

AUTOMATED STORAGE SYSTEM AND OPERATIONAL EFFICIENCY OF FOOD AND BEVERAGE COMPANIES IN NIGERIA

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Abstract

This study examined the correlation between automated storage system (ASS) and operational efficiency of food and beverage (F&B) companies in Nigeria, focusing on how ASS relates to inventory accuracy, cost saving and space utilization. Founded on the Lean Theory, the study adopted correlational research design with a cross-sectional approach. The population of the study comprised 20 F&B companies in Nigeria. All the companies were studied because the population is small. However, the study collected data from 119 respondents provided through a semi-structured questionnaire consisting 16 measurement items, and designed in 5-point Likert scale. The Pearson Product Moment Correlation (PPMC) statistic was used to test the hypotheses formulated for the study. The results indicates that ASS relates positively and significantly to inventory accuracy, cost saving and space utilization. Based on these findings, the study concluded that there is a positive and significant relationship between ASS and operational efficiency of F&B companies in Nigeria; and recommends that F&B companies in Nigeria that seek improved operational efficiency in terms of tory accuracy, cost saving and space utilization should prioritize investment in ASS to capitalize on long-term cost saving, maximize space efficiency, collaborate with technology providers to design and implement customized ASS, and integrate data analytic tools that allow them to continuously analyze operational data generated by ASS to reduce cost, and stay ahead of competitors.

Keywords: Automated storage system, cost saving, inventory accuracy, operational efficiency, space utilization

Introduction

The food and beverages (F&B) industry in Nigeria faces mounting challenges, including rising consumer demand, fluctuating supply chain dynamics and the need for cost efficiency. Automated storage systems (ASS) have emerged as a critical solution to these challenges, as it revolutionizes inventory management across industries (Adeyemi & Afolabi, 2021). ASS integrate advanced technologies like robotics, artificial intelligence and real-time data analytics to optimize storage, retrieval and order fulfillment processes (Okonkwo et al., 2020).

Operational efficiency, a measure of how effectively resources are utilized to produce desired outputs, is vital for competitiveness in the F&B sector (Nwankwo & Eze, 2022). ASS help to minimize errors, reduce labor costs and improve speed and accuracy in warehouse operations (Adebayo, 2020). In Nigeria, where infrastructural challenges often impede supply chain performance, adoption of ASS is becoming indispensable to competitiveness of businesses (Chukwu & Onuoha, 2019).

This study examined the relationship between ASS and the operational efficiency of F&B companies in Nigeria, with particular focus on how ASS drive productivity, inventory accuracy, cost saving and space utilization. By highlighting recent advancements, the study aims to provide insights into how ASS can transform the F&B sector of Nigeria's economy. The study is underpinned by Technology acceptance model (TAM).

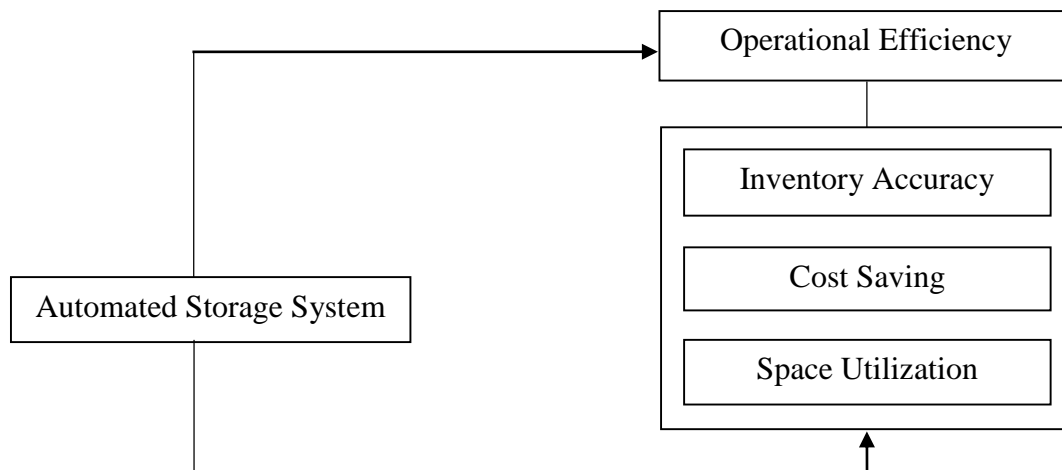


Fig. 1: Conceptual framework of relationship between automated storage system and operational efficiency of food and beverages companies in Nigeria

Source: Adapted from Gajšek et al. (2021).

