Journal of Commerce Management and Tourism Studies, Vol. 3 No. 3 (December 2024), p. 231—243
e-issn 2964-9927 DOI: https://doi.org/10.58881/jcmts.v3i2
http://ympn.id/index.php/JCMTS

Navigating supply chain management: Technology adoption in Southeast Nigerian breweries

Kelechi Enyinna Ugwu[1], Olu Balogun[2]

Federal University of Technology Owerri, Imo State Nigeria[1,2]
[1]Email: kelechi.ugwu@futo.edu.ng

Abstract - The study focuses on evaluating the influence of the adoption of technological advancement on supply chain management in Selected Nigerian Brewery Plc, South-East Zone Nigeria. The research employed a survey design and questionnaire as instruments for data collection. The total population of the study comprised 2,100 staff of the organization. Taro Yamane method was used to estimate the sample size which produced a result of 336. A proportionate allocation formula was applied in the distribution of the survey in the following states: River State, Bayelsa, Akwa Ibom, Delta, and Edo State, Nigeria. Out of 336 copies of a questionnaire sent to the participants, only 321 were returned and utilized for the study while the remaining 15 copies were not utilized for this study. The study hypotheses were statistically tested and analyzed using Pearson correlation methods at a 5% significance level. The findings of research hypothesis one indicates that artificial intelligence (AI) adoption positively contributes to supply chain visibility (SCV) when the p-value (.000) is less than a 5 % level of significance ($p < 0.05$). The researcher recommends that businesses should create a demand forecast based on using historic sales to meet customer demands. Management of the Nigerian Brewery Plc should continue to invest in advanced technologies such as AI and IoT to further enhance supply chain operations. This will help maintain a competitive edge in the market by improving efficiency and reducing costs. This study adds to the body of knowledge by presenting data on the beneficial effects of technology improvements on supply chain management in the Nigerian brewery industry. The study would guide the Nigerian government to implement e-government, and e-health services to citizens.

Keywords: technological advancement, artificial intelligence, blockchain technology, supply chain management, supply chain visibility and demand forecasting

1. Introduction

Over the years, recent developments in technological advancement have significantly changed various industries, and Nigerian Brewery International's developments are no exception. As this new technology continued to evolve, warehouse workers have taken advantage of it to streamline workflows and improve supply chain efficiency (Koegler, 2023). Presently, most firms are turning to innovative technology to manage their global supply chain, improve worker productivity, reduce costs, and optimize workflows. The use of Augmented reality-(AR) technology has contributed to improving supply chain management in the warehouse. This innovative technology is utilized in the warehouse to access vital information (such as product weight, and dimensions) and to receive guidance on the best routes for picking and packing products. This technology enables workers to perform their tasks with precision and efficiency to ensure that

the right products are delivered to the right location. Workers often use this technology to access vital information and improve communication on the warehouse floor.

Additionally, companies presently use sensors and actuators such as radio frequency identification (RFID), GPS, POS tags, and other smart devices to collect real-time data on their inventory, transportation, and other aspects of their supply chain (Papadopoulos, Baltas & Balta, 2020; Fossi Wamba, Gunasekaran, Dubey and Ngai, 2018). This data is used to make informed decisions that can improve efficiency and reduce and optimize processes. Recent advancements in technology have significantly transformed supply chain management, and SCM, enhancing efficiency, transparency, and resilience. Emerging technologies are key drivers of efficiency and innovation in supply chains.

Recent research emphasizes the integration of digital technologies such as the Internet of Things- IoT, artificial intelligence- AI, and blockchain to enhance supply chain visibility and resilience (Kumar, & Singh, 2023). AI-driven solutions can analyze huge volumes of data, understand relationships, provide visibility into operations, and support better decision-making AI a potential game-changer (McKinsey Report, 2021; Martinez & Gupta, 2023). Similarly, Miller (2023) identified the potential of emerging technologies in revolutionizing supply chain processes, building resilience, and maintaining operational flexibility to adapt to future challenges of firms. Another study by Khoa and Toai (2024) has identified the role of artificial intelligence in optimizing supply chain planning and decision making enabling the organization to tackle the complexities of modern supply chains. The authors noted that AI solutions can be deplored in the supply chain to analyze historical data and market trends to predict future demand accurately. Innovative technology can optimize transportation routes, modes, and schedules, and assist in supplier selection and risk management.

Supply-chain management solutions based on artificial intelligence (AI) are expected to be potent instruments to help organizations tackle these challenges (McKinsey Report, 2021). An integrated end-to-end approach can address the opportunities and constraints of all business functions, from procurement to sales. Getting the most out of these solutions is not simply a matter of technology, however; companies must take organizational steps to capture the full value from AI. Building resilient supply chains that can withstand and quickly recover from disruptions is a top priority for many organizations, particularly in the wake of recent global events (Wieland & Durach, 2022). The COVID-19 pandemic has highlighted vulnerabilities in global supply chains, prompting a reevaluation of strategies and increased focus on resilience and risk management (Ivanov, & Dolgui, 2022).

Previous studies have identified a linkage between technological advancement and supply chain management with mixed results. A study by Hu and Yao (2023) using Chinese firms have found that technological innovation has significantly improve supply chain effectiveness and sustainability. A study by Ifekandu and Ifekandu (2024) revealed that value innovation significantly impacted product availability, on-time delivery, and supply chain flexibility of food and beverage firms in South-South Nigeria. A similar study by Pereira and Shafique (2024) using humanitarian organizations in Pakistan found that the use of artificial intelligence – big data analytical capabilities significantly enhance information alignment and supply chain agility. Another study by Shukla, Kumar, Rana, and Prasha (2024) using the food delivery sector discovered that perceived risk and digital culture have a negative influence on the adoption intention of blockchain technology.

