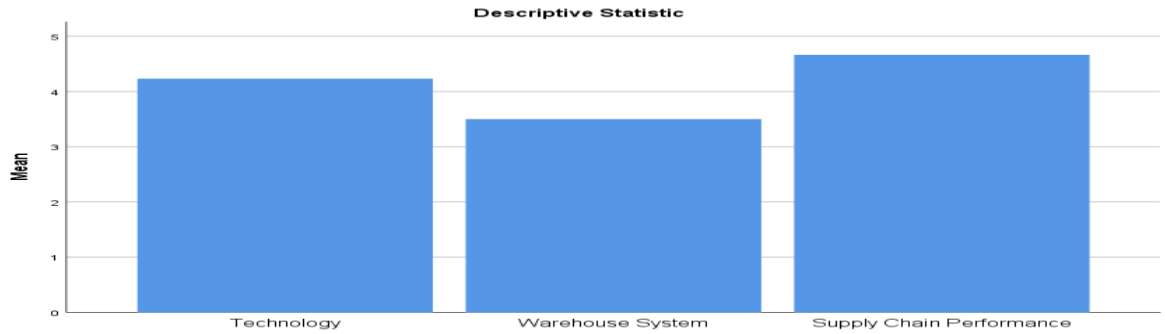
β_1, β_2, β_3, β_4 and β_5 are the rate of change of the just-in-time inventory variables with respect to supply chain performance variable

4. DATA ANALYSIS AND RESULTS

Descriptive Statistics

This section provides descriptive statistics of the variables of the study, using mean and standard deviation. The result is presented on table 3.

Table3: DescriptiveStatisticsofVariables



Source:Field Survey, 2025

Table 3 present the descriptive statistics of the variables of the study. The variables are supply chain performance, technology and warehouse system. All variables were measured in a five point Likert scale. Supply chain performance which have the highest mean of 4.66 which show that majority of the respondents strongly agreed to statement on the questionnaire about supply chain performance. Followed by technology shows a mean of 4.23 which show that majority of the respondents agreed to the statement on technology in the questionnaire and lastly warehouse system shows a mean of 3.50 which show that majority of the respondents agreed to the statement on warehouse system.

Regression Results

Dependent Variable: Supply Chain Performance				
Variable	Coefficient	Std. error	t-statistic	prob.t
(Constant)	1.884	0.208	9.046	0.000
Technology	0.716	0.071	10.052	0.000
Warehouse system	-0.072	0.054	-1.339	0.183
R – squared	.565			
Adj. R – squared	.559			
F – statistics	92.717			
Prob. (R - squared)	0.000			

Table 4: Regression Results

Source: Computed using SPSS v25.

Table 4 shows regression result of the model. The model consists of dependent variable supply chain performance and independent variables (i.e., technology and warehouse system). In the model the multiple coefficients of determination R^2 is 0.565. This means that 56.6% of change in Supply chain performance was caused by changes in independent variables while the remaining 43.4% change in supply chain performance was caused by other factors not included in the model. The f-statistics is 92.717 with p-value of 0.000 which is less than 0.05 and is statistically significant which mean the model is a fit, because it accounts for the variation in the dependent variable.

The effect of independent variable technology on the dependent variable supply chain performance is positive with the coefficient value of 0.716, meaning that a unite increase in technology while other variables remain constant will lead to an increase in supply chain performance by 71.6%. The effect of independent variable warehouse system on the dependent variable supply chain performance is negative with the coefficient value of -0.072, meaning that a unite increase in warehouse system while other variables remain constant will lead to a decrease in supply chain performance by 7.2%

Discussion of Findings

Most of the studies reviewed confirmed that just-in-time inventory management practices has a direct and considerable effect on supply chain performance. In this study technology was found to have a significant effect at (0.000) on supply chain performance. This is in agree with the study of Huselin, *et al.*, (2024) conducted an empirical study that identified articles between 2017 and 2022 focused on technology in agricultural supply chains.Their study found that the technology has transformed the agricultural supply chain operations by using advanced technology such as data analytics, blockchain, IoT and other technological aspects.

Warehouse system was found to not have significant effect at (0.183) on supply chain performance. This could be due to insufficient training for employees on warehouse system usage and management can lead to suboptimal performance. This is in disagreement with the study of Mwizerwa and Akumumtu (2024) evaluated how inventory management, warehouse capacity building, and material handling affects supply chain performance in Inyange Industries Ltd and found supply chain effectiveness to be positively and significantly impacted by warehouse demand planning, design, and management

5. CONCLUSION AND RECOMMENDATIONS

This study concluded that just-in-time inventory management practices had a significant effect on supply chain performance. Technology has a direct and significant effect on supply chain performance this is observed from the adopting new technologies (Artificial Intelligent AI, Blockchain, Internet of Thing IoT) improves supply chain performance. Warehouse system has an indirect and insignificant effect on supply chain performance this can be seen as digital warehouse

system has not been in place which has not lead to space reduction.

The study suggest that united and vita foam manufacturing companies should integrate digital application such as AI-powered predictive analytics can accurately forecast demand, enabling better inventory management and reduced stock outs. analyzes data to identify bottlenecks, predict demand, and optimized delivery times, that is combining technology upgrades with process reworks to achieve significant performance improvement of foam manufacturing companies in Nasarawa and Plateau states of Nigeria. United and Vita foam should identify inefficiencies in their warehouse system by evaluating the warehouse system and try to integrate with other supply chain system.

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