Theoretical Framework

The technology Acceptance Model (TAM) of Davis (1989) was adopted as baseline theory for the study. TAM is one of the most influential frameworks for understanding adoption and utilization of technology in organizations. TAM posits that two primary factors - perceived usefulness (PU) and perceived ease of use (PEOU) - significantly influence user's attitude toward a technology. These factors ultimately impact behavioral intention to use and actual usage of technology. In the context of ASS and operational efficiency in F&B companies, TAM provides a robust theoretical framework for analyzing how and why these companies adopt automated solutions to optimize their operations.

ASS are innovative technologies that streamline storage, retrieval and management of inventory through automation. For F&B companies, adoption of ASS often hinge on the perceived benefits they provide, such as faster operations, improved accuracy, reduced labor costs, and minimized spoilage. Perceived usefulness, which refers to the extent to which individuals or organizations believe that a technology enhance job performance, is particularly relevant in this case (Venkatesh & Bala, 2008). ASS is likely to be adopted when decision-makers recognize its potential to improve operational efficiency and overall productivity.

Similarly, perceived ease of use - the extent to which a technology is seen as free of effort - plays a critical role in the adoption of ASS. If a technology is viewed as overly complex or difficult to integrate with existing systems, resistance may arise, even if its benefits are acknowledged. F&B companies, especially in Nigeria where technology adoption may face challenges due to infrastructure and skill gaps, are more likely to adopt systems that are user-friendly and require minimal training for employees (Adebayo, 2020).

TAM's emphasis on understanding how technological perceptions influence adoption directly aligns with the study of operational efficiency. ASS can enhance efficiency by reducing manual processes, improving accuracy in inventory management, and enabling real-time monitoring of stock levels. However, these benefits can only be realized if the technology is widely accepted and effectively utilized within the organization. TAM also identify barriers to acceptance, such as employees' resistance to change or perceived high cost of implementation (Davis, 1989).

Furthermore, TAM's adaptability allows for the inclusion of external variables such as organizational culture, technical support, and regulatory compliance, which may affect the adoption of ASS in Nigeria's F&B sector (Venkatesh et al., 2003). By incorporating these contextual factors, the model provides a comprehensive understanding of how technology adoption influences operational outcomes.

Thus, TAM serves as a valuable theoretical lens for examining the correlation between ASS and operational efficiency of F&B companies. By focusing on perceived usefulness and ease of use, TAM provides insights into factors that drive or hinder adoption of automation technologies. This understanding is essential for addressing adoption barriers and leveraging automated systems to enhance operational performance in the sector.

Concept of Automated Storage System

ASS is a system that utilizes machinery and software to handle, store and retrieve stock in warehouses with minimal human intervention. They are systems designed to improve operational efficiency by optimizing space utilization, increasing accuracy, and reducing the time required for inventory handling (Gupta & Arora, 2021). ASS are seen in different mechanized solutions that integrate robotics, conveyor systems and control software to facilitate automated handling, storage, and retrieval of inventory in warehouses. ASS are particularly useful in high-volume operations, as they streamline workflows and enhance speed and precision of order fulfillment (Smith et al., 2020).

The F&B industry is highly dynamic and competitive, requiring organizations to adopt innovative solutions to optimize their operations and remain competitive. ASS have become a transformative technology in warehouse and inventory management, particularly in addressing challenges such as perishable goods, high demand variability, and regulatory compliance (Gupta & Arora, 2021). F&B firms deal with unique operational challenges (maintaining quality and safety of perishable goods, managing temperature-controlled environments, and complying with strict regulations). ASS play a pivotal role in overcoming these challenges by ensuring accurate inventory management, rapid order fulfillment and traceability (Adebayo, 2020).