The use of artificial intelligence offers promising solutions to promote supply chain visibility by deploying data analytics, machine learning, and real-time monitoring in supply chain operations. However, implementing artificial intelligence presents several challenges for Nigerian Breweries Heineken International. Artificial Intelligence requires large information from multiple stakeholders, such as suppliers, manufacturers, and logistics service providers for training and decision-making. In the case of the Nigerian Brewery PLC, collecting accurate and comprehensive data on various parameters such as temperature, fermentation rates, and ingredient quality can be difficult. Ensuring that the collected data is clean, consistent, and free from errors is critical. Poor data quality can lead to inaccurate predictions and suboptimal

outcomes which would in turn affect supply chain visibility. Therefore, poor quality of data poses several challenges for supply chain visibility. In addition, many breweries use legacy systems and equipment that may not be compatible with modern AI technologies. Integrating AI with these systems can be complex and costly. Furthermore, developing and implementing AI solutions requires specialized knowledge in both AI and brewing processes. Breweries may need to invest in training their staff to understand and work with AI technologies, which can be time-consuming and expensive. Finding professionals with expertise in both fields can be challenging. Poor data quality and skill gaps can affect the implementation of supply chain activities. These problems necessitate the study objective formulated below.

This study aims to evaluate the influence of the adoption of technological advancement on supply chain management in Selected Nigerian Brewery Plc, South-East Zone. The specific objective seeks to evaluate the extent to which the adoption of artificial intelligence (AL) devices relates to supply chain visibility in Selected Nigerian Brewery Plc, South-East Zone.

1.1 Review of Related Literature

1.1.1 Technological Advancement

Technology adoption is defined as the process by which an innovation or new technology is accepted, integrated, and used by an individual, group, or organization (Hall, & Khan, 2003). It encompasses the entire cycle, from the initial awareness and interest in technology to its regular and proficient use. The author posits that technology adoption goes beyond simply acquiring a new device or software. It involves actively integrating technology into workflows, tasks, or daily routines to derive value from it.

Technological adoption refers to the use of new technologies in operations and daily activities by individuals and organizations (Oliveira, Thomas, Baptista, & Campos, 2020). The integration and effective utilization of new technologies for businesses are geared towards enhancing their operations, improving productivity, and gaining competitive advantage (Rymarczyk, 2020). The adoption of new technology is relevant in the health sector in predicting healthcare providers' and patients' ability to accept and use new medical technologies and systems, to improve health outcomes and diagnostic tools. Technology adoption can assess patients' perceptions of telehealth consultations, including concerns about privacy, security, and effectiveness.

A study by Ferreira, Monteiro, and Águas (2011) explores the application of UTAUT to understand patient use of telehealth services, emphasizing the role of facilitating conditions like reliable internet access. UTAUT can be used to evaluate factors influencing healthcare providers' willingness to use EHRs. Venkatesh, Morris, Davis, and Davis (2003) discuss the original UTAUT model's applicability to understand user acceptance of information technology in healthcare settings.

1.1.2 Artificial Intelligence

Artificial Intelligence is defined as the application of computer systems to perform tasks normally requiring human intelligence (Scott, 2024). These tasks include learning, reasoning, problem-solving, perception, and language understanding. Algorithms are part of the structure of artificial intelligence, where simple algorithms are used in simple applications, while more complex ones help frame strong artificial intelligence. Artificial intelligence technology is apparent in computers that play chess, self-driving cars, and banking systems to detect fraudulent activity.

According to Pushkar (2024), artificial intelligence refers to the use of machines to perform several tasks using human intelligence. This technology allows machines to learn on their own from past data and the information given, make sense of it, and use this information to do lots of business tasks. AL is a component of machine learning and deep learning, and these technologies have their own sets of responsibilities while equipping machines.

AI is revolutionizing supply chain management by enhancing efficiency and transparency in demand forecasting, logistics optimization, and risk management (Lenovo Story Hub, 2024). An AI-powered solution with the aid of Supply Chain Intelligence (SCI) can continuously analyze supply chain data to identify potential issues and resolve them in real time. AI is revolutionizing supply chain visibility by integrating vast amounts of data from various sources to provide end-to-end transparency.

A recent study conducted by IBM Index (2023), which surveyed 3,000 CEOs from over 30 countries and 26 industries, highlights several critical aspects of technology adoption, particularly focusing on generative AI. The report indicates that early adopters of companies with AI recorded 59% of investments and rollout in the past 24 months, with countries like China and India leading the way. The findings also identified the top barriers preventing the deployment of AL including limited AI skills and expertise (33%), too much data complexity (25%), and ethical concerns (23%). Another study also found that AI adoption has remained steady at large organizations surveyed found that Organizations in India (59%), the UAE (58%), Singapore (53%), and China (50%) are leading the way in active use of AI, compared with lagging markets like Spain (28%), Australia (29%), and France (26%). The study also found that companies within the financial services industry are most likely to be using AI, with about half of IT professionals within that industry reporting that their company has actively deployed AI. 37% of IT professionals within the telecommunications industry state that their company is also deploying AI.

1.1.3 Supply Chain Management

Fernando et al (2024) defined supply chain management as the centralized management of the flow of goods and services to and from a company and includes all the processes involved in transforming raw materials and components into final products. Supply chain management components can cut excess costs and deliver products to the consumer faster and more efficiently. The five most critical phases of supply chain management are planning, sourcing, production, distribution, and returns. A supply chain manager is tasked with controlling and reducing costs and avoiding supply chain shortages.

Perkins et al (2021) defined supply chain management as the process by which an enterprise manages the sourcing of raw materials to create a product or service and deliver that product or service to customers. The goal of supply chain management is to improve supply chain performance. Timely and accurate supply chain information allows manufacturers to make several products that can be sold. Effective supply chain management helps both manufacturers and retailers reduce excess inventory. This decreases the cost of planning, shipping, insuring, and storing products that cannot be sold.

A recent study by Liddell (2024) on supply chain management (SCM) has highlighted that technological integration and automation are transforming supply chain management by enabling swift development and deployment of applications with minimal coding. This facilitates the automation of various supply chain tasks, making the systems more agile and resilient to disruptions. According to the author, digital technologies such as control towers and digital twins are improving visibility and transparency across supply chains.

Additionally, supply chain management today is a multifaceted and technologically driven discipline focused on optimizing the entire supply chain process from raw material sourcing to product delivery. It aims to enhance efficiency, reduce costs, and improve customer satisfaction through integrated and collaborative efforts across all parties involved.

1.1.4 Supply Chain Visibility

Robinson (2017) defined supply chain visibility as the ability to track different goods and or products in transit, giving a clear view of the inventory and activity. It enables shippers to improve customer service and cost controls through the management of inventory in motion, proactive status updates, limiting disruptions, and risk mitigations. As a result, the supply chain will become stronger and more agile in the process of having good visibility. The goal of supply chain visibility is to gain advanced insights into how your supply chain network works.

Supply chain resilience refers to the ability of a supply chain to anticipate, adapt and recover from disruptions swiftly and effectively while maintaining continuous operations (Mehrhoff, 2023). It involves the capacity to withstand and bounce back from various challenges such as natural disasters, economic fluctuations, geopolitical changes, supplier issues, or unexpected events like the recent COVID-19 pandemic. According to the author, supply chain resilience is characterized by the ability of firms to anticipate risks and identify potential disruptions of risks in advance to proactively prepare for them.

Journal of Commerce Management and Tourism Studies, Vol. 3 No. 3 (December 2024), p. 231—243
e-issn 2964-9927 DOI: https://doi.org/10.58881/jcmts.v3i2
http://ympn.id/index.php/JCMTS

Supply chain resilience is the ability of a supply chain network to withstand disruptions and minimize the effects of upheaval or revenues, costs and customers (GEP, 2024). Resilience supply chains help enterprises to respond more effectively to radical economic, technological and market changes to achieve competitiveness.

Recent studies on supply chain resilience have highlighted various approaches and strategic changes necessary to cope with disruptions. One study by Holgado and Niess (2023) explores how multinational companies are responding to frequent major disruptions. It identifies five categories of recovery actions: leveling, rationing, buffering, bridging, and boundary redefining. Additionally, the study outlines key strategic changes in competitive priorities and internal coordination structures to enhance resilience in global supply chains.

Another significant study by Ababou et al (2023) focuses on the food industry, conducting a bibliometric analysis of research trends in food supply chain resilience. This study categorizes research into five clusters: food systems resilience and public health, seafood supply chain resilience, digital and sustainable food systems, agri-food Industry 4.0, and meat production resilience. It emphasizes the importance of robust food supply chains to maintain public health during disruptions.

1.2 Theoretical Framework

This study adopted the Theory of Constraints (TOC) which is stated below.

1.2.1 Theory of Constraints (TOC)

This study is anchored on the theory of Constraints (TOC) postulated by Israel's Physicist, Goldratt in 1984. He developed a revolutionary method for production scheduling (Goldratt, 1984; Goldratt, 1980). The central idea of the theory is that all systems including businesses and manufacturing processes have at least one performance-limiting constraint. These constraints can be in the form of physical limitations such as machine capacity, or intangible limitations such as skilled labor availability. TOC emphasizes that resources spent optimizing non-constraints yield minimal benefits. Instead, by focusing on the constraint and implementing solutions like bottleneck scheduling or process improvements, true progress is achieved. The scholar argued that resolving the limitation would significantly enhance overall system efficacy (Goldratt, 1984; Goldratt, 1990; Goldratt & Cox, 2016; Watson, Blackstone & Gardiner, 2007). In addition, TOC has received some criticism despite its widespread adoption. Some critics argue that TOC oversimplifies complex systems and that focusing solely on the constraint can neglect other important aspects of business management. Additionally, the theory also focuses on short-term gains over long-term strategic improvements. Alternately, the theory addresses physical constraints and ignores human and behavioral factors that can also limit system performance. Finally, identification of the true constraint can be challenging, requiring careful analysis and potentially leading to implementation delays.

Despite the criticism of the theory, it is applied in production environments to streamline operations and increase throughput. By focusing on the most critical bottleneck in the production process, organizations can enhance efficiency, reduce cycle times, and improve overall productivity. TOC is applied in a production environment to identify and exploit constraints. This involves identifying the single point in the production process that limits overall system performance. This could be a machine, a process, or a resource. Once the constraint is identified, it is crucial to optimize its performance. This can involve ensuring the constraint is always working at its maximum capacity, reducing downtime, and eliminating non-value-added activities (Schragenheim, Dettmer, & Patterson, 2009; Goldratt & Cox, 2016).