Furthermore, ASS allow companies to optimize storage capacity by efficiently utilizing vertical and horizontal space, which is especially critical in urban areas where warehouse space is limited (Chukwu & Onuoha, 2019). By minimizing the need for manual handling, ASS also reduce the likelihood of product damage and contamination, which is vital to maintaining quality of F&B products. Implementation ASS has direct and measurable impact on operational efficiency. Firstly, ASS significantly reduce labor costs by automating repetitive tasks like picking, sorting and stocking; and allow employees to focus on higher-value activities, like quality control and customer service (Smith et al., 2020). Secondly, the precision and speed of ASS leads to faster order processing and reduced lead times, enabling companies effectively meet customer demand.

ASS also enhance inventory accuracy by using advanced sensors and real-time monitoring systems, thus, reduce errors associated with manual stock-taking (Okonkwo et al., 2020). For F&B companies, this level of accuracy ensures that stock levels are maintained appropriately, preventing both overstocking and stockouts. Additionally, automation reduces energy consumption in warehouses by optimizing material movement and reducing idle time, contributing to cost savings and sustainability.

While the benefits of ASS are significant, their adoption in Nigeria's F&B industry faces challenges, including high initial investment costs, lack of skilled personnel and infrastructure

limitations (Nwankwo & Eze, 2022). However, the long-term benefits of improved operational efficiency, reduced wastage and enhanced customer satisfaction outweigh these challenges, making ASS a strategic investment for forward-looking companies.

Concept of Operational Efficiency

Efficiency focuses on optimal use of resources to achieve “best possible outcomes” (Ateke et al., 2025). Efficiency in business studies, represent positive outcome of comparison of input employed and output obtained; and is often exemplified in a firms’ ability to generate maximum outputs with minimal resources (Ateke et al., 2025). Operational efficiency therefore, refers to the ability of a company to optimize its processes, resources and workflows to deliver high-quality products at the lowest possible cost while meeting customer demand. It involves minimizing waste, reducing production costs and maximizing productivity through streamlined operations and effective supply chain management (Nwankwo & Eze, 2022).

In the context of F&B companies, operational efficiency is the degree to which a firm achieve its production and delivery goals using the least amount of time, effort and resources while maintaining product quality and adhering to regulatory standards. It encompasses the optimization of manufacturing processes, inventory management, and distribution systems (Adebayo, 2020).

Operational efficiency is critical to the success of F&B companies, as it directly impact their ability to produce high-quality products, meet consumer demand and remain competitive in a cost-sensitive market. Thus operational efficiency in the context of F&B companies, also include maintaining the freshness and safety of perishable goods, adhering to regulatory standards, and ensuring timely delivery to consumers (Adebayo, 2020).

F&B companies face numerous challenges that can hinder operational efficiency. These include fluctuating consumer demand, inventory mismanagement, high levels of waste, labor-intensive processes, and compliance with stringent safety and quality standards. Additionally, infrastructure limitations and inefficient supply chain management are common obstacles, particularly in emerging economies like Nigeria (Chukwu & Onuoha, 2019). Addressing these challenges requires innovative solutions that streamline operations and reduce costs while ensuring product quality and safety.

Operational efficiency is a multi-dimensional concept encompassing a wide range of performance indicators that enable organizations evaluate how effectively they convert inputs into outputs while minimizing waste and maximizing productivity. Thus, there are various indicators of operational efficiency. According to Richards (2017), operational efficiency is typically assessed using several KPIs, including: order inventory accuracy rate, inventory turnover, order cycle time, cost per order, warehouse space utilization rate, and labor productivity. In the context of F&B companies productivity, cost saving and customer satisfaction are commonly used to measure operational efficiency (Gajšek et al., 2021). In this study however, inventory accuracy, cost saving and space utilization are adopted and examined.

Inventory accuracy

Inventory accuracy plays a vital role in warehouse operations by determining efficiency, cost control, and service quality. It refers to the correctness of recorded versus physical stock, as well as precision in order picking, shipping, and data entry. In the Nigerian F&B sector where perishability and regulatory standards are critical, automation technologies such as Automated

Storage and Retrieval Systems (AS/RS), conveyor belts, and robotic picking systems enhance inventory accuracy by minimizing human error and enabling real-time monitoring.