In addition, the theory of constraints has become more relevant in Supply Chain Management. It is a powerful tool used for identifying and managing bottlenecks in the supply chain, ultimately improving overall efficiency and responsiveness (Goldratt & Cox, 2016; Simatupang, Wright, & Sridharan, 2004). By focusing on the most critical constraint within the supply chain, organizations can enhance flow, reduce delays, and better meet customer demands. Examples of TOC applications in Supply Chain Management include retail supply chain, automatic supply chain, and consumer goods supply chain.

1.3 Empirical Review

Several researchers have carried out studies on technological advancement in supply chain management within Nigeria and the rest of the world. However, some of the findings have produced both positive and negative results in literature. Some of these reviews are shown below.

1.3.1 The influence of technological advancement and supply chain management

Hu and Yao (2023) explored how developments in artificial intelligence, the Internet of Things, and big data have changed supply chain practices and their consequent effects on environmental sustainability in various Chinese cities. The findings showed both a high and low relationship between technological innovation, supply chain effectiveness, and sustainability.

Ifekandu and Ifekandu (2024) explored frugal innovation strategies and supply chain performance of food and beverage firms in South-South Nigeria. The study adopted a correlational research design. The population of the study comprised 82 registered food and beverage firms in the South-East. The sample size was determined using the Taro Yamane formula and calculated as 68. The study hypothesis was tested and analyzed using Pearson product-moment correlation coefficients. The findings revealed that value innovation significantly impacted product availability, on-time delivery, and supply chain flexibility of food and beverage firms.

Medina et al (2023) explored supply chain finance along different supply chain stages using the Italian agri-food industry. The study explored multiple exploratory case studies of Italian firms. The study adopted a qualitative research method. Data was analyzed using content analysis with the aid of Nvivo. Empirical data confirmed that different SC stages (producer, cooperative, processor, and retailer) adopt different SCF solutions ((reverse factoring, dynamic discounting, inventory finance, and Minibond), influenced by different contingent variables, drivers, and barriers.

Harju et al (2023) assessed the impact of procurement digitalization on supply chain resilience using empirical evidence from Finland. The study adopted a survey research design and questionnaire as instruments for data collection. The total population of the study comprised 388 firms and a sample of 147 was drawn from the population. The hypothesis was tested and analyzed empirically using partial least squares to generate results. The result showed that the procurement function's capacity to use data analytics and attain digital process maturity positively affects the level of information sharing in the supply chain. Information sharing and supply chain risk management mediate the positive relationship between procurement digitalization and resilience in the supply chain.

Anis et al (2022) explored technological advances in the supply chain of processed foods during COVID-19. The study used a systematic literature review to locate articles on processed foods, food delivery, and supply chains. The study concludes that blockchain-based food supply chains, value stream mapping, sustainable supply chain domain, and online ordering systems via mobile applications served as information and communication technology platforms during covid 19.

1.3.2 The influence of artificial intelligence (AL) devices on supply chain visibility

Pereira and Shafique (2024) established a link between digital and humanitarian supply chain management in Pakistan. The population of the study comprised of humanitarian organizations. A simple random sampling method was adopted in data collected from 242 respondents using an online questionnaire. The partial least square and structural equation modeling techniques were utilized in testing and analyzing data. The findings showed that artificial intelligence and big data analytical capabilities are beneficial for information alignment and supply chain agility.

Elkady and Sedky (2023) explored artificial intelligence and machine learning for supply chain Resilience. The study explored systematic literature to review articles on the main subject. The findings emphasized the potential of artificial intelligence and machine learning to improve decision-making processes, optimize resource allocation, increase supply chain visibility, and promote sustainable practices.

Luqman, Ahmad and Hussain (2023) examined the influence of supply chain resilience and supply chain capability on supply chain performance in the United Arab Emirates energy sector. The study adopted a correlation survey research and questionnaire to collect primary data from a sample of 168 participants. The study also utilized a Partial least square-structural equation

modeling in testing and analyzing the hypothesis. The findings showed that supply chain resilience and supply chain capability were found to have a significant positive effect affecting a supply chain performance by mediating role in improving performance during or after a supply chain disruption.

Lima and Shala (2020) evaluated artificial intelligence for face recognition in the recruitment process in Kosovo. The study used systematic literature review by making use of a sample of 24 articles that covers the period of 2006 to 2000 indexed in the Scopus database. The study found that face recognition feature is significant in the recruitment process to know more about the applicant information.

Long et al (2023) wrote on Intelligent selection of healthcare supply chain mode – applied research based on artificial intelligence in China. The study used a systematic literature review approach. The study concludes that the healthcare supply chain mode selected by artificial intelligence is consistent with the target mode. On the contrary, the study noted that the healthcare supply chain mode selected by the basic selection method showed that artificial intelligence has more advantages in the selection of the medical supply chain mode.

Nozari, (2024) investigated Green Supply Chain Management based on the Artificial Intelligence of Everything in the United Arab Emirates, Dubai. The study employed a systematic literature review approach. This research identified the dimensions, components, and indicators affecting the smart, green, and sustainable supply chain based on Artificial Intelligence (AI). It also presented an analytical framework that shows the cause-and-effect relationships of all active actors in this system.