According to Richards (2017), accurate inventory systems directly influence service quality and cost efficiency. AS/RS can achieve over 99.9% accuracy through barcode and RFID integration (Frazelle, 2012), while conveyors equipped with sensors detect and correct misrouted items (Ten Hompel & Henke, 2007), robotic systems improve picking precision, reaching 99% accuracy rates (Bartholdi & Hackman, 2016). Improved inventory accuracy reduces stockouts, returns, and recall risks - crucial for safety and regulatory compliance under standards such as ISO 22000 and NAFDAC guidelines (Okonkwo & Ifediora, 2020).

However, Ajayi et al. (2021) aver that adoption of automated systems face challenges in Nigeria, including high costs, poor infrastructure and skill shortages. TAM suggests that demonstrating the usefulness of automation can improve its acceptance. Lean principles also support automation since error-proof systems minimize waste and enhance process stability (Slack et al., 2016). Empirical insights affirm these benefits. Nestlé Nigeria's automation initiatives reduced shipping errors by over 20% (Business Day, 2021), while semi-automated warehouses report 15% higher inventory accuracy than manual ones (Akinlabi & Olatunji, 2022).

Cost saving

Cost saving in the context of F&B companies refer to reduction in operational expenses achieved by optimizing production processes, improving resource utilization, and minimizing waste while maintaining product quality and meeting consumer demands (Adebayo, 2020). In F&B companies, cost saving involve strategies and initiatives aimed at reducing total operating costs, including labor, materials, energy and logistics, through the adoption of efficient technologies and streamlined supply chain practices, without compromising regulatory compliance and product integrity (Chukwu & Onuoha, 2019).

Cost saving is critical to sustainability and profitability of F&B companies, as they operate in a highly competitive market with tight profit margins. Achieving cost saving in F&B companies is particularly challenging due to the perishable nature of products, fluctuating raw material costs, and compliance with stringent regulatory requirements. However, adoption ASS has emerged as a transformative strategy for reducing costs and improving overall operational efficiency.

Several cost drivers affect F&B companies, including labor costs, energy consumption, inventory holding costs, and waste due to spoilage or mismanagement. Inefficiencies in warehouse operations, such as overstocking, stockouts, and manual handling errors, further exacerbate these costs (Gupta & Arora, 2021). Additionally, the increasing complexity of supply chains and the need for temperature-controlled environments to store perishable goods add to operational expenses (Chukwu & Onuoha, 2019).

Space utilization

Space utilization refers to the strategic allocation and management of warehouse and production space to achieve highest possible storage density without compromising speed of product access or product safety. In F&B companies, space utilization means efficient use of available storage space to optimize storage, handling and retrieval of inventory. Space utilization also involves arranging inventory in a way that maximizes storage capacity while maintaining easy access, thereby improving operational efficiency (Chukwu & Onuoha, 2019). Optimal space utilization is crucial to minimizing overhead costs, improving supply chain operations, and ensuring compliance to safety standards, particularly for perishable goods (Adebayo, 2020).

Space utilization influence efficiency, customer experience and profitability of F&B firms. Effective use of space enhance operational workflows, optimize seating arrangements and improve overall service delivery (Kim & Im, 2020). As urbanization increases and real estate costs rise, F&B establishments must adopt strategic approaches to maximize space efficiency without compromising service quality (Pizam & Tasci, 2019).

Efficient space utilization in restaurants and cafes is essential for balancing customer comfort and operational effectiveness. A well-planned layout can reduce congestion, streamline service delivery, and improve employee productivity (Cheng et al., 2021). The allocation of space for kitchen operations, dining areas, and storage plays a significant role in determining service speed and overall customer satisfaction.

The spatial layout of an F&B establishment affects both operational efficiency and the dining experience. The use of flexible seating arrangements, open kitchen designs, and ergonomic furniture placement can optimize available space while enhancing aesthetics (Wansink & van Ittersum, 2012). For instance, modular furniture and multi-purpose spaces allow establishments to adapt to changing customer demands and seasonal variations (Dutta et al., 2023; Bujisic et al., 2020).