Pereira and Shafique (2024) examined the role of artificial intelligence in supply chain agility: a perspective of the humanitarian supply chain in Pakistan. The targeted population is humanitarian organizations in Pakistan. A simple random sampling method was employed in data collection from a population of 242 respondents using an online questionnaire. The Partial Least Square – square-structural equation Modelling technique has been used for analysis. Findings showed the use of artificial intelligence – big data analytical capabilities are beneficial for information alignment and supply chain agility.

2. Method

2.1 Research Design

Research design is a method that explains how research objectives are met. To achieve the study objective, the researchers carefully choose and implement a survey as an appropriate design to ensure that this study provides valuable and actionable insights. The target population of the study comprised employees of Nigerian Brewery Plc. The total population of the study consists of two thousand one hundred (2,100) staff. These employees are in two Southeast zones, Enugu and Abia State, Nigeria.

2.2 The Population of the Study

The study's sample size consists of three hundred and thirty-six (336) participants from two Southeast zones (Enugu and Abia State). This study also uses Taro Yamane's (1967) formula to determine the sample size for the study. Furthermore, Bowley's (1964) formula was used in assigning questionnaires to each firm. The formula is below.

Yamane formula:

$$n = \frac{N}{1 + N(e)^2}$$

Were,

n = sample size to be determined

N = population size

e = the error of sample at 5% or 0.05 significant level

Yamane formula is stated as follows:

n = The total sample size; N = The population.

$$n = \frac{2100}{1+2100(0.05)^2}$$

$$n = \frac{2100}{1 + 5.25}$$

The sample size is = 336

Bowler's proportional allocation method was used as a sampling technique to allocate appropriately the questionnaire to the selected states and firms. The Bowlers proportional allocation formula is stated below as follows:

$$nh = \frac{nNh}{N}$$

Where nh = Bowley's allocation formula
Nh = Number of items in each stratum in the population.
n = Sample size
N = Population size

Applying the formula, we have:

i). Enugu State -Ama Brewery Office $nh = \frac{336 * 1200}{2100} = 192$

ii). Abia State – Aba Brewery Office $nh = \frac{336 * 900}{2100} = 144$

2.3 Data Collection Method

Additionally, a survey and questionnaire were adopted as methods of data collection to achieve research purposes. Technological Advancement and Supply Chain Management questionnaires were formulated into different sections. All the questions in these sections used a 5-point Likert scale with the following interval scales: "Strongly Agree, SA" = 5, "Agree" AG = 4, "Undecided" UN= 3, "Disagree" DA = 2, and "Strongly Disagree" SD = 1.

2.4 Validity and Reliability of the Instrument

The questionnaire was validated on the face, construct, and content level to ensure the instrument covers the entire range of the concept being measured and to determine whether the instrument accurately measures the theoretical construct it is intended to measure. The Cronbach Alpha was used in testing the reliability of the research instrument with the aid of Statistical Package for Social Sciences (SPSS) version 21, only items with alpha values equal to, or more than 0.7 were used. Pilot Testing was conducted using a preliminary sample questionnaire to identify any issues and make necessary adjustments.

Table 1 Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.9251	.994	5

Source: (SPSS Version 25)

2.5 Data Analysis Method

The Pearson correlation coefficient was utilized as a valuable statistical tool to determine the linear relationships between continuous variables. By understanding its assumptions and conditions of use, researchers can apply it effectively in their analyses.

3. Results and Discussion

3.1 Presentation of Data

This study aims to evaluate the influence of the adoption of technological advancement on supply chain management in Selected Nigerian Brewery Plc, South-East Zone. To achieve this objective, the data were presented following the order of the research questions. Data was collected, tabulated, and analyzed using Statistical Package on Social Science (SPSS Version 25). Out of 336 copies of the questionnaire distributed to the respondents, only 321 were filled and returned, while the remaining 15 were not returned and used for the analysis.

Table 2 Schedule of Questionnaire Response Rate

Journal of Commerce Management and Tourism Studies, Vol. 3 No. 3 (December 2024), p. 231—243
e-issn 2964-9927 DOI: https://doi.org/10.58881/jcmts.v3i2
http://ympn.id/index.php/JCMTS

S/N	Offices	Population	Copies Distributed	Copies Filled and Returned
1	Enugu State (Ama)	1200	192	185
2	Abia State	900	144	136
	Total	2100	**336**	**321**

Source: (Field Survey, 2024)

3.2 Analysis of Research Question One

To what extent does the adoption of artificial intelligence influence supply chain visibility in Selected Nigerian Brewery Plc, South-East Zone?

Table 3 Investigative questions on the adoption of artificial intelligence Technology and supply chain visibility

S/N	Questions	SA	AG	UN	DA	SD	Total
A.	**Adoption of Artificial Intelligence (Independent Variable)**						
1	Our brewery operations have greatly improved with the aid of AI applications.	129	135	22	19	16	321
2	My firm has reduced the cost of operations and increased profitability due to the integration of AI into our operations.	113	119	24	27	18	321
3	AI-driven data analytics have enabled better decision-making and strategic planning within the company.	122	117	39	28	15	321
4	The cost of implementing advanced technology is too high and impacts our financial stability.	126	129	35	23	8	321
5	Employee safety has been enhanced through AI-driven safety protocols and monitoring systems.	120	123	37	29	12	321
6	We have recorded huge job losses and increased unemployment within the company due to the introduction of AI solutions.	131	128	29	23	10	321
7	There is a lack of adequate training and support for employees to adapt to new technological systems.	127	125	27	24	18	321
B.	**Supply chain visibility (Dependent Variable)**						
1	My firm has optimized inventory management and reduced waste as a result of artificial intelligence.	126	137	23	16	19	321
2	The implementation of AI technology has improved our ability to predict and mitigate supply chain disruptions.	131	128	20	25	27	321
3	We can monitor the entire supply chain in real-time, allowing for quicker response to any issues with the aid of new technology.	132	121	31	29	8	321
4	The integration of AI has enhanced our ability to maintain product quality and consistency throughout the supply chain.	135	126	30	26	4	321
5	There is a lack of skilled personnel to manage and operate AI systems effectively within our supply chain.	120	124	36	24	17	321

6	AI-driven supply chain visibility tools are not fully reliable and have occasionally provided inaccurate data.	133	120	28	21	19	321
7	The dependence on AI for supply chain visibility has led to reduced human oversight, increasing the risk of errors.	129	123	25	28	16	321

Source (Field Survey, 2024)

3.3 Test of Research Hypothesis One

$H_{o1:}$ Artificial Intelligence adoption does not significantly enhance supply chain visibility in Selected Nigerian Brewery Plc South-East Zone.

3.3.1 Decision Rule

The study rejects the null hypothesis at a point when the p-value is less than 0.05; otherwise, accept the alternative hypothesis (HA). Table 4 below shows the results of the bivariate linear regression. The null hypothesis which states that artificial intelligence (AI) adoption does not significantly enhance supply chain visibility (SCV) in Selected Nigerian Brewery Plc South-East Zone was rejected. This is because the p-value (000) is less than the critical value (0.05). On the contrary, the alternate hypothesis which states that artificial intelligence (AI) adoption significantly enhances supply chain visibility (SCV) in Selected Nigerian Brewery Plc South-East Zone was accepted.

This result can be explained so far that a .994 unit increase in adoption of artificial intelligence (X) contributed to a 1 unit increase in supply chain visibility. This can be better explained by the implementation of artificial intelligence to improve supply chain visibility. Therefore, a value close to r= 1 indicates a strong (positive) linear correlation existing between X (artificial intelligence, AL) and Y (supply chain visibility, SCV).

Table 4 Bivariate Linear Correlations

		AI	SCV
AI	Pearson Correlation	1	.994**
	Sig. (2-tailed)		.000
	N	320	320
SCV	Pearson Correlation	.994**	1
	Sig. (2-tailed)	.000	
	N	320	320

Source: (SPSS Version 25)

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

Table 5 Descriptive Statistics

Items	N	Minimum	Maximum	Mean
AI	321	8.00	135.00	63.6286
SCV	321	4.00	137.00	64.4857
Valid N (listwise)	321			

Source: (SPSS Version 25)

3.4 Discussion of Findings

Research hypothesis one was tested statistically using the bivariate Pearson correlation method. The result showed that there exists a positive statistical relationship between artificial intelligence (AI) adoption and supply chain visibility (SCV) when the p-value (.000) is less than a 5 % level of significance ($p < 0.05$). This result can be explained that a .994 unit increase in the adoption of artificial intelligence (X) contributed to a 1 unit increase in supply chain visibility. Therefore, a value close to r= 1 indicates a strong (positive) linear correlation existing between X (artificial intelligence, AL) and Y (supply chain visibility, SCV).

4. Conclusions and Recommendations

4.1 Summary of Findings

The summary of the findings is stated as follows:
The findings of research hypothesis one showed that artificial intelligence (AI) adoption positively contributes to supply chain visibility (SCV) when the p-value (.000) is less than a 5 % level of significance ($p < 0.05$). This result can be explained that a .994 unit increase in adoption of artificial intelligence (X) contributes to a 1 unit increase in supply chain visibility.

4.2 Conclusion of the Study

The general objective of this study is to examine the influence of the adoption of technological advancement on supply chain management in Selected Nigerian Brewery Plc, South-East Zone. The findings of research objective one showed that artificial intelligence (AI) adoption positively contributes to supply chain visibility (SCV) when the p-value (.000) is less than a 5 % level of significance ($p < 0.05$). AI can facilitate seamless data sharing between different stakeholders (suppliers, manufacturers, distributors) ensuring everyone has access to the same real-time information.

The adoption of artificial intelligence improves supply chain visibility through inventory optimization, real-time analytics, increased forecasting accuracy, work automation, improved collaboration, and improved customer experiences. The findings agree with the extant literature on the previous work of Elkady and Sedky (2023) which emphasized the potential of artificial intelligence and machine learning to improve decision-making processes, optimize resource allocation, increase supply chain visibility, and promote sustainable practices. The result is also supported by the work of Pereira and Shafique (2024) which explained the potential of artificial intelligence and big data analytical capabilities to enhance supply chain information and supply chain agility.

4.3 Recommendations

Based on findings from the study, the researcher made the following recommendations.

i. Businesses should create a demand forecast based on using historic sales to meet customer demands.
ii. Management of the Nigerian Brewery Plc should continue to invest in advanced technologies such as AI and IoT to further enhance supply chain operations. This will help maintain a competitive edge in the market by improving efficiency and reducing costs.
iii. It is crucial for the human resources (HR) of the organization to provide ongoing training for employees to ensure they are trained to utilize new technologies effectively. This includes upskilling in data analysis, AI tools, and other relevant technologies to maximize the benefits of technological adoption.