Despite the benefits of efficient space utilization, several challenges persist. High rental costs, strict zoning laws, and the need to maintain aesthetic appeal while maximizing seating capacity are some of the key issues faced by restaurant owners (Smith & Brown, 2021; Pizam & Tasci, 2019). Additionally, customer expectations regarding privacy and comfort may limit the extent to which space can be optimized (Kim & Im, 2020).

Automated Storage System and Operational Efficiency

Here are five empirical research studies that examine the impact of ASS on operational efficiency of F&B companies. Gupta and Arora (2021) investigated impact of automated warehousing systems (AWS) on supply chain efficiency in the F&B Industry in India. The study explored how implementation of AWS improve supply chain efficiency of F&B companies. Specifically, it investigated effects of AWS on inventory management, storage capacity and order fulfillment time. Regression analysis was deployed in the analysis of data. The study found that AWS led to improved inventory accuracy, reduced order fulfillment time, and better space utilization. Companies utilizing AWS experienced 15% reduction in operational costs. Thus, it was concluded that AWS significantly enhanced operational efficiency by contributing to cost saving and improved customer satisfaction.

Adebayo (2020) carried out a study on leveraging automation in supply chain management for cost reduction in food industry operations in Nigeria. The study evaluated the impact of automation technologies, including ASS, on the reduction of operational costs in Nigerian food processing companies. Factor analysis and cost-benefit analysis were deployed. The study found that ASS helped food companies reduce labor costs, space requirements, and spoilage rates, leading to an overall reduction of 20% in operational expenses. Hence, it was concluded that ASS provides significantly improve operational efficiency in the food industry.

Okonkwo et al. (2020) investigated the role of ASS in Nigerian F&B manufacturing. This research examined the role of ASS in improving the operational efficiency of Nigerian F&B manufacturing companies. The focus was on how ASS impacts inventory management and product handling. The study adopted Structural Equation Modeling (SEM) and survey questionnaires, and it was found that introduction of ASS resulted in significant improvements in

stock management, reduced lead times and minimized human errors. The F&B companies reported a 25% reduction in stock-outs and an increase in inventory turnover rates. The study concluded that, adoption of ASS is a key enabler of operational efficiency in terms of improved inventory management and reduced product handling errors.

Nwankwo and Eze (2022) investigated the role of ASS in enhancing operational efficiency of Nigerian manufacturing firms. The purpose of the study was to analyze the contribution of ASS to operational efficiency, with emphasis on cost saving and time reduction in warehousing operations. Data Envelopment Analysis (DEA) and operational performance metrics were conducted. The study indicated that F&B companies that adopted ASS experienced a 30% improvement in operational performance, including reductions in warehouse operational time and costs. Therefore, the study concluded that, ASS is crucial to enhanced operational efficiency by streamlining warehousing operations, reducing costs, and improving processing speed.

Smith et al. (2020) explored the impact of robotics and ASS on operational efficiency of F&B warehouses, focusing on how these technologies affect space utilization, labor efficiency, and cost saving. Case study methodology and performance analysis were conducted. The findings showed that F&B companies that integrated ASS experienced higher throughput, better space utilization (up to 40% more efficient use of warehouse space), and a 15% reduction in labor costs. The study concluded that robotics and ASS significantly improve efficiency of warehouse operations, offering both cost saving and enhanced productivity.

These empirical studies highlight how ASS can enhance operational efficiency by reducing costs, improving inventory management, optimizing space utilization and streamlining warehouse operations in the F&B sector. However, in view of our need to conduct statistical analyses, the following null hypotheses were formulated:

Ho₁: There is no significant correlation between ASS and inventory accuracy of F&B firms in Nigeria.

Ho₂: There is no significant correlation between ASS and space utilization of F&B firms in Nigeria.

Ho₃: There is no significant correlation between ASS and cost saving of F&B firms in Nigeria.