4.4 Suggestion for Future Research

Future research could focus efforts on challenges and opportunities associated with emerging technologies like AI, IoT, and blockchain. Again, future researchers should expand the scope of this study by cutting across various industries in Nigeria and the rest of the world on the adoption of technological advancements. This could provide insights into the best practices and highlight industry-specific challenges and solutions. In addition, the researchers also recommend future research on investigating the long-term effects of technological adoption on the sustainability of supply chains, particularly in the manufacturing sectors. Research on environmental impact could offer valuable insights for companies looking to align with global sustainability goals.

4.5 Contribution to Knowledge

This study adds to the body of knowledge by presenting data on the beneficial effects of technology improvements on supply chain management in the Nigerian brewery industry. It draws attention to the influence of AI in boosting supply chain visibility. The study also contributes to existing literature through the identification of useful concepts and theoretical frameworks on the advancement of technology and supply chain management. The conclusion of this study opens a new window of opportunity for future scholarly work on this subject.

References

Ababou, M., Chelh, S., & Elhiri, M. (2023). A bibliometric analysis of the literature on food industry supply chain resilience: Investigating key contributors and global trends. *Sustainability*, 15 (11), 8812. https://doi.org/10.3390/su15118812

Anis, Z., Iqbal, R., Nazir, W., & Khalid, N. (2022). Technological advances in the supply chain of processed foods during COVID-19: a systematic literature review. *Arab Gulf Journal of Scientific Research, 41 (2), 158-174*.

Bowley, A. L. (1964). *Elements of Sampling*. London: Butterworths.

Elkady, G., & Sedky, A. H. (2023). Artificial Intelligence and Machine Learning for Supply Chain Resilience. *Current Integrative Engineering, 1(1), 23-28*.

Fernando, J., James, M., & Eichler, R. (2024). Supply chain: how it works and why it is important. Retrieved from https://www.investopedia.com

Ferreira, J. A., Monteiro, S. M., & Águas, A. P. (2011). Applying the UTAUT Model to Understand the Use of Behavior Health Applications Users in Indonesia During the COVID-19. https://www.researchgate.net/publication/362254049_The_UTAUT_Model_Explaining_Intentions_to_Use_Telemedicine_Among_Thai_People_During_the_COVID-19_Pandemic_A_Qualitative_Study_in_Krabi_Thailand

Fossi Wamba, S., Gunasekaran, A., Dubey, R, & Ngai, E.W.T. (2018). Big data analytics in operations and supply chain management. *Annals of Operations Research, 270 (1-2), 1-4*. DOI:10.1007/s10479-018-3024-7.

GEP (2024). What is supply chain resilience? Retrieved from https://www.gep.com

Goldratt, E. M. (1980). Optimal production timeline: a revolutionary program for industry, APICS 23rd annual conference proceedings.

Goldratt, E. M. (1990). *What is this thing called the Theory of Constraints and how should it be implemented?* North River Press.

Goldratt, E. M., & Cox, J. (2016). *The Goal: A Process of Ongoing Improvement.* North River Press.

Goldratt, E. M. (1984). The Goal: A Process of Ongoing Improvement. North River Press.

Hall, B. H., & Khan, B. (2003). Adoption of new technology. The New Economy Handbook, 521-546. (https://www.sciencedirect.com/science/article/pii/S0040162522006096)

Harju, A., Hallikas, J., Immonen, M., & and Lintukangas, K. (2023). The impact of procurement digitalization on supply chain resilience: empirical evidence from Finland. *Supply Chain Management*, 28 (7), 62-76. Retrieved from https://doi.org/10.1108/SCM-08-2022-0312

Holgado, M., & Niess, A. (2023). "Resilience in global supply chains: analysis of responses, recovery actions and strategic changes triggered by major disruptions", *Supply Chain Management*, 28 (6),1040-1059. Retrieved Online from https://doi.org/10.1108/SCM-01-2023-0020

Hu, H., & Yao, C. (2023). Technology innovations in supply chains: unlocking sustainability and social developmental goals advancement. Environmental Science and Pollution Research, 30, 102725-102738.

IBM Index (2023). Data Suggests Growth in Enterprise Adoption of AI is Due to Widespread Deployment by Early Adopters, But Barriers Keep 40% in the Exploration and Experimentation Phases. Retrieved Online from https://newsroom.ibm.com/2024-01-10-Data-Suggests-Growth-in-Enterprise-Adoption-of-AI-is-Due-to-Widespread-Deployment-by-Early-Adopters

Ifekandu, C.C., & Ifekandu, I. C. (2024). Frugal innovation strategies and supply chain performance of food and beverage firms in South-South Nigeria. *International Journal of Entrepreneurship and Business Innovation, 7 (2), 193-212*.

Ivanov, D., & Dolgui, A. (2022). Stress-testing supply chains and creating viable plans for future risks: Lessons learned from the COVID-19 pandemic. *International Journal of Production Research*, *60 (1), 11-18*.

Khoa, N., & Toai, N. (2024). The Role of Artificial Intelligence in Optimizing Supply Chain Management. *Journal of Supply Chain Innovation*, 12 (3), 45-62.

Koegler, S. (2023). Wearable Technology for Warehouse Workers: examining wearables and Augmented Reality Technology aiming to improve warehouse workflows. Retrieved Online from https://www.supplychaintechnews.com

Kumar, S., & Singh, A. (2023). IoT in supply chain management: Real-time visibility and cost savings. *International Journal of Logistics Management*, 34 (1), 75-90.

Lenovo Story Hub (2024). Lenovo uses AI and machine learning to build an ultra-resilient supply chain. Retrieved Online from https://news.lenovo.com/ai-machine-learning-build-ultra-resilient-supply-chain/

Liddell, P. (2024). Supply chain trend: digital shake-up. Retrieved from https://kpmg.com/xx/en/home/insights/2023/12/supply-chain-trends-2024.html

Lima, D., & Shala, V. (2020). Artificial intelligence applications for face recognition in the recruitment process. *Journal of Management Information and Decision Sciences, 23 (S1), 499-506.*

Long, P., Lu, L., Chen, Q., Chen, Y, Li, C., & Luo X (2023). Intelligent selection of healthcare supply chain mode – applied research based on artificial intelligence. *Frontiers Public Health 11, 1-17*. Retrieved Online from https://doi.org/10.3389/fpubh.2023.1310016

Luqman, N.A., Ahmad, S. Z., & Hussain, M. (2023). Effects of the degree of supply chain resilience capability in supply chain performance in the United Arab Emirates energy sector. *Supply chain management, 28 (6), 1009-1025*.

Martinez, R., & Gupta, V. (2023). Big data analytics in supply chain management: Enhancing efficiency and customer satisfaction. *Big Data Journal*, 19 (3), 202-218.

McKinsey & Company (2021). Succeeding in the artificial intelligence supply chain revolution. Retrieved Online from https://www.mckinsey.com/industries/metals-and-mining/our-insights/succeeding-in-the-ai-supply-chain-revolution

Medina, E., Caniato, F., & Moretto, A. M. (2023). Exploring supply chain finance along different supply chain stages: case-based research in the agri-food industry. *Supply Chain Management*, 28 (7), 77-96. Retrieved from https://doi.org/10.1108/SCM-10-2022-0393

Mehrhoff, J. (2023). The importance of resilience in global supply chain management. Retrieved from https://www.orkestrascm.com

Miller, A. (2023). Robotic Process Automation in modern supply chains. Automation Today, 42 (4), 89-99.

Nozari, H., (2024). Green Supply Chain Management based on Artificial Intelligence of Everything. Journal of Economics and Management, 46, 171-188. https://doi.org/10.22367/jem. 2024.46.07

Oliveira, T., Thomas, M., & Espadanal, M. (2014). Assessing the Determinants of Cloud Computing Adoption: An Analysis of the Manufacturing and Services Sectors. *Information & Management, 51*(5), 497-510.

Papadopoulos, T., Baltas, K. N., & Balta, M.E. (2020). The use of digital technologies by small and medium enterprises during COVID-19: Implications for theory and practice. International Journal of Information Management, 55:102192. DOI: 10.1016/j.ijinfomg.2020.102192.

Pereira, E. T., & Shafique, M. N. (2024). The Role of Artificial Intelligence in Supply Chain Agility: A Perspective of Humanitarian Supply Chain. Engineering Economics, 35(1):77-89.

Perkins, B., White, S. K., & Wailgum, T. (2021). What is supply chain management? Mastering logistics end to end. Retrieved from https://www.cio.com

Pushkar, A. (2024). The benefits of artificial intelligence in healthcare. Retrieved Online from https://intellipaat.com

Robinson, C. H. (2017). Why is supply chain visibility so important? Retrieved Online from https://www.chroninson.com

Rymarczyk, J. (2020). Technologies, opportunities and challenges of the industrial revolution 4.0: Theoretical considerations. *Entrepreneurial Business and Economics Review, 8*(1), 185-198.

Schragenheim, E., Dettmer, H. W., & Patterson, J. W. (2009). *Manufacturing at Warp Speed: Optimizing Supply Chain Financial Performance.* CRC Press.

Scott, G. (2024). What is artificial intelligence? Retrieved from https://www.investopedia.com/terms/a/artificial-intelligence-ai.asp#citation-2

Shukla, V., Kumar, J., Rana, S., & Prasha, S. (2024). Navigating the adoption landscape of blockchain in food delivery: a unified theory of acceptance use of technology (UTAUT). British Food Journal, Vol-ahead-of-print. No-ahead-of-print. Retrieved from https://doi.org/10.1108/BFT-08-2023-0681

Simatupang, T. M., Wright, A. C., & Sridharan, R. (2004). *Applying the theory of constraints to supply chain collaboration.* Supply Chain Management: An International Journal, 9(1), 57-70.

Yamane, T. (1967). Statistics: An Introductory Analysis (2nd ed.). New York: Harper and Row.

Venkatesh, V., Morris, M. G., Davis, G. B., & Davis, F. D. (2003). User Acceptance of Information Technology: Toward a Unified View. *MIS Quarterly, 27*(3), 425-478.

Watson, K. J., Blackstone, J. H., & Gardiner, S. C. (2007). *The evolution of a management philosophy: The theory of constraints.* Journal of Operations Management, 25(2), 387-402.

Wieland, A., & Durach, C. F. (2022). Two decades of supply chain resilience research: A bibliometric analysis. *International Journal of Physical Distribution & Logistics Management*, 52(5), 422-439.