Methodology

This study adopted correlational research design with a cross-sectional approach. The population of the study comprised 20 F&B companies that are listed in the Nigerian Exchange Group (2025). All the companies were studied because the population is small. However, 119 respondents comprising (i) warehouse managers (ii) operations supervisors (iii) IT specialists (iv) supply chain managers (v) logistics personnel (vi) procurement managers and (vii) finance managers provided data for the study through a semi-structured questionnaire consisting of 16 measurement items. The instrument was designed in Likert 5–point scale. Again, to determine the reliability of the instrument, a pilot study (pretest) was conducted and the data were subjected to Cronbach's Alpha reliability test within a threshold of 0.70 set by Nunally (1978). Furthermore, the construct validity of the instrument was determined through Exploratory Factor Analysis (EFA). See Table 1 for results of reliability and validity tests. To establish the correlation between ASS and operational efficiency, Pearson Product Moment Correlation was used to test 3 hypotheses. The analysis was done with the aid of Statistical Package for Social Sciences (SPSS) version 25. Results of the hypotheses are shown in the tables 2, 3, and 4.

Table 1: Results of Reliability and Validity Tests

S/N	Variables	Number of Items	Cronbach's Alpha Coefficients	Factor Loadings
1	Automated storage systems	4	0.799	0.727
2	Inventory accuracy	4	0.740	0.876
3	Space utilization	4	0.707	0.572
4	Cost savings	4	0.728	0.891

Source: SPSS Output form field data

Results of the Cronbach's alpha analysis in Table 1 revealed that all the variables in the study produced high Cronbach's Alpha coefficients. This is an evidence to show that, there is inter-item consistency among the variables in the study. In other words, if this study is conducted again in a similar condition the results will be similar to the results of this study. Again, all the variables have high factor loadings greater than 0.4, indicating that the items and variables in the questionnaire measured what they were supposed to measure. These loadings indicated that there is no cross-loading hence there is discriminant validity.

Test of Hypotheses and Results

Table 2: Correlation between Automated Storage System and Inventory Accuracy

		Automated Storage System	Inventory Accuracy
Automated Storage System	Pearson Correlation	1	.601**
	Sig. (2-tailed)		.000
	N	119	119
Inventory Accuracy	Pearson Correlation	.601**	1
	Sig. (2-tailed)	.000	
	N	119	119

** . Correlation is significant at the 0.01 level (2-tailed).

Source: Field Survey, 2025.

Pearson correlation analysis was run to assess the correlation between ASS and inventory accuracy of F&B companies in Nigeria. Using data obtained from 119 respondents drawn from 20 F&B companies in Nigeria, the analysis revealed - as shown in Table 2 - that, ASS has strong, positive and significant correlation with inventory accuracy of F&B companies in Nigeria. This result is evident in the correlation coefficient of 0.601 and a probability value of $0.000 < 0.05$. In view of this result, we reject the hypothesis and confirm that ASS has significant correlation with Inventory Accuracy of F&B companies in Nigeria.

Table 3: Correlation between Automated Storage System and Cost Saving

		Automated Storage System	Cost Saving
Automated Storage System	Pearson Correlation	1	.890**
	Sig. (2-tailed)		.000
	N	119	119
Cost Saving	Pearson Correlation	.890**	1
	Sig. (2-tailed)	.000	
	N	119	119

** . Correlation is significant at the 0.01 level (2-tailed).

Source: Field Survey, 2025.

Table 3 demonstrates the result of P(R) test conducted to assess the correlation between ASS and cost saving of F&B companies in Nigeria. Using data collected from 119 respondents drawn from 20 F&B companies in Nigeria, the analysis revealed that ASS has very strong, positive and statistically significant correlation with cost saving of F&B companies. This result is evident in the correlation coefficients of 0.890 and a probability value of $0.000 < 0.05$. Thus, the null hypothesis was rejected.

Table 4: Correlation between Automated Storage System and Space Utilization

		Automated Storage System	Space Utilization
Automated Storage System	Pearson Correlation	1	.439**
	Sig. (2-tailed)		.000
	N	119	119
Space Utilization	Pearson Correlation	.439**	1
	Sig. (2-tailed)	.000	
	N	119	119

**, Correlation is significant at the 0.01 level (2-tailed).

Source: Field Survey, 2025.

Pearson correlation analysis was run to assess the correlation between ASS and space utilization of F&B companies in Nigeria. Using data collected from 119 respondents drawn from 20 F&B companies, the analysis that ASS has moderate, positive and statistically significant correlation with space utilization of F&B companies in Nigeria. This result is evident in the correlation coefficient of 0.439 and a probability value of $0.000 < 0.05$. In view of these facts, the researchers reject the hypothesis which denies the existence of significant correlations between ASS and space utilization of F&B companies in Nigeria.

Discussion of Findings

This study examined the correlation between ASS and operational efficiency of F&B companies in Nigeria. The statistical analyses conducted, revealed ASS has a strong, positive and statistically significant correlation with inventory accuracy, a very strong positive statistically significant correlation with cost saving; and a moderate positive and statistically significant correlation with space utilization of F&B companies in Nigeria. These findings cohere with findings of Arora and Sharma (2020) who investigated the impact of warehouse automation on operational performance in food processing firms in India, and revealed that warehouse automation significantly improve inventory accuracy, reduces human error, and optimizes space utilization.

The findings also conform to that of Adebayo (2020) whose study on “leveraging automation in supply chain management for cost reduction in food industry operations in Nigeria” revealed that ASS help food companies reduce labor costs, space requirements and spoilage rates. Similarly, the current findings reecho the results of Okonkwo et al. (2020) whose investigation on the role of ASS in Nigeria’s F&B manufacturing sector showed that ASS results in significant improvement of stock management, reduced lead times and minimizes human errors.

The F&B companies reported a 25% reduction in stock-outs and an increase in inventory turnover rates. The results are also in agreement with the results of Nwankwo and Eze (2022) who investigated the role of ASS in enhancing operational efficiency in Nigerian Manufacturing Firms. The study indicated that F&B companies that adopted ASS experienced a 30% improvement in operational performance, including reductions in warehouse operational time and costs.

In addition, our findings support the results of Smith et al. (2020) who investigated robotics and ASS in F&B warehouses in the context of global companies in the United States; and found that F&B companies that integrated ASS experienced higher throughput, better space utilization (up to 40% more efficient use of warehouse space), and a 15% reduction in labor costs. The study of Smith et al. (2020) highlight how robotic picking system enhance operational efficiency by reducing costs, improving inventory management, optimizing space utilization, and streamlining warehouse operations in the F&B sector.

Conclusion and Recommendations

This study examined the correlation between ASS and operational efficiency of F&B companies in Nigeria. The study found that there is a positive and significant relationship between ASS and operational efficiency of F&B companies in Nigeria. These findings affirm that F&B companies in Nigeria that adopt ASS enjoy greater inventory visibility, reduced stock discrepancies, faster processing time and improved warehouse layout utilization. Thus, ASS is not just a technological upgrade but a catalyst for operational transformation in the F&B beverage sector. That is, F&B companies in Nigeria that embrace ASS are more likely to achieve superior operational outcomes and maintain competitive edge in both domestic and international markets.

The study therefore concludes ASS is a catalysts for operational efficiency of F&B companies in Nigeria; and recommends that F&B companies in Nigeria that expect improved operational efficiency should prioritize investment in ASS to capitalize on long-term cost savings; explore the use of ASS that maximize space efficiency, such as vertical storage solutions and automated retrieval systems; train employees in the operation and maintenance of these systems; and identify areas where ASS may need upgrades or adjustments, ensuring that the systems remain efficient and aligned with the company's operational goals.

Additionally, F&B companies in Nigeria should collaborate with technology providers to design and implement customized ASS. These solutions should be tailored to specific operational needs, such as managing temperature-sensitive products or high-demand goods, which are common in the F&B industry. Beyond real-time monitoring, F&B companies in Nigeria should integrate data analytics tools that allow them to continuously analyze operational data generated by ASS.

By following these recommendations, F&B companies in Nigeria can harness the full potential of ASS to improve operational efficiency and stay ahead of competitors. Automation is not just a technological upgrade but a strategic investment that enhances productivity, optimizes resources, and ensures better overall business performance. Through thoughtful implementation and ongoing evaluation, companies can realize significant operational gains and sustainable growth.